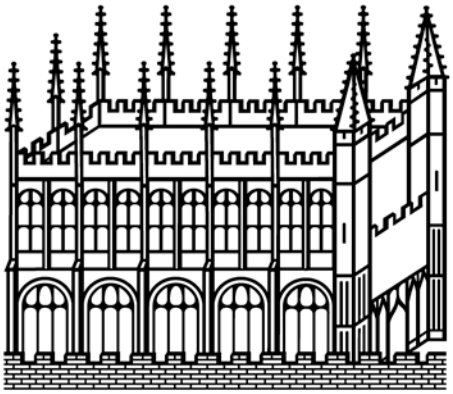

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THE

SURGICAL ANATOMY

OF THE

PRINCIPAL REGIONS OF THE HUMAN BODY.

BY

THOMAS MORTON,

LATE FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND; AND LATE ASSISTANT SURGEON TO UNIVERSITY COLLEGE HOSPITAL:

AND

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ILLUSTRATED BY LITHOGRAPHIC PLATES AND WOOD-ENGRAVINGS.

LONDON:

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1850.

LONDON:
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Bangor House, Shoe Lane.

ADVERTISEMENT.

THE object of this work is to present the Student engaged in anatomical pursuits, with a systematic plan by which he may proceed in his dissections, and at the same time to induce him to connect the knowledge he thus obtains of the structures of the principal regions of the human body with the study of the diseases that occur within their respective limits, and of the surgical operations which may be required for their relief. It is hoped also—and considerable experience has shown the hope to be well grounded—that the several parts which compose this work may be useful to all those who, after quitting the schools, may desire to keep up or refresh their recollection of the anatomy of the important divisions of the human frame of which they treat.

The entire Work is the production of the late Mr. Morton, with the exception of the Commentary on the Head and Neck and Upper Limb, which was undertaken by Mr. Cadge, at the request of the Publishers, and in the Advertisement to which he says—

"The necessarily restricted limits to which the writer was confined, have obliged him to omit much that he would otherwise have mentioned, and to treat concisely and briefly, that which is included; it is hoped, however, that he has, in some measure, succeeded in carrying out the object with which the Work was originally designed."

Most of the lithographic plates and wood engravings have been accurately engraved after original drawings carefully made from Mr. Morton's own dissections. The following have been copied from other works:—

PERINÆUM.

Second wood cut, from Sir Charles Bell's Operative Surgery.
Third ditto, from Scarpa on the Cutting Gorget of Hawkins.

GROIN.

Fourth and fifth wood cuts, from Hesselbach on Herniæ.
The wood cuts illustrating the injuries of the Hip Joint, are from Sir Astley Cooper's Treatise on Dislocations and Fractures.

HERNIÆ.

Plate 5 is from Scarpa on Herniæ.
The wood cut representing the seminiferous ducts of the Testes, is from Sir Astley Cooper's Wook on the Anatomy and Diseases of that organ.
The wood cuts 4, 5, and 9 are from Hesselbach; 2 and 9 from Cloquet and Camper.

HEAD AND NECK.

Plate 4 is from Arnold's Treatise on the Nerves of the Head.

UPPER GOWER STREET,
November, 1850.

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THE

SURGICAL ANATOMY

OF THE

PERINÆUM.

BY

THOMAS MORTON,

FORMERLY ONE OF THE HOUSE SURGEONS OF THE UNIVERSITY COLLEGE HOSPITAL.

ILLUSTRATED WITH LITHOGRAPHIC PLATES, AND WOOD ENGRAVINGS.

LONDON:

PRINTED FOR TAYLOR AND WALTON,

BOOKSELLERS AND PUBLISHERS TO UNIVERSITY COLLEGE,

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LONDON:
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Dorset Street, Fleet Street.

ADVERTISEMENT.

THE object of this work is to present the Student engaged in anatomical pursuits with a systematic plan, by which he may proceed in his dissections of the Perinæum; and, at the same time, to induce him to connect the knowledge which he thus obtains of the anatomy of this region, with the study of the diseases occurring within its limits, and the surgical operations which may be required for their relief. It is hoped, also, that the work may prove useful to those who, having quitted the schools, may still be desirous to keep up or renew their acquaintance with the anatomy of this important division of the human body.

The lithographic plates, which serve to illustrate the work, have been engraved with great accuracy, after original drawings, carefully made from my own dissections. Of the wood engravings, the first is executed after a drawing made from the parts dissected; the second is copied from one of the plates in Sir Charles Bell's work on Operative Surgery; and the third is taken from an engraving in Scarpa's memoir on the cutting gorget of Hawkins. I wish, also, to take this opportunity of acknowledging the assistance which I have derived, in the completion of this work, from a perusal of the valuable treatise on Surgical Anatomy, by M. Velpeau, the distinguished surgeon of the Hospital of La Charité at Paris.

THOMAS MORTON.

UNIVERSITY COLLEGE,
1ST OCT. 1838.

THE SURGICAL ANATOMY

OF

THE PERINÆAL REGION.

CHAPTER I.

DISSECTION OF THE PERINÆUM.

WHERE it is in the power of the dissector to select a subject, he will find it of considerable advantage to make choice of the body of a muscular adult who has died of some lingering disease; more particularly so when it is his intention to study with exactness the numerous and important vessels and fasciæ which are situated within the boundaries of this region. It is by no means an easy task to make even a tolerably satisfactory display of these structures when the subject is much loaded with fat.

Previously to fixing the subject in the position which is best suited for the dissection of the perinæum, it is strongly recommended that the introduction of the catheter both in the curved and straight forms should be practised, and the several modes of effecting its introduction compared with one another; and also the most likely means of avoiding the natural obstacles which the many irregularities of the internal surface of the urethra and the structures that surround the canal are capable of presenting to the easy passage of the instrument. When the subject has been tied up in the usual position, with the thighs widely separated, it is frequently extremely difficult to introduce a catheter or staff without using a considerable degree of force, and running a great risk of lacerating the lining membrane of the urethra, and thus making a false passage; accidents

which ought to be avoided, as they will interfere with the perfect display of the parts in the dissection which is about to be made.

After the catheter has been introduced into the bladder, it should be allowed to remain there, while an examination of the prostate gland and the neck of the bladder is made from the rectum by means of the forefinger of the left hand introduced by the anus into that intestine. It will be found, as soon as the extremity of the finger has entered a little way within the anus, that the calibre of the rectum becomes suddenly very much enlarged; and this more particularly so in elderly subjects, and in those who have suffered in their lifetime from habitual constipation. When the palmar surface of the finger is directed against the anterior or upper wall of the bowel, that part of the catheter which rests in the membranous portion of the urethra will be readily distinguished, since the thickness of the structures that intervene between the finger and the catheter is very inconsiderable; at the same time, it will be readily conceived that the coats of the rectum are in very great danger of being cut in the lateral operation of lithotomy, unless the edge of the knife is carefully directed downwards and outwards, at the time when the membranous portion of the urethra is opened, previously to passing the knife along the groove of the staff into the bladder.

Introducing the finger a little farther into the rectum, still keeping it applied against the anterior surface of the intestine, the prostate gland will be perceived by its greater thickness, and by the sense of resistance which its firm and dense structure offers to the finger when it is compressed between it and the catheter. By carrying the finger a little to the side of the mesial line, a much larger proportion of the prostate gland may be felt, which is owing to the greater size of its lateral lobes.

Beyond the base of the prostate gland the catheter is again felt more distinctly through the thin coats of the base of the bladder; this is the spot that is selected by the surgeon for entering the trocar when he punctures the bladder from the rectum for the relief of cases of complete retention of urine, and in which the prostate gland is not much enlarged.

In persons who are far advanced in years, the prostate gland

is not unfrequently found to be much increased in size, and also to be almost surrounded, so to speak, by the rectum; as the bowel, instead of lying simply underneath the gland, rises very considerably upon each side of it, and in such a manner as to invest it for two-thirds, and sometimes even more, of its circumference: this is a circumstance that is worthy of being borne in mind during the performance of the lateral operation of lithotomy upon aged individuals.

It is by examining the prostate gland in this manner, with his finger introduced into the rectum, that the surgeon is enabled to determine whether it is diseased or not; and he is enabled by the same means to direct the point of the catheter with greater certainty in cases where the introduction of it has been rendered more than usually difficult by any injury or disease of the membranous and prostatic portions of the urethra. With the fingers introduced into the rectum, it is possible sometimes to determine the weight and figure of a calculus more accurately than by any other means, and to facilitate the seizing of the stone by the forceps after the operation of lithotomy has been performed in cases where the calculus lies deeply behind the prostate gland in the bas-fond of the bladder. It is from the close connections that exist between the rectum and the membranous and prostatic portions of the urethra that the recto-vesical operation of lithotomy derives its simplicity and easy execution; though for other reasons, that will be noticed in another part of this work, it is an operation which has not been very favourably entertained by the profession.

Position of the subject.—When these preliminary steps have been taken, the catheter may be removed, and a full-sized staff introduced into the bladder; after which, the subject is to be fixed in the usual position as when the operation of lithotomy is about to be performed, which is done by bending the legs and thighs upon the trunk, and then tying the hands and feet together with bandages. The penis and scrotum are next to be tied up to the handle of the staff, in such a manner as that they shall not obscure the view of the perinæum: the buttocks of the subject ought to be made to project a little beyond the edge of the table upon which it lies; and, if it should be considered to be necessary, they may be elevated a little

more by placing a block of wood underneath the sacrum. The rectum is to be moderately distended with a little cotton wool introduced into the anus. Before commencing the incisions of the skin, which are necessary for the exposure of the subjacent structures, it will be found of great use to refer for a moment to a dried preparation of the bones and ligaments of the pelvis, in order to determine more accurately upon the recent subject the osseous boundaries of the perinæal region. As continual reference will be made in the course of the dissection to the bones of the pelvis, the dried preparation should be placed upon the table so as to be near at hand.

Extent of the perinæal region.—Anatomists have differed much from each other in their description of the extent and boundaries of the perinæum, and the greater number perhaps have restricted the application of the term to the space which is included between the posterior fold of the scrotum and the anus. More lately, however, it has become the custom to include the anal region also; and then the boundaries of the perinæum will extend from the arch of the pubis, which is in front, to the tip of the coccyx and the great sacro-sciatic ligaments behind; the branches of the ischia and ossa pubis, and the tuberosities of the former bones, will form its limits laterally.

In the recent subject the inferior edge of the large gluteal muscles may be added, as forming a part of the postero-lateral boundary. In this manner of viewing it, the perinæal region will present an ovoid figure, the largest extremity of which is directed backwards, and the narrow or elongated one anteriorly. If a line is drawn transversely between the tuberosities of the ischia, the perinæal region will be divided into two compartments of nearly equal size: that which is posterior to this line will contain the anus, with the inferior portion of the rectum; while that in front of it will comprise the urethra and the root of the penis, together with the numerous structures which are connected with them. The first of these may be termed the *anal*, and the second the *urethral* division of the perinæal region.

The urethral division, or the perinæum strictly so called, may be said to present the form of a triangle, the base of which, represented by the transverse line drawn between the tuberosities of the ischia, is a little less in its extent than the

sides, the length of the sides being from three inches to three inches and a half; while the base scarcely equals three inches, and most frequently is rather less.* The raphé or central line of the body will subdivide this triangular space into two smaller triangles, which are of equal size, within one of which the first incisions of the lateral operation of lithotomy must commence.

The external surface of the perinæum is convex anteriorly from side to side, which is owing to the prominence of the bulb of the urethra; but between the tuberosities of the ischia it is more or less excavated, especially where the anus is situated. The skin is thin and delicate, and easily moveable upon the subjacent structures, which requires that it should be fixed with the fingers of the left hand while the first incisions of lithotomy are being made. Generally the perinæum is more or less covered with hair, which ought to be removed with the razor previously to the performance of any operation upon this region. There are numerous follicles which open upon the surface of the skin, especially around the circumference of the anus; these follicles frequently inflame and suppurate, forming small abscesses, which might be mistaken for a fistula in ano. In front of the anus the raphé or central elevation of the skin is particularly distinct where it extends forwards towards the scrotum. It is upon the left side of the raphé, and about one inch in front of the anus, that the first cut of the lateral operation of lithotomy is usually commenced, which is carried in an oblique direction downwards and outwards between the anus and the tuberosity of the ischium, a little nearer, however, to the latter point than to the anus. The length of this incision is from two to three inches.

In the bilateral operation of lithotomy the external incision commences on the right side, between the tuberosity of the ischium and the anus; and is carried across the perinæum in a semicircular direction, until it is made to terminate opposite to the point at which it was begun. The centre of the incision should be

* In twenty-three subjects which he examined for this purpose, Dupuytren found the base of the urethral portion of the perinæum of very variable extent; in some cases not exceeding two inches, and in others being as much as three inches and a half. Velpeau has seen the tuberosities of the ischia as near to one another as 1¾ inch. In my own observations I have seldom found the base to exceed 2¾ inches.

situated about three-quarters of an inch in front of the anus, with the anterior half of the circumference of which its concavity should be made to correspond.

The skin around the anus is of a dark brown hue, and at the margins of this opening it becomes insensibly continuous with the mucous membrane of the rectum: when the anus is closed, the skin is thrown into numerous radiated folds or wrinkles, which arrangement no doubt allows the anus to be largely distended without a rupture of the cutaneous tissues. The interspaces between these folds sometimes become the seat of very troublesome ulcerations in some forms of venereal disease, and cause the patient much pain and annoyance. These ulcerations may nevertheless exist independent of any syphilitic taint, and excite by their irritation such a painful and constant contraction of the sphincter muscle, that it becomes necessary to divide its fibres completely across before a cure can be obtained.

Within the margin of the anus the extremities of the hæmorrhoidal veins are usually observed in a varicose state, forming those little tumours which are well known as constituting the affection termed piles. There are two varieties of these tumours; one which consists in the simple varicose dilatation of the veins of the intestine; and the other in which the tumours are in part formed by the veins dilated, and partly by coagula of blood which has become extravasated into the adjacent cellular tissue in consequence of a rupture of the coats of the vessels. The margins of the anus are frequently also the seat of the firm fleshy tumours called condylomata, which consist of a simple hypertrophy of the cellular structure; and though very commonly the consequence of the irritation of gonorrhæal discharges, yet may exist independently of any specific disease.

Dissection of the Perinæum. — The dissection may be commenced by exposing the superficial fascia and external sphincter muscle of the anus. For this purpose make an incision from the scrotum backwards, following the direction of the raphé of the perinæum, as far as the anterior margin of the anus, when the edge of the knife must be carried round that aperture, and thus encircle it, where the skin and the mucous membrane of the rectum are blended with one another; from the posterior margin of the anus a single incision is to be made as

far as to the coccyx, upon which it may terminate. Another incision must be made across from one tuberosity of the ischium to the other, passing in front of the anus; the extremities of this last cut should be extended for some distance upon the thighs. These incisions should not be made deeper than is necessary for the dissection of the skin from the subjacent structures. Laying hold of the inner angles of the flaps which have been thus marked out, raise them for a considerable distance on each side, and then reflect them upon the thighs and buttocks, where they may be fixed by means of pins or hooks. While raising the two posterior flaps, the edge of the scalpel must be carried round the anus in the direction of the fibres of the external sphincter muscle, which, being immediately underneath the skin, is at once exposed to view. The fascia lata of the thighs may be displayed a little distance upon each side by removing the thin layer of adipose tissue which covers its external surface, and conceals its attachments to the external margins of the tuberosities and branches of the ischia and ossa pubis. While this is being done, some small nerves, which pierce the fascia lata a little in front of the lower edges of the great gluteal muscles, will be found; and which, after dividing into several smaller filaments, pass inwards towards the mesial line, supplying the integuments of the perinæal region. These nerves are branches of the posterior and internal cutaneous divisions of the small sciatic nerves. More posteriorly, a part of the inferior border of the large gluteal muscles may be dissected, and their attachment to the lateral borders of the coccygeal bones and posterior sacro-sciatic ligaments shown.

Between the external margin of the sphincter of the anus and the borders of the tuberosities of the ischia, a large quantity of adipose substance will be observed, which must be next removed in order that the fibres of the levator ani muscles may be exposed, as they descend from the sides of the pelvis towards the extremity of the rectum.*

* In removing the masses of fat which fill up on each side the space between the anus and the tuberosities of the ischia, the knife should not be carried farther forwards than a line extended across the perinæum in front of the anus, in order to avoid doing any injury to the superficial fascia where it passes upwards to unite, behind the transverse muscles of the perinæum, with the deep fascia or triangular ligament of the urethra.

During the removal of this fat, some small arteries which run in its substance should be preserved: these are the external or inferior hæmorrhoidal arteries, branches from the internal pudic vessels, and given off from these as they are running along under cover of the tuberosities of the ischia. They are distributed to the superficial structures around the inferior extremity of the alimentary canal. These little vessels are worthy of attention, as they are frequently divided in the operations of lithotomy and of fistulæ in ano, &c. and may sometimes furnish a considerable quantity of blood; sufficient indeed to render the application of a compress or a ligature necessary, to prevent the continuance of the bleeding.

When all the fat has been removed, a large excavated hollow remains on each side of the anus; these have been named by M. Velpeau the *ischio-rectal fossæ*. The figure of each of these spaces is triangular, the base being formed by the skin, and the apex or summit by the angle where the fibres of the levator ani separate from the obturator fascia. The internal wall is very oblique, and is formed by the fibres of the levator ani; the external one on the other hand is nearly perpendicular, and is formed by the obturator fascia and the tuberosity of the ischium.* The depth of the cavity increases towards the external wall, where it may be estimated at nearly two inches. If the subject has been injected, by placing the finger against the external wall of the cavity, about an inch above the edge of the tuberosity of the ischium, the internal pudic artery can be

* The obturator fascia is a thick and strong membrane, which binds down the obturator internus muscle to the internal surface of that part of the os innominatum, and to the ligament of the thyroid foramen, from which its fibres take their origin. The fascia is attached superiorly to the margins of the thyroid foramen, posteriorly to the spinous process of the ischium, and inferiorly to the falciform process of the great sacro-sciatic ligament, and the rami of the ischium and os pubis. Relations—externally with the obturator interuus muscle; internally with the pelvic fascia, part of the origin of the levator ani, and the adipose substance which fills the ischio-rectal space. The internal pudic vessels and nerve, as they pass from the smaller sciatic foramen, by which they re-entered the pelvis, to their termination in the branches which they furnish to the bulb, corpus cavernosum, and dorsum of the penis, are inclosed in a sheath, which is formed by the division of the fascia into two lamellæ at this point. The inferior hæmorrhoidal and superficialis perinæi arteries pierce this fascia immediately after their origin from the trunk.

felt as it is running along enclosed between the layers of the fascia, accompanied by its corresponding veins and nerve.

It is in the large quantity of adipose tissue which occupies the ischio-rectal fossæ, that the greater number of those abscesses form which degenerate into confirmed fistulæ in ano. By a reference to the structure of the walls of the ischio-rectal cavity, it will be readily understood why it happens that these fistulæ can rarely be cured, except by the division of the external sphincter muscle; an operation which allows the walls of the fistula to remain at rest, and to unite with one another by the process of granulation.

The superficial fascia of the perinæum is next to be exposed by removing the layer of adipose and cellular tissue which lies between it and the skin. It is difficult to effect this in corpulent subjects without doing some injury to the fascia, which in such instances is frequently very thin and weak. The best way is to remove the subcutaneous layer carefully by degrees in one spot, until the smooth and regular surface of the fascia is exposed, when it can be followed on each side to its insertions into the edges of the branches of the ischium and ossa pubis, forwards into the scrotum, and posteriorly to its attachment to the triangular ligament of the urethra.

When these directions have been properly executed, the structures which are exposed to view are as follows: surrounding the anus is the external sphincter muscle, in front of which is the superficial fascia of the perinæum; on each side of the sphincter muscle are the ischio-rectal fossæ, emptied of the large masses of adipose tissue which naturally fill them; the inner walls of the fossæ are formed by the fibres of the levator ani muscles, which must be more completely displayed by removing a thin fascia that covers them, and which is a prolongation backwards of the triangular ligament of the urethra: posteriorly are the coccyx, the inferior border of the great gluteal muscles, and, under cover of these, part of the sacro-sciatic ligaments; externally to the tuberosities of the ischia, a portion of the fascia lata of the thigh is exposed. (See Plate I.)

Before proceeding any further with the dissection, each of these structures should be more closely examined in succession.

The *external sphincter of the anus* encircles the inferior extremity and orifice of the rectum. The muscle is of an ellipti-

cal figure, and is composed of two bundles of fleshy fibres, which are united with one another in front and behind the aperture of the anus, at the same time diminishing in their breadth. Posteriorly, the fibres of the muscle are attached to the extremity of the coccyx by means of a narrow fibro-cellular band of about an inch in length; anteriorly, the fibres are inserted partly into the inferior surface of the superficial fascia, and partly into the central tendinous point of the perinæum. The structure of the muscle is fleshy, except at its attachment to the coccyx, where it is slightly tendinous. In some subjects the muscle is very thick and strong, while in others it is extremely delicate. Relations—inferiorly, this muscle is covered by the skin; superiorly, with the superficial fascia and the levator ani, from which last, however, it is separated by some of the fibres of the triangular ligament of the urethra; externally, with the adipose tissue which occupies the ischio-rectal fossæ; and internally,

EXPLANATION OF PLATE I.

This represents a dissection of the superficial fascia of the perinæum: posteriorly, the external sphincter and levatores ani muscles are dissected in order to show the ischio-rectal fossæ.

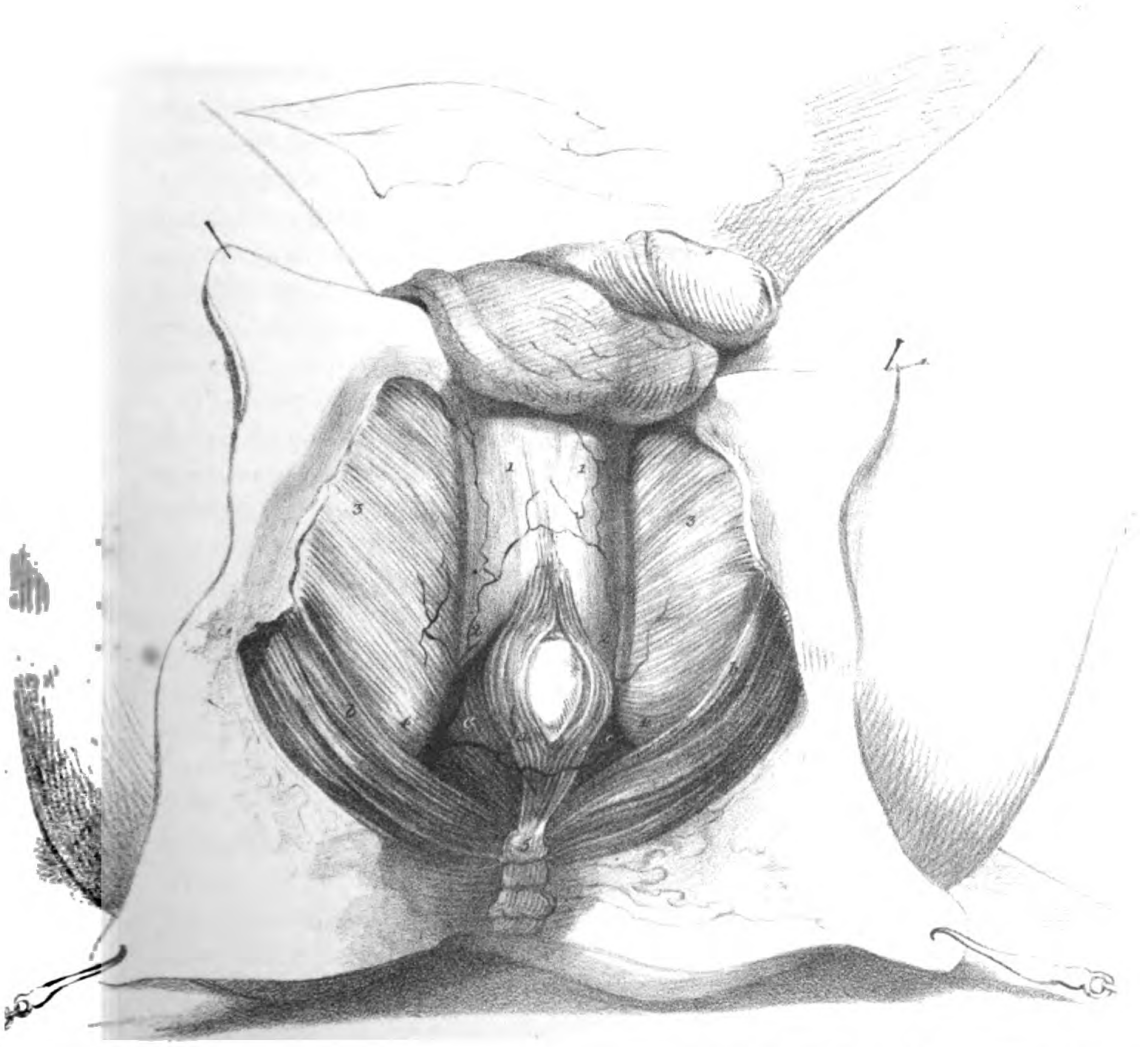
1. 1. The superficial fascia of the perinæum. This fascia covers the muscles of the penis, and is attached on each side to the edge of the branches of the ischia and ossa pubis; anteriorly, it is continuous with the dartos of the scrotum.
2. 2. These figures indicate the point where the superficial fascia of the perinæum passes behind the transverse muscles to become attached to the anterior surface of the triangular ligament of the urethra.
3. 3. The fascia lata of the thighs covering the adductor muscles.
4. 4. The tuberosities of the ischia.
5. The coccyx.

a. The external sphincter muscle surrounding the anus, which is stuffed with a little cotton wool. The attachment of the fibres of the muscle upon the inferior surface of the superficial fascia is seen in front; posteriorly, the fibres are connected by a fibro-cellular band to the coccyx.

b. *b*. The inferior border of the great gluteal muscles.

c. *c*. The levatores ani. Between the tuberosities of the ischia and the anus, are the hollow spaces named by M. Velpeau the *ischio-rectal fossæ*.

PLATE 1.



W. Fairland. lith.

London. Taylor & Walton Upper Gower Street.

Printed by Fairland

with the circular muscular fibres of the intestine, which are here more strongly developed than elsewhere, and which in consequence have been named the *sphincter ani internus.* The action of this muscle is to close the extremity of the rectum, and prevent the escape of its contents. It belongs to the class of voluntary muscles, and is supplied by a branch from the pudic nerve.

This muscle is cut across in the recto-vesical operation of lithotomy and in the operation for fistula in ano, and occasionally also to promote the cure of painful and obstinate ulcerations near the margin of the anus.

The *internal sphincter* muscle consists, as has been already mentioned, of the most inferior of the circular fibres of the muscular coat of the rectum, and which are more strongly developed than the rest. Circular in its form, the muscle embraces the mucous membrane of the bowel, and is covered externally by the external sphincter.

The *levator ani* muscle is but partially seen in this stage of the dissection, as only those of its fibres have been exposed which are attached at the circumference of the muscle to the spinous processes of the ischia, and to the tendinous band which stretches across from them to the posterior surface of the bodies of the ossa pubis; which band is situated at the summit of the ischio-rectal fossæ, in the angle that is formed by the separation from one another of the pelvic and obturator fasciæ. The fibres of the muscle are inserted into the sides of the coccyx, and between the extremity of that bone and the anus they are blended with one another by means of a common band of junction, which is situated above the posterior portion of the external sphincter of the anus; more anteriorly the remaining fibres descend to be inserted between the external sphincter and the muscular coat of the rectum, having attachment to both of these structures. The structure of the muscle is chiefly fleshy, though it is slightly tendinous where it is inserted into the coccyx, and the raphé between the extremity of that bone and the anus.*

The *superficial fascia of the perinæum* is situated in the anterior or urethral division of the perinæal region, and is a thin

* For a more complete description of this muscle, see page 47.

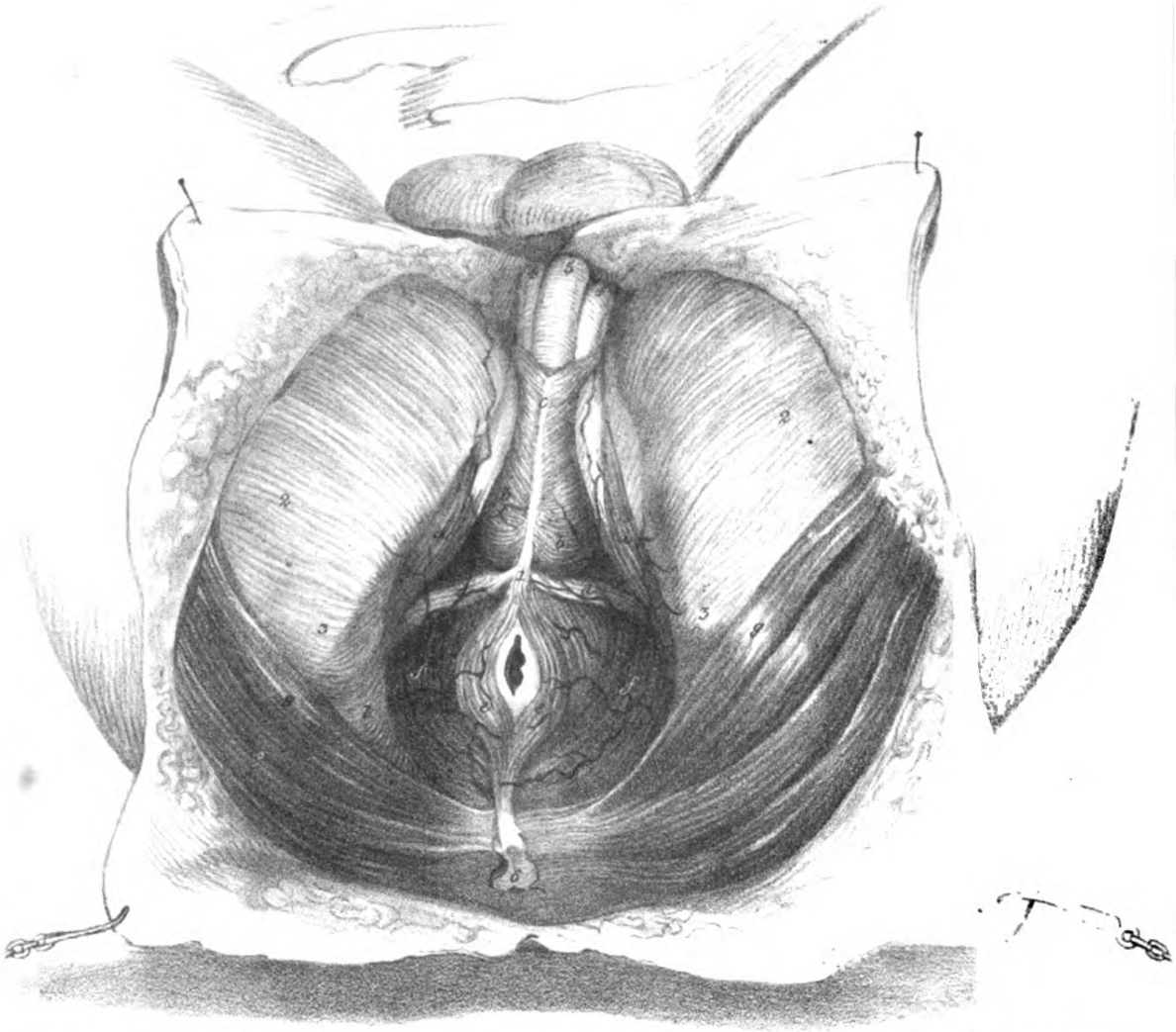
membranous layer which conceals the muscles of the penis. On each side the fascia is attached to the borders of the branches of the ischia and ossa pubis; anteriorly it passes forwards into the scrotum, where it appears to become continuous with the dartos; posteriorly it is inserted into the inferior surface of the triangular ligament of the urethra, behind the posterior border of the transverse muscles of the perinæum, which it covers. The superficial fascia is pierced at various points by some of the small cutaneous branches of the superficial arteries and nerves of the perinæum. Relations—by its inferior surface with the skin, the subcutaneous layer of adipose tissue, and some of the fibres of the external sphincter muscle which are inserted into it near the mesial line; by its superior surface with the crura and erector muscles of the penis, the accelerator urinæ, and transverse muscles, and with the cellular tissue which fills up the interspaces between them, in which the superficial vessels and nerves of the perinæum ramify.

If a small slit be made into this membrane posteriorly, and the extremity of a blowpipe introduced underneath it, the air which is inflated will be observed, after distending the perinæal portion of the fascia, to pass forwards into the scrotum, and diffuse itself into the loose cellular tissue which separates the dartos from the sheath which the spermatic cords and testicles receive from the margins of the external abdominal rings. If the inflation is continued, the air will, after distending the scrotum, make its way upon the front of the abdomen in the loose cellular tissue which connects the aponeuroses of the external oblique muscles with the superficial fascia of the inguinal and hypogastric regions. It is by following the same course that the urine, which is sometimes extravasated underneath this fascia by a rupture of the anterior part of the urethra, is seen to make its way along the perinæum into the scrotum, and even upon the anterior and lateral parts of the abdominal parietes.*

Dissection of the muscles of the penis.—The muscles of the penis may now be exposed by laying open the superficial fascia by a crucial incision, and reflecting to either side the flaps,

* Previously to the description of the superficial fascia by Mr. Colles, of Dublin, it was found difficult to explain the course which the urine pursued when extravasated into the perinæum, as may be seen by referring to the second volume of Mr. Abernethy's Surgical Observations, p. 245.

PLATE II.



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which will show more completely the attachments of the fascia to the edges of the arch of the pubis, and the mode in which it incloses the root of the penis and its muscles, as it were, in a sheath. In dissecting the muscles of the penis it is necessary that the edge of the knife should be carried in the same direction as that of their fibres, for they are very delicate and easily injured. While removing the cellular tissue which fills up the space between the accelerator urinæ and the erectores penis, the small arteries, which are named *superficialis* and *transversus perinæi*, branches of the internal pudic arteries, may be also dissected and preserved:—the first of these runs forwards between the erector penis and the accelerator urinæ, and the other along the posterior border of the transverse muscle. Each of these arteries is accompanied by corresponding branches of the nerve and veins.

A delicate fascia, which closely invests each of the muscles of the penis, must be removed before the direction of their fibres can be clearly seen. (See Plate II.)

The *erector penis* is a long narrow muscle placed beneath

EXPLANATION OF PLATE II.

This represents the muscles of the perinæum. The superficial fascia has been removed.

1. The common central tendinous point of the perinæum.
2. 2. The fascia lata of the thighs.
3. 3. The tuberosities of the ischia.
4. 4. The corpora cavernosa of the penis.
5. The corpus spongiosum urethræ.
6. The coccyx.
7. The great sacro-sciatic ligament.

a. a. The erector muscles of the penis.

b. b. The accelerator urinæ muscle.

c. The raphé or fibro-cellular line from which the fleshy fibres of the accelerator urinæ muscle take their origin.

d. d. The transverse muscles of the perinæum.

e. e. The external sphincter muscle of the anus.

f. f. The levatores ani.

g. g. The great gluteal muscles.

A triangular space is observed between the accelerator urinæ and the erector penis muscles, the base of which is formed by the transverse muscle. The depth of this space is limited by the triangular ligament of the urethra.

the ramus of the ischium and root of the penis. The muscle on each side arises from the inner surface of the tuberosity of the ischium by fleshy and tendinous fibres, and, after passing forwards and upwards about three inches, is inserted into the sides of the corpus cavernosum by two delicate processes, of which the external one is the longest. The muscle is fleshy in its structure, except at its origin and insertions, where it is slightly tendinous. Relations—inferiorly and externally, with the superficial fascia of the perinæum; superiorly, with the ramus of the ischium and the crus of the penis, into which it is inserted; internally, with the accelerator urinæ, from which it is separated by a little cellular tissue and the superficialis perinæi artery. Action—to assist in the erection of the penis.

The *transversus perinæi* is a small triangular-shaped muscle, extending across the middle of the perinæal space. The fibres of this muscle are attached by their broad extremity to the inner surface of the tuberosity of the ischium above the attachment of the erector penis, and they are inserted into the central tendinous point of the perinæum, where they are united with the fibres of the muscle of the opposite side, and with some of those belonging to the accelerator urinæ and the external sphincter of the anus. The muscle is fleshy, except at its insertion, which is tendinous. Relations—by its posterior and inferior surface, with the superficial fascia; and superiorly, with the triangular ligament of the urethra: the superficial artery of the perinæum crosses the muscle near its origin, and, as it does so, gives off the transverse artery which runs along the posterior border of the muscle.

These muscles are sometimes absent altogether, and then their place is frequently supplied by some muscular fibres which run obliquely forwards and join the accelerator urinæ; at other times one of these muscles only is to be found. When these muscles are accompanied by another set of fibres following nearly the same direction, the smaller and most anterior set are called *m. transversalis alter*. Use—to fix the central point of the perinæum, and thus facilitate the action of the sphincter ani and accelerator urinæ.

The muscle of the left side, with its accompanying artery and nerve, is cut across in the lateral operation of lithotomy; in the bilateral operation the muscle of each side is divided.

The *accelerator urinæ* is situated in the centre of the perinæum, and surrounds the bulb and posterior part of the spongy body of the urethra. This muscle is divided into two equal portions by a cellulo-fibrous band or raphé, which extends forwards from the central point of the perinæum as far as the whole length of the muscle, and which has given rise to the usual description of it as consisting of two muscles, though it may equally as well be considered as one. The muscular fibres, after their origin from the central raphé, incline obliquely outwards and forwards, and are inserted, posteriorly, into the anterior surface of the triangular ligament of the urethra near to its attachment to the branches of the ossa pubis; the middle fibres encircle the spongy part of the urethra, and are re-united to each other underneath the junction of the crura of the penis, while those most anterior are prolonged for a considerable distance forwards and outwards to be inserted into the sides of the corpora cavernosa penis, opposite the point where the penis, when in the flaccid state, bends upon itself in front of the pubis. The figure of the muscle is cylindrical in its centre, where it embraces the spongy body of the penis; but anteriorly and posteriorly it presents the form of a simple groove, which supports the bulb and part of the spongy body. The structure of the muscle is fleshy, except at its origin and insertions, where it is slightly tendinous. Relations—inferiorly, with the superficial fascia and skin; superiorly, with the triangular ligament, the bulb and spongy body of the urethra; in the mesial line it is connected posteriorly, through the medium of the common central point, with the external sphincter of the anus and the transverse muscles. Action—to propel forwards the urine and seminal fluid.

There can be no doubt, from the mode in which the middle fibres of this muscle encircle the urethra, that it may by a spasmodic contraction prevent for a time the introduction of a catheter along that part of the canal. The truth of this observation has been frequently proved in practice during the introduction of bougies, &c. Some of the most posterior fibres of this muscle are commonly cut in the lateral operations of lithotomy.

When the muscles have been dissected, a triangular space is exposed between the accelerator urinæ and the erector penis, the

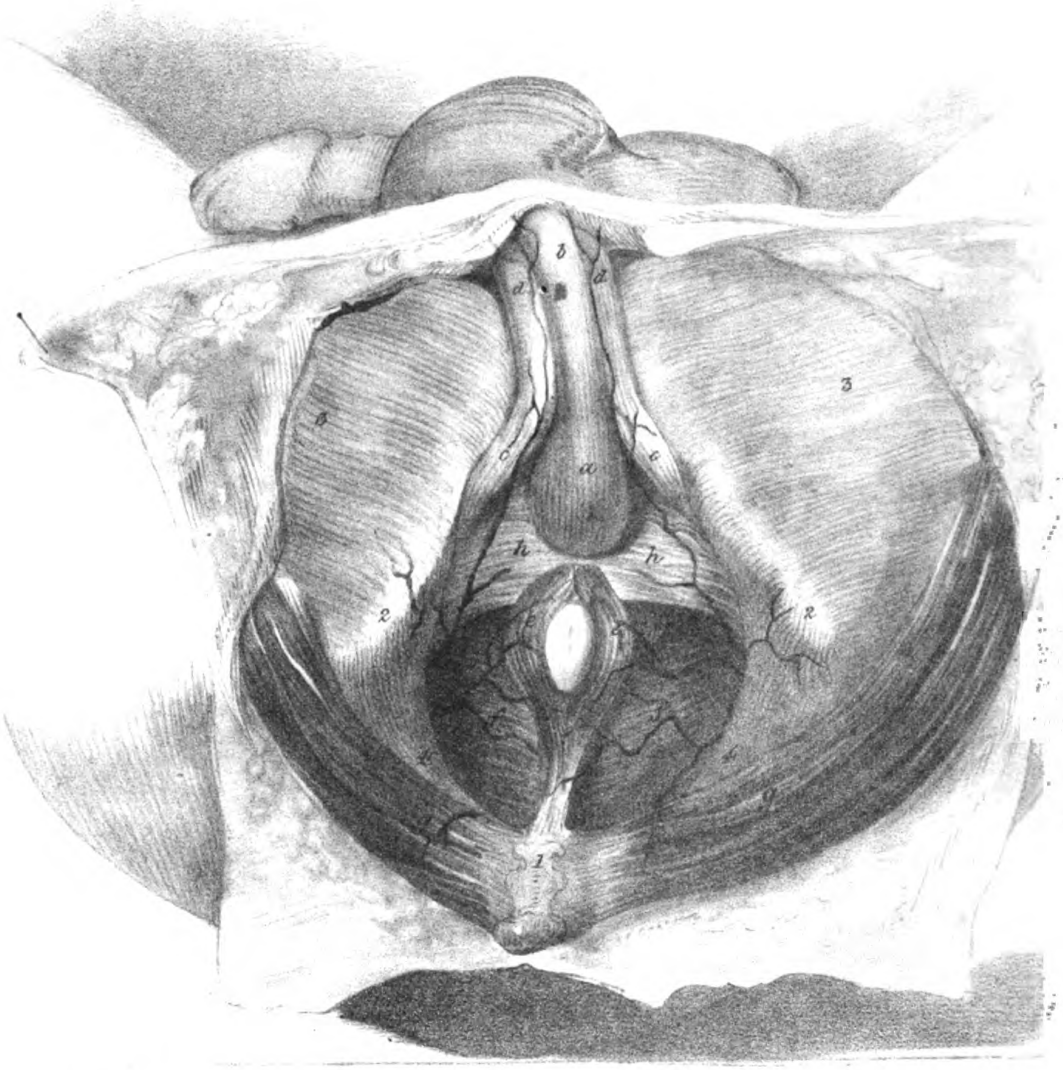
base of which is directed posteriorly, and is formed by the transverse muscle; in this space the superficialis perinæi artery runs forwards in its course to the scrotum. If the finger or the handle of the scalpel be placed in this space, its further progress inwards will be arrested by the triangular ligament of the urethra, which limits its depth: when the muscles are held apart from each other, the triangular ligament may be partially seen; it is of a bluish colour, and of a tendinous structure.

The knife is carried obliquely across the posterior part of this triangular space in the lateral operation of lithotomy. It should however be recollected that, previous to the dissection of the muscles, this space is very much smaller than it now appears.

The *central tendinous point* of the perinæum is that spot where the fibres of the accelerator urinæ, external sphincter of the anus, and transverse muscles are united with one another; it is covered by the skin and superficial fascia, and it rests upon the triangular ligament of the urethra between the bulb and the rectum. The cellulo-fibrous raphé, which has been described as connecting the lateral portions of the accelerator urinæ muscle to each other, extends forwards from this point.

Dissection of the bulb of the urethra, crura of the penis, &c. — The transverse muscles and the erectors of the penis should next be cut away entirely, to expose the crura of the penis, and the greater part of the triangular ligament of the urethra; after which, divide the accelerator urinæ muscle along the mesial line, and carefully reflect the flaps on each side so as to follow the fibres to their respective insertions; by this way they may be traced round the spongy body of the urethra, immediately in front of the bulb.*

* It is sometimes recommended, for this purpose, to cut the urethra across about three inches in front of the bulb, and turn it downwards by dissecting it from the body of the penis. By following this method, it is true that the fibres of the muscle may be very clearly seen to unite with one another in the angle which is formed by the junction of the crura of the penis. But if it is the intention of the dissector to proceed throughout with the dissection, it will be better not to do this, as the continuity of the urethra is interfered with. It is better in such case to be contented with showing the circular fibres by pulling alternately upon each flap of the muscle after their reflection.



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If the accelerator urinæ is now removed altogether, that portion of the spongy body which had been covered by it, with the bulb of the urethra, will be completely exposed to view; on each side, the crura of the penis are seen where they are fixed into the branches of the pubis; the triangular ligament of the urethra occupies the interval between these structures, and, by being prolonged backwards, covers the external surface of the levator ani muscle, separating its fibres from the external sphincter of the anus, and the adipose tissue which filled the ischio-rectal fossæ. (See Plate III.)

The *crura* of the penis are the posterior extremities of the corpora cavernosa, and differ only from them in the greater thickness of the fibrous investment which encloses the vascular or erectile tissue, of which their internal structure is composed. The crura of the penis are at first separated from one another by the width of the arch of the pubis; but as they proceed forwards and upwards they converge towards the mesial line, and opposite the symphysis unite with one another, forming by their junction the larger part of the body of the organ, assuming the name of the *corpora cavernosa penis*. The corpora cavernosa are two cylindrical-shaped bodies, slightly compressed

EXPLANATION OF PLATE III.

This represents the root of the penis and bulb of the urethra, with the triangular ligament of the urethra; the muscles of the perinæum having been cut away.

1. The coccyx.
2. 2. The tuberosities of the ischia.
3. 3. The fascia lata of the thigh.
4. 4. The great sacro-sciatic ligaments.

a. The bulb of the urethra.

b. The corpus spongiosum urethræ.

c. *c*. The crura of the penis.

d. *d*. The corpora cavernosa penis.

e. *e*. The external sphincter muscle of the anus.

f. *f*. The levatores ani covered by a thin fascia, which is a prolongation of the triangular ligament of the urethra.

g. *g*. The great gluteal muscles.

h. *h*. The triangular ligament of the urethra. The artery of the bulb is seen on the left side as it runs between the crus penis and the bulb of the urethra.

however from side to side, which extend forwards as far as the base of the glans penis, which they support upon their rounded extremities. The dorsal vessels and nerves of the penis run in the groove which the corpora cavernosa present superiorly by their junction in the mesial line, while the spongy body of the urethra lies in a similar but deeper groove upon their inferior surface.

The structure of the corpora cavernosa consists externally of a strong fibrous sheath, which is thickest near their posterior extremities, or the crura, as they are termed, of the penis, and internally, of a vascular structure, which has been considered as an intermediate structure between arteries and veins, and named "*erectile tissue.*" The vascular structure of the corpora cavernosa has no communication with that of the corpus spongiosum urethræ.

There is an imperfect septum which separates the cavity of one corpus cavernosum from that of the other, and which from its figure has been called the *septum pectiniforme*, in which are numerous oblong-shaped foramina that allow a free communication to be established between the internal structure of one cavernous body and that of the opposite side. By making a small puncture into one of the cavernous bodies, and introducing some air by means of a blow-pipe, the body of the penis becomes distended as in the state of erection, but none of the air which is thus inflated passes into the corpus spongiosum urethræ.

The corpora cavernosa are suspended to the symphysis pubis by a triangular-shaped band of fibro-cellular or ligamentous structure, which is called the *suspensory ligament* of the penis, and which is inserted by its base into the posterior part of the groove upon their upper surface.

The urethra, where it is supported in the groove on the inferior surface of the corpora cavernosa, is surrounded by a thin layer of erectile tissue, which is named the *corpus spongiosum urethræ.* It differs from the corpora cavernosa in the greater thinness of its external fibrous investment, and in the small quantity of the erectile tissue of which it is composed. At each extremity the corpus spongiosum presents a very considerable enlargement, the anterior of which is the *glans penis*, and the posterior the *bulb of the urethra.*

The *glans penis* is so named from its figure, which, when partially covered by the prepuce, resembles an acorn. It is of a conical figure, its base being seated upon the anterior extremities of the corpora cavernosa; at its apex is a vertical slit or fissure, which corresponds to the external opening of the urethra (*meatus urinarius*). The base of the glans presents a thick rounded and elevated margin *(corona glandis)*, which is disposed so obliquely that the superior surface of the glans is three or four times as long as the inferior. Behind the corona glandis is a deep groove from which the mucous membrane which lines the internal surface of the prepuce is reflected upon the surface of the glans; here are numerous sebaceous follicles which are named *glandulæ Tysoni.* The inferior surface of the glans is slightly grooved for the insertion of the small band (*frænum præputii*) which fixes the prepuce to the glans, and prevents its being retracted to too great a degree.

The glandulæ Tysoni are frequently the seat of venereal ulceration, which may affect either one or many of them at one time. The sore is of a circular form, excavated, with sharp edges; when there are several of these affected at one time, it constitutes the form of the disease which has been named Confluent Chancre. When a chancre occurs upon the frænum, it frequently perforates that fold of the mucous membrane, which should then be cut completely across as the first step towards promoting the cure of the sore.

The *bulb of the urethra* is the posterior extremity of the corpus spongiosum, and is so named from its figure. The greater part of the bulb is placed below the canal of the urethra, and lies upon the anterior surface of the triangular ligament, to which it is firmly fixed by a fibrous investment which it receives from the ligament. Its structure consists internally of a large quantity of erectile tissue, which is a continuation of that of the corpus spongiosum. The canal of the urethra presents a slight depression in its inferior surface opposite the bulb, which is often the cause of some difficulty being experienced in the introduction of a catheter or bougie, by entangling the point of the instrument. When the lining membrane of the urethra is torn at this point, a copious hæmorrhage is a common result. The corpora cavernosa and the bulb of the urethra receive large branches from the internal pudic arteries.

The skin of the penis is remarkably thin, and loosely adherent to the subjacent fibrous structures, so that it readily accommodates itself to the varying states of the organ. Anteriorly, the skin of the penis is continuous with the mucous membrane which is reflected from the base of the corona glandis upon its inner surface; the fold which is thus formed is named the *prepuce*, and the extent to which it covers the glans is very different in different individuals: there are some who cannot uncover the glans at all, which condition forms what has been named a *congenital phymosis;* there are others, again, in whom the prepuce is so short that the glans is habitually uncovered, and between these two states innumerable varieties may occur. The *frænum præputii* is the small duplicature of mucous membrane which retains the prepuce in its situation; it is situated on the under surface of the glans.

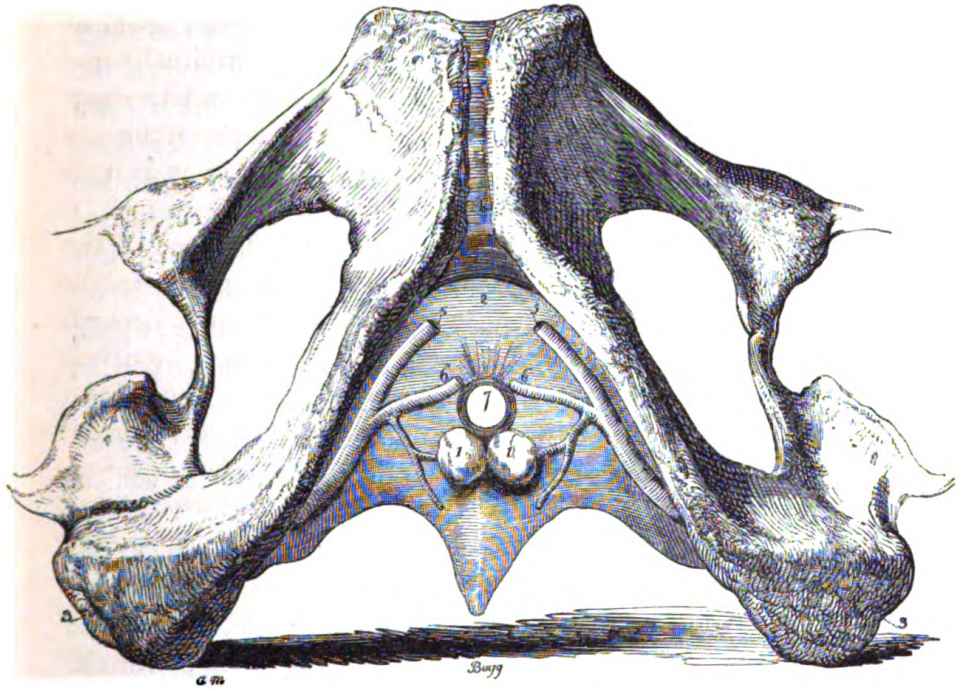
There is a small artery that runs in the substance of the frænum; this little vessel, when it has been divided in the operation for phymosis, should be either ligatured or cauterised, as large quantities of blood have been known to have been lost in consequence of a neglect of these precautions.* The cellular tissue which connects the skin of the prepuce to the mucous membrane is so extensible, that after an operation for phymosis, though every precaution possible may have been previously taken to make the section of the two surfaces of exactly equal extent, the edges of the incision become widely separated by the retraction of the skin. Some surgeons recommend the use of the interrupted suture to bring the edges into contact with one another, while others prefer to cut away the whole of the mucous membrane that may yet remain undivided.

The *triangular ligament of the urethra*, or *deep fascia of the perinæum*, is a strong membranous structure which closes up the anterior part of the inferior outlet of the pelvis. It is attached on each side to the borders of the branches of the ischia and ossa pubis; superiorly, it incloses between its layers the subpubic ligament, and is continuous with the periosteum which lines both surfaces of the symphysis pubis; inferiorly, this fascia has usually been considered as ceasing opposite the lower border of the transverse muscles of the perinæum, though in

* I have known a patient lose as much as three pints of blood after an operation for phymosis, where this vessel had not been secured.

reality it may be traced upon the external surface of the levator ani muscle and the rectum, where, however, it is exceedingly thin and weak. Several openings exist in the triangular ligament, some of which serve for the passage of vessels, and others transmit the rectum and the membranous portion of the urethra.

The opening which allows of the passage of the membranous portion of the urethra is situated nearly one inch below the



The engraving represents the triangular ligament of the urethra where it fills up the arch of the pubis: the penis, and all the soft parts covering the bones, have been removed, as also the anterior lamina of the ligament, for the purpose of showing the situation of the glands of Cowper and the arteries of the bulb. In consequence of the rectum having been removed, the ligament presents the appearance of terminating inferiorly by a free border, which, in the natural condition of the parts, is not the case. The figures 1. 1. mark Cowper's glands. 2. The posterior lamina of the triangular ligament of the urethra. 3. 3. The tuberosities of the ischia. 4. The symphysis pubis. A little below this figure is observed a strong semicircular band of fibres, which is the sub-pubic ligament. 5. 5. The dorsal arteries of the penis, or last branches of the internal pudic arteries. 6. 6. The arteries of the bulb. 7. The foramen or opening in the triangular ligament through which the membranous portion of the urethra passes.

symphysis of the pubis, and is equidistant from the inner edge of the branches of the ossa pubis; this opening is of a circular figure, and about three or four lines in diameter. The membranous portion of the urethra receives, as it passes through, a fibrous investment from the margins of the opening on each side. About half an inch below the symphysis pubis several smaller apertures are formed in the ligament, which serve for the passage of the dorsal arteries, veins, and nerves of the penis.

The triangular ligament of the urethra is composed of two layers of fibro-cellular or tendinous structure, the fibres of which are arranged chiefly in a transverse direction. Between the layers are the sub-pubic ligament superiorly, and lower down Cowper's glands and the arteries of the bulb; besides these structures there is a quantity of tissue, the nature of which has not yet been satisfactorily determined, but which is considered by some anatomists as partaking of a vascular character, while by others it is supposed to be fibrous, if not muscular.

Mr. Guthrie has described two muscles in this situation, which, according to his description, surround the membranous portion of the urethra, and may, by their contraction, be a cause of retention of urine. Their fibres run transversely, and are attached by their extremities, which are elongated, to the rami of the arch of the pubis.*

The direction of the triangular ligament is vertical above, oblique inferiorly, where it covers the levator ani muscle. Relations —by its anterior surface, with the bulb of the urethra, the muscles of the penis, and the external sphincter; posteriorly, with the membranous portion of the urethra, along which it sends a prolongation that connects it with the pelvic fascia, the levator ani, and Wilson's muscles. The superficial fascia of the perinæum is attached to its anterior surface behind the posterior edge of the transverse muscles.

The triangular ligament strengthens the rest of the structures which assist in closing up the inferior outlet of the pelvis, and it serves to support the canal of the urethra. It also frequently forms one of the principal obstacles to the introduction of the catheter, when that operation is not skilfully performed. This ligament is divided to a considerable extent in the lateral operations of lithotomy.

* *Vide* London Med. Surg. Journ. 1833, p. 491.

To expose Cowper's glands and the arteries of the bulb, the anterior lamina of the triangular ligament must be removed.

The *glands of Cowper* are two small bodies of the size and figure of a large pea; they are situated immediately below the membranous part of the urethra, on each side of the mesial line, inclosed between the layers of the triangular ligament. The structure of these bodies resembles that of the other conglomerate glands, consisting of several small granules of a pale ash-colour aggregated together; their ducts are so small as to admit with difficulty the introduction of a bristle; they traverse the coats of the urethra very obliquely, and open into the inferior surface of that canal about an inch and a half in front of the triangular ligament. These glands are sometimes so small that it is with great difficulty they can be displayed.

Cowper's glands are frequently enlarged in cases of stricture of the urethra, and are occasionally the seat of abscesses. I have found the left one divided after the lateral operation of lithotomy had been performed.

The *arteries of the bulb* are two branches of considerable size, which are commonly given off by the internal pudic vessels opposite the opening in the triangular ligament which transmits the membranous portion of the urethra. When this is the case, there is little risk of their being divided in the lateral operation of lithotomy, if the incisions be not made too high when exposing the groove of the staff. Occasionally, however, they run much lower down, and it may then be impossible to avoid wounding them.

To dissect the membranous portion of the urethra and the prostate gland, &c. without making a section of the pelvis.—When the dissector is desirous of obtaining a view of the membranous portion of the urethra, and the structures which surround the neck and base of the bladder, and is not allowed to do so by following the usual method of making a lateral section of the pelvis, he may nevertheless effect his object by adopting the following plan, which consists in separating the rectum from its connexions, and depressing it towards the sacrum and coccyx. The advantages of this plan are the facility of its performance, the little disfigurement of the body which ensues,—circumstances which are frequently of considerable importance—and a more accurate conception of the depth of the perinæum, and the dis-

tance from the surface at which the base of the prostate gland usually lies, than can be acquired, perhaps, by any other means.

For this purpose, the triangular ligament must be divided by carrying an incision across from one tuberosity of the ischium to the other, passing between the bulb of the urethra and the rectum. In making this incision, Cowper's glands and the arteries of the bulb need not be injured. Those of the fibres of the levator ani muscle which descend upon the sides of the prostate gland and rectum must be also divided, in order that the lower part of the intestine may be depressed upon the coccyx. By a little dissection, the membranous portion of the urethra, and the mode in which it is nearly surrounded by the fibres of Wilson's muscles, when they exist, may be shown, as they lie in the interval between the posterior surface of the triangular ligament and the apex of the prostate gland. Immediately behind these structures is the prostate gland itself, and the extent to which it may be safe to cut the left lobe of the gland in the lateral operation of lithotomy may now be determined; the incision in the adult can seldom exceed with safety an inch in length, and its direction should be obliquely downwards and outwards, corresponding with the longest diameter of the gland.

In making this dissection it will be observed how loosely the rectum is connected to the prostate gland and base of the bladder; a circumstance which will explain the frequent occurrence of those mistakes, mentioned by all writers upon lithotomy, in which the gorget or the forceps have been thrust repeatedly between the bladder and the rectum, and the patient allowed to die with a stone in his bladder that ought to have been extracted had the operation been properly performed. I have seen this happen once, in an operation which I witnessed while abroad; the mistake was discovered in time and corrected, after which the stone was extracted: the patient, who was a young boy, recovered very well.

A little behind the base of the prostate gland are situated the vesiculæ seminales; and close along the inner sides of these will be found the vasa deferentia, as they descend upon the base of the bladder, in their course from the testicles to the point where they terminate in the prostatic portion of the urethra. They will be observed to converge towards each other as they approach the base of the prostate gland, where they are placed

nearly in contact. Between the vasa deferentia, a very small portion of the base or "bas-fond" of the bladder is exposed to view, which is the point where the surgeon should enter his trocar, when performing the operation of puncturing the bladder from the rectum. This space will be observed to be extremely small, so that considerable caution is requisite on the part of the operator to avoid injuring either the prostate gland which is in front, the peritonæum which is behind, or the vesiculæ seminales and the vasa deferentia which lie on each side.

In post-mortem examinations, the bladder, prostate gland, and greater part of the urethra may be removed from the body without causing any external disfigurement, and consequently without any violence to the feelings of the friends, who frequently object to the removal of valuable morbid specimens, only upon the ground of the unseemly appearance which might be given to the body of their deceased relative: the removal is effected by cutting out the diseased parts with a knife introduced into the rectum.

CHAPTER II.

SECTION I.

DISSECTION TO EXPOSE, BY A LATERAL VIEW, THE ORGANS CONTAINED IN THE CAVITY OF THE PELVIS.

An incision should be made, in the direction of the linea alba, from the upper part of the symphysis pubis to the umbilicus, and another from the latter point to the spinous process of the fourth lumbar vertebra. The flap which has been thus marked out may be dissected from the peritonæum, (which should remain intact,) and reflected downwards upon the thigh. As it is usual to perform the operation of lithotomy upon the left side, it need scarcely be said that these incisions should be also made upon the same side of the body. Detach now the peritonæum from the iliac fossa, and expose the fascia which covers the iliacus internus and psoas magnus muscles; trace this fascia over the brim of the pelvis as far as the neck of the bladder, and upon the rectum, where it becomes gradually weaker until it can hardly be distinguished from the subserous cellular tissue. Separate this, which is the pelvic fascia, and the fibres of the levator ani muscle, from their attachments to the left os innominatum, which may then be detached by sawing it across at a little distance from the symphysis pubis, and dividing the ligamento-cartilaginous substance which forms the bond of union between it and the sacrum; not forgetting to divide also the ilio-lumbar ligament. The bone, together with the obturator internus muscle, and the fascia that covers it, is to be removed altogether; leaving, however, the spinous process of the ischium, with the fibres of the levator ani, which have their origin from it. While doing this, as much of the left crus penis and of the triangular ligament of the urethra is to be retained as is possible, by cutting the soft parts close to the branches of the os pubis and the ischium of the left side. In this stage of the dissection, besides the structures which have been already mentioned, some

of the fibres of the gluteus maximus, and of the pyriformis and coccygeus muscles, must be divided, together with the sciatic nerves and the larger branches of the internal iliac artery and vein which issue from the pelvis by the great sacro-sciatic notch. Dissect the fibres of the levator ani from their attachment to the posterior surface of the os pubis, and reflect the muscle with the spine of the ischium downwards, so as to expose the prostate gland, membranous portion of the urethra, and the middle portion of the rectum. After this, the pelvic fascia should be traced, and it will be found that at the base of the prostate gland it divides into two laminæ ; one of which, and it is the weakest, ascends and covers the bladder and first portion of the rectum ; whilst the other, much the stronger, forms a sheath for the prostate gland and the vesiculæ seminales, and is continuous along the membranous portion of the urethra, and the middle division of the rectum, with the posterior surface of the triangular ligament of the urethra.

When the pelvic fascia has been thus followed in all its extent, remove the coverings or sheaths which it furnishes to the prostate gland and membranous portion of the urethra ; expose also the muscular coat of the horizontal or middle portion of the rectum, the vesiculæ seminales, the vasa deferentia, and the ureter. Lay open now the peritonæum, in order to show the point where that membrane is reflected from the rectum upon the posterior surface of the bladder, and measure the distance of this reflection from the base of the prostate gland, and from the external surface of the perinæum.

When these directions have been executed, the parts which remain exposed to view are the following, and they may be examined separately in detail. In front is the cut surface of the bone of the pubis, and posteriorly the cartilaginous surface of the sacrum, by which it was united to the ilium ; underneath is the coccyx. Below the symphysis pubis is seen the triangular ligament, containing, between the two layers of which it is composed, Cowper's glands, the arteries of the bulb, and, according to Mr. Guthrie, some muscular fibres. In front of this ligament are the bulb of the urethra and the last portion of the rectum, which are separated from one another by a small triangular-shaped interval (the *recto-urethral triangle*), which is occupied by the central point of the perinæum, some cellular

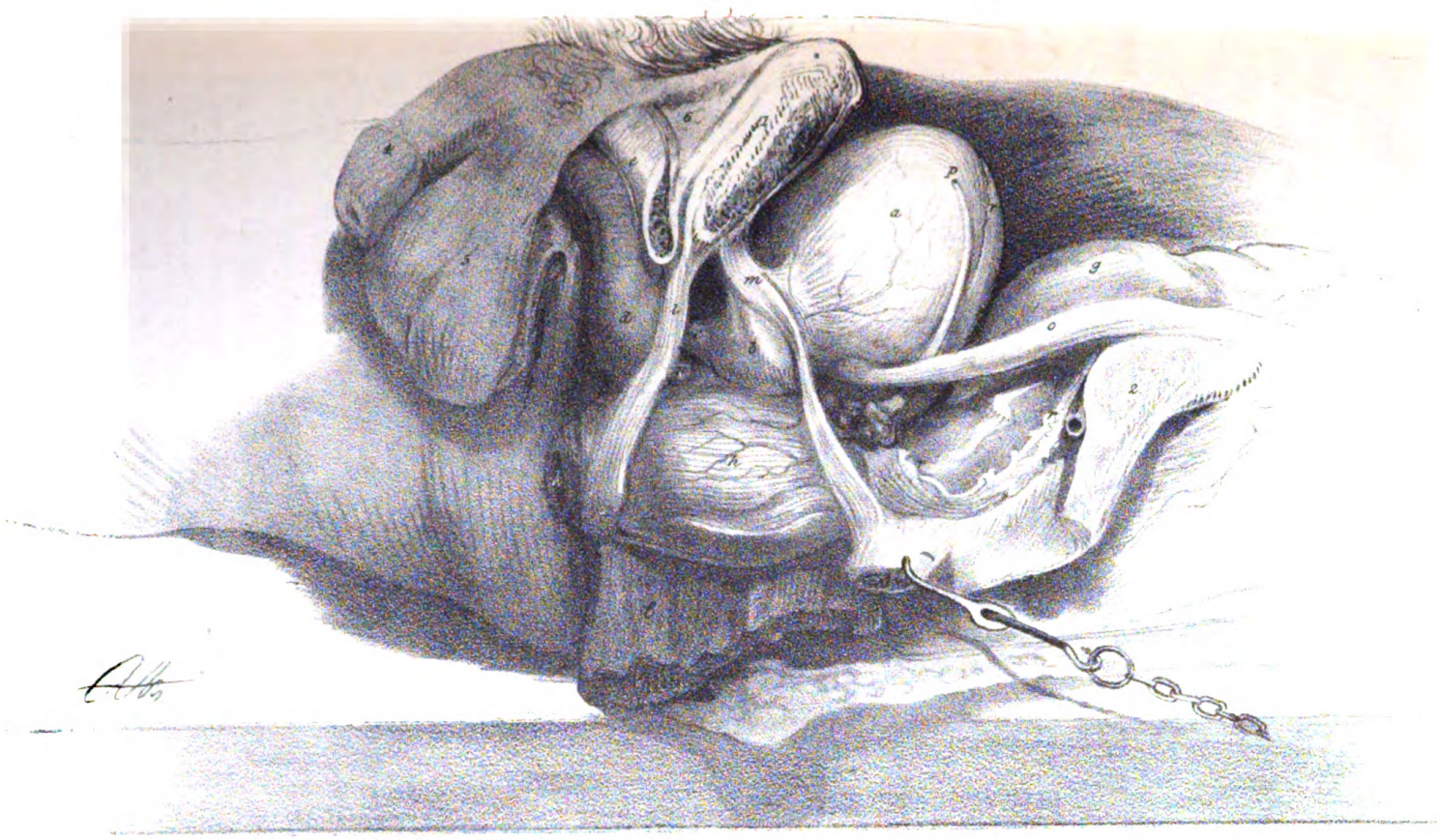
tissue, and the superficial fascia as it passes behind the transverse muscles of the perineum to join the triangular ligament; still more anteriorly are observed the body of the penis, with the left crus cut from the ramus of the pubis which has been removed, and the scrotum. Behind the triangular ligament are the greater part of the membranous portion of the urethra,

EXPLANATION OF PLATE IV.

This represents the view of the parts in the male pelvis, as obtained by removing the os innominatum of the left side.

1. The os pubis of the left side divided by the saw, about half an inch from the symphysis.
2. The sacrum. The figure is placed upon the cartilaginous surface of the bone, by which it was articulated with the left os ilii, which has been removed.
3. The spinous process of the ischium, which has been sawn across and left attached to the pelvic fascia. The hook is inserted into the pelvic fascia, which it holds gently upon the stretch.
4. The penis lying against the right thigh.
5. The scrotum.
6. The suspensory ligament of the penis.

a. The bladder slightly distended.
b. The prostate gland.
c. The membranous portion of the urethra.
d. The bulb of the urethra.
e. The crus penis of the left side, which has been cut from its attachment to the branch of the ischium.
f. The levator ani muscle of the left side dissected from its attachments to the sides of the rectum and bladder, from which it has been turned down, it conceals the coccyx.
g. *h*. *i*. mark the rectum. The letter *g*. is placed upon the first portion of the intestine; *h*. upon the second, or horizontal portion; and *i*. upon the third, or oblique.
k. The anus.
l. The triangular ligament of the urethra.
m. The pelvic fascia inserted upon the base of the prostate gland.
n. Cowper's gland of the left side.
o. The ureter of the same side.
p. The vas deferens, cut across where it is leaving the side of the bladder in its course to the internal abdominal ring.
q. The vesicula seminalis.
r. *r*. *r*. The divided edge of the peritonæum covering the posterior surface of the bladder and the rectum. The cul-de-sac which this membrane forms where it passes from the rectum upon the bladder, is seen to be situated near the posterior extremity of the vesicula seminalis, and not far from the base of the prostate gland.
s. The trunk of the common iliac artery cut across in making the section of the pelvis.



W. Fairland, lith.

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and the prostate gland; above these the anterior ligaments of the bladder; below them the middle or horizontal portion of the rectum; and still farther behind are situated the bladder, vesiculæ seminales, and the perpendicular portion of the rectum, covered by the peritonæum, which passes from it upon the posterior surface of the bladder. (See Plate IV.)

The *peritonæum*, where it passes from the rectum upon the posterior surface of the bladder, forms, on each side of the cul-de-sac which it presents here, two folds, which have been named the posterior ligaments of the bladder, though without any good reason, for they are rather calculated to facilitate the changes which are produced in the position of this viscus, by its different states of repletion and vacuity, than to maintain it in any one fixed relation.

The peritonæum is reflected from the posterior surface of the bladder at its summit, where the ligamentous remains of the urachus ascend to the umbilicus. On each side, the vasa deferentia and umbilical arteries limit the extent to which this membrane covers the bladder.

The distance from the base of the prostate gland at which the peritonæum is reflected from the rectum upon the posterior surface of the bladder, is sometimes not more than one quarter of an inch; so that it may be wounded by an incautious operator in performing the operation of puncture of the bladder from the rectum.

A layer of cellular tissue,* of a very loose and easily distensible nature, is placed underneath the peritonæum, and separates it from the pelvic fascia; this cellular tissue allows the changes of relative position which so frequently take place between the bladder and rectum to be very easily effected. In corpulent subjects this tissue is much loaded with adipose substance, which renders it difficult to distinguish it from the pelvic fascia, which, in such cases, is very thin and delicate.

The *pelvic fascia* (recto-vesical fascia, fascia pelvica) is the membrane which lines the whole of the cavity of the pelvis, and is placed between the peritonæum and the muscles. To expose it, it is only necessary to remove the peritonæum and subserous cellular tissue; which may be done with the handle

* The subserous cellular tissue,—fascia propria of the French anatomists.

of the scalpel. The pelvic fascia is a continuation of the same membranous structure which is called, where it lines the parietes of the inguinal region, *fascia transversalis*, and upon the iliacus and psoas muscles, *fascia iliaca:* as it passes over the brim of the pelvis it is very thin and weak, and it is with great difficulty that it can be separated from the periosteum of the bones, to which it closely adheres. As the pelvic fascia descends behind the symphysis of the pubis, and upon the levator ani muscles, it becomes much stronger and is easily traced upon the sides of the bladder and rectum, upon which it is gradually expanded. The pelvic fascia is pierced by the several vessels and nerves which leave the cavity of the pelvis for the supply of the lower extremities and the genital organs; each of these structures receives an investment or sheath from the fascia as they pass through it, which may be traced a short distance along their course.

On each side of the symphysis pubis the pelvic fascia presents two thick and strong processes, which extend from the bodies of the ossa pubis to the neck of the bladder, lying above the prostate gland. These processes are about an inch long, and have been named the *anterior ligaments of the bladder;* they connect some of the muscular fibres of the bladder to the posterior surface of the ossa pubis.

Between the anterior ligaments of the bladder, the pelvic fascia presents a slight depression, which corresponds with the upper surface of the membranous portion of the urethra and prostate gland; underneath this depressed part of the pelvic fascia will be found the continuation of the dorsal veins of the penis, after they have passed through the triangular ligament to join the prostatic plexus.

When the pelvic fascia reaches the neck of the bladder, it divides into two lamellæ, of which the superior one is much the thinner, and ascends upon the muscular parietes of that organ, which it invests; the other end is much stronger and thicker, descends upon the prostate gland which it envelopes, as it were, in a perfect sheath, and may thence be followed along the membranous portion of the urethra as far as to the posterior margin of the opening by which that canal passes through the triangular ligament, where it becomes continuous with the posterior layer of that structure.

A large number of veins run in the substance of the sheath which the pelvic fascia furnishes to the prostate gland; these veins are called the *prostatic plexus*. It is not very unfrequent to find small calcareous concretions, or phebolites, as they are termed, in the interior of these veins.*

There are several cases recorded where the division of these veins, in the operation of lithotomy performed upon old people, has been followed by a considerable hæmorrhage; they are sometimes also the seat of phebitis, which indeed, according to many of the French writers of the present day, is to be regarded as one of the principal causes of death after that operation.

Where the pelvic fascia is traversed by the rectum, it divides into two layers also, one of which ascends, and the other descends, upon the muscular fibres of the intestine. It is in this manner that the pelvic fascia separates the bladder, the membranous portion of the urethra, with the prostate gland and the vesiculæ seminales, from the horizontal portion of the rectum, upon which they are supported. If this part of the pelvic fascia be now removed, the vesiculæ seminales and the vasa deferentia may be shown as they lie in the interval between the convex surfaces of the base of the bladder and the rectum.

The pelvic fascia is in relation superiorly with the peritonæum and the subserous cellular tissue; inferiorly, or by its external surface, with the obturator fascia, the fibres of the levatores ani, pyriformes and coccygei muscles, as well as the several structures to which, as has been already mentioned, it furnishes separate investments. The fascia also serves to strengthen this part of the walls of the abdomen, and to prevent the more frequent occurrence of hernia either in the perinæal region, or by the sacro-sciatic and thyroid openings; moreover, it assists in maintaining the viscera of the pelvis in their respective situations. The strongest part of the fascia is at the point where it is attached to the base of the prostate gland and the neck of the bladder; here it is considered by many to form the chief obstacle to the occurrence of infiltration of urine into the cellular

* "The formation of phlebolites is a remarkable example of the gradual conversion of the fibrine of the blood in the veins into isolated, round, or ovoid bodies of a strong hardness."—Dr. Carswell's Pathol. Anat. art. Analogous tissues.

tissue of the pelvis, after the lateral operations of lithotomy; and hence the anxiety of many surgeons to avoid injuring it at this situation, while dividing the prostate gland with the knife or gorget. The incision or laceration of the prostate gland must extend beyond the base of the gland, and reach the base of the bladder, before infiltration of urine into the subserous cellular tissue of the pelvis can take place.

The *prostate gland* is a firm fleshy body, placed in front of the neck of the bladder, which it embraces by its base or larger circumference. The figure of the prostate is heart-shaped, or, as is more commonly said, resembles that of a large chestnut; the base or broad part being directed posteriorly, whilst its apex, which is truncated, looks towards the arch of the pubis, from which it is distant about half an inch: here it surrounds the commencement of the membranous portion of the urethra.

The prostate gland is somewhat flattened or compressed upon the superior and inferior surfaces, and is much more prominent on either side; from which circumstance it is usual to describe it as consisting of two lobes,—the *lateral lobes* of the prostate, as they are called.

In some subjects the posterior border of the prostate gland is more irregular in its outline than in others, and a small portion of its substance is found projecting between the vasa deferentia previous to their entering the body of the gland: this has been described as another lobe, and is named the *third* or middle lobe of the prostate by Sir Everard Home, who first described it, and who considered that the retention of urine, which is so common in old men, was generally caused by a morbid growth of the *third lobe;* an opinion, however, which is not universally adopted at the present day, since it has been frequently shown that the tumour which causes the retention of the urine alluded to, is a distinct growth, and wholly independent of thi portion of the prostate.

The prostate belongs to the class of conglomerate glands, as being composed of minute granules aggregated together by a very dense and strong tissue. Its ducts, which are very numerous, open into the floor of the prostatic portion of the urethra, on each side of the *verumontanum* or *caput gallinaginis*. It is by no means an unfrequent occurrence to meet with numbers of small calculi, of a dark brown colour, interspersed in the sub-

stance of the gland. They are formed in the ducts, and consist, as has been found by analysis, of phosphate of lime; these calculi sometimes acquire a considerable size. When the prostate gland is cut, the section presents a firm, resistant, and striated surface, which is not unlike in its appearance, especially in elderly people, to that of a scirrhous tumour. The structure of the prostate is very lacerable, and admits of being extended to a very great degree.

Relations—by its inferior surface, with the middle portion of the rectum; superiorly, with the anterior ligaments of the bladder; and, on each side, with the fibres of the levatores ani, which descend from the posterior surface of the ossa pubis to the central point of the perinæum, and have been named the *compressor prostatæ*, — in front with Wilson's muscles, and the membranous portion of the urethra; behind, with the neck of the bladder. The gland is closely invested in a sheath or capsule, which is furnished by the pelvic fascia; underneath, or in the thickness of which, run the prostatic plexus of veins, which have been already alluded to.

In some instances, which are happily, however, of rare occurrence, the internal pudic artery, instead of pursuing its usual course, runs along the side of the prostate gland; and would be almost inevitably divided in the lateral operation of lithotomy, if performed under such circumstances. Sometimes it is a large branch of the internal iliac artery which runs in this unusual course.*

The urethra runs through the prostate in such a manner that it is much nearer to the superior than the inferior surface of the gland; though some exceptions have been noticed to this very general rule. The common ejaculatory ducts, which result from the union of the vasa deferentia with the ducts of the vesiculæ seminales, also traverse the greater part of the substance of the gland, as they run in an oblique direction forwards and upwards

* In a man who was operated upon by the late Mr. J. Shaw, and who died of hæmorrhage soon after the operation, it was found that the source of the bleeding was this anomalous distribution of the arteries; a large branch of the internal iliac artery ran along the side of the prostate gland, and had been cut by the knife in opening the neck of the bladder.—Ed. Journ. of Med. Science, vol. ii. 1826.

to the point where they open into the floor of the prostatic portion of the urethra, underneath the verumontanum.

In children the prostate gland is exceedingly small, while in elderly persons it very frequently becomes very much enlarged. Owing to its peculiar figure, its diameters are of very unequal extent; thus, if measured from the urethra, where it is passing through the gland, to the circumference of the base, we shall have superiorly a radius of not more than three or four lines, inferiorly about four or six; on each side, in a transverse direction, six or eight lines; whilst in an oblique direction downwards and outwards, which is that of the incision to be made in the lateral operation of lithotomy, we shall find the radius to be from nine to twelve lines in length.

There is scarcely, perhaps, any point in surgery which has been more disputed than the question, What ought to be the extent to which it is proper to carry the incision of the prostate gland in the lateral operation of lithotomy? This is a question that still remains undecided; although in this country the majority of surgeons appear inclined to adopt the opinion that it is more safe in general not to extend the incision so far as to divide the whole of the base of the prostate gland, as by thus limiting the section, the chances of infiltration of urine into the subserous cellular tissue of the pelvis will be less than when the base of the prostate gland is divided, together with the reflection of the pelvic fascia which is connected with it.

The prostate gland is sometimes the seat of abscesses, the contents of which may be discharged by the collections of pus bursting either into the rectum or the urethra. Tuberculous deposits have been noticed in the substance of the gland.

The *vas deferens* is the long and narrow tube which conveys into the urethra the seminal fluid secreted by the testicle. It leaves the other component structures of the spermatic cord at the internal abdominal ring, and, after crossing over the epigastric artery, descends along the side of the bladder, running in the angle which is formed by the reflection of the peritonæum from the posterior surface of the bladder upon the sides of the pelvis. In the latter part of this course it crosses the ureter at nearly right angles, passing upon its inner side; and then, inclining more towards the mesial line, runs along the inner border of the corresponding vesicula seminalis, with the duct of which it unites at the base of the prostate gland. The vas deferens is accom-

panied in the whole of its course by a very small artery, which is a branch of the vesical artery. Near to its termination the vas deferens becomes considerably enlarged, and somewhat tortuous in its figure, and the calibre of the tube, which is extremely small in the greater part of its extent, here becomes much increased and sacculated in its figure, so as to present, when cut open, a honeycombed appearance. The external coat is of very great thickness; and so firm, that it is easy to distinguish the vas deferens from the other components of the spermatic cord by the hard wiry sensation which it communicates to the fingers when the cord is handled: internally, the vas deferens is lined with a delicate mucous membrane.

The *vesiculæ seminales* are oblong-shaped cellular bodies, situated one on each side of the base of the bladder, behind the prostate gland. They are enclosed in a sheath derived from the pelvic fascia, and lie in the interval between the convex surfaces of the rectum and base of the bladder. Their external surface is very irregular, from the sacculated form of their interior, which is composed of numerous cells that communicate freely with each other. The larger extremity, which is directed posteriorly, is separated by a considerable interspace from the base of the opposite vesicula; while their anterior extremities, which are narrow, and end in the ducts that join with the vasa deferentia, are only separated from one another by the breadth of these vessels, and by the middle lobe of the prostate gland when it exists. The structure of the external coat of the vesiculæ seminales appears to be similar to that of the vasa deferentia, but is much thinner; the internal coat is composed of mucous membrane.*

According to some authors, the vesiculæ seminales form reservoirs for the seminal fluid secreted by the testicles; though there are several points of difference between their contents, as found after death, and the semen itself. It was the opinion of John Hunter, that the vesiculæ seminales did not receive semen from the vasa deferentia. The fluid which they contain is usually clear, of a viscid or glairy consistence, and of a darkish brown colour.

The *common seminal ducts* (ducti ejaculatorii) are two in

* Not long since, in examining the body of a man who died in the hospital, we found the vesiculæ seminales ossified. The preparation is now in the Museum of the College.

number; they are formed by the junction of the duct of the vesicula seminalis on each side with the corresponding vas deferens; their length is about an inch, and they run obliquely forwards and upwards, through the substance of the prostate gland, to the point at which they terminate by opening into the prostatic portion of the urethra. As they run parallel with each other in their course through the gland, they are not likely to be wounded in the lateral operation of lithotomy; but one or both must in all probability be divided in the recto-vesical method.

The *membranous portion of the urethra* is the narrowest part of the canal, and extends from the apex of the prostate gland to the bulb of the urethra; its length is about one inch when measured upon the superior surface; but it appears to be somewhat less than this inferiorly, on account of the bulb of the urethra here encroaching upon it. The triangular ligament divides the membranous portion of the urethra unequally, the larger part being behind, placed between the ligament and the prostate gland. This part, which is surrounded on the sides and inferiorly by Wilson's muscles when they exist, is also in very close apposition with the middle division of the rectum, which renders it useful to depress the intestine with the forefinger of the left hand, in order to avoid injuring the coats of the bowel, while the groove of the staff is being exposed with the knife in the operation of lithotomy.

The membranous portion of the urethra is invested by a sheath from the pelvic fascia, which joins with the posterior layer of the triangular ligament around the margins of the opening by which the canal passes through. Cowper's glands are also closely situated beneath it, and the dorsal veins of the penis run along the upper surface in their way to join with the prostatic plexus.

What is the nature of the structure which lies between the mucous membrane of the membranous portion, and the sheath which it receives from the pelvic fascia? According to some, it is a vascular or erectile tissue; while in the opinion of others it is of a muscular nature; of which latter character, indeed, it has generally appeared to me to partake most. If this be the case, the old name of *muscular portion*, which was formerly given to it, would appear to be more applicable than the present one.

The *bladder* is the musculo-membranous reservoir that serves to contain the urine during the intervals of its evacuation from the body. It lies behind the bones and symphysis of the pubis, and in front of the first or perpendicular division of the rectum, resting upon the middle portion of the gut. When the bladder and rectum are empty, the space between them is usually occupied by some of the folds of the small intestine, which then descend into the pelvis. The figure of the bladder is not always the same, for it differs considerably according to the age and sex of the individual, and also in the opposite conditions of repletion and vacuity. In children the bladder is of pyriform figure, and is situated much more in the hypogastric and the umbilical regions than in the cavity of the pelvis, which it occupies in the adult, when it is also of a rounded or ovoid shape.

The bladder in the adult, when empty, lies closely behind the pubis, and in this condition must be greatly protected from injury from external violence; but, when it is distended with urine, the upper part of it rises above the edge of the pubis, and lies behind the lower part of the recti muscles.

For the purpose of description, the exterior of the bladder may be divided into four surfaces or regions, to which may be added its summit and base.

The *anterior surface* is separated from the pubis by a quantity of loose cellular and adipose tissue, and extends, from the insertion of the urachus into the summit of the bladder, to the upper edge of the prostate gland, where the anterior ligaments fix it more firmly to the bones of the pubis. This part of the surface of the bladder is uncovered by peritonæum; and upon this circumstance is founded the practice of puncturing the bladder above the pubis in some cases of retention of urine, and also the high operation of lithotomy. That these operations may be performed with safety, it is necessary, however, that the bladder should be considerably distended.

In thin persons it is always easy to determine whether the bladder is distended or not, by the tumour which it forms in the hypogastric region; but the case is very different in corpulent individuals, in whom the belly is more than usually prominent: in these circumstances the diagnosis is frequently extremely difficult and obscure.

The *posterior surface* is inclined very obliquely downwards

and backwards, extending from the urachus to the point where the peritonæum is reflected from the rectum upon the bladder. The posterior surface is covered in the whole of its extent by the peritonæum. Some of the folds of the small intestine usually separate it from the first portion of the rectum, except when the bladder is very largely distended.

When the bladder is ruptured by a fall or from a blow upon the lower part of the belly, the rent is usually situated in some part of the posterior surface; which is probably to be attributed to the unyielding nature of the peritonæum which covers it at this part.

The *lateral surfaces* are of greater extent inferiorly than superiorly; the peritonæum covers the sides of the bladder to a very small extent superiorly, as it soon leaves them to be reflected upon the sides of the pelvis, where it forms what are called the *false lateral ligaments* of the bladder: a quantity of loose cellular tissue invests the remainder of the lateral surfaces, and separates them from the pelvic fascia. The vasa deferentia, and the ligamentous remains of the hypogastric arteries, lie in this cellular tissue as they descend obliquely along the sides of the bladder.

The *summit of the bladder*, or, as it is sometimes termed, *the fundus*, may be said to be formed by the junction superiorly of the preceding surfaces. It is covered posteriorly, and partially upon the sides, by the peritonæum. From its centre extends upwards to the umbilicus a fibro-cellular cord, somewhat triangular in its shape, and named the *urachus*. This is the remains of a hollow tube which in the early stages of fœtal existence extends from the bladder to the umbilicus, where it is connected with the membranes of the ovum. Lying between the linea alba and the peritonæum, and having attachment inferiorly to the muscular coat of the bladder, it serves as one of the principal means of retaining the bladder, during its distension, against the posterior surface of the anterior wall of the abdomen. The two ligamentous bands which result from the obliteration of the hypogastric arteries also extend, on each side of the urachus, from near the summit of the bladder to the umbilicus.

The *base of the bladder*, sometimes also called the "*bas-fond*," is that part of the viscus which rests upon the middle portion of the rectum, the vesiculæ seminales, and vasa defer-

entia; it is limited in front by the posterior edge of the prostate gland, and behind by the recto-vesical cul-de-sac of the peritonæum. On each side the ureters pierce the tunics of the bladder obliquely, in their course to reach its interior.

The base, in the adult subject, is the most depending portion of the bladder, and it is much more so in some subjects than in others; so that it not unfrequently occurs that a calculus, especially when of inconsiderable size, may lie so deeply here that it eludes for some time all the attempts of the surgeon to touch it with the sound. From the same circumstances also, some delay may be produced in seizing the stone with the forceps in the operation of lithotomy, as it cannot be reached with the finger. It is of importance to be observed, that the triangular space through which the point of the trocar can be safely introduced into the bladder, when it is punctured from the rectum, is exceedingly limited in its extent; as the cul-de-sac of the peritonæum frequently descends between the vesiculæ seminales much nearer towards the posterior edge of the prostate gland than is commonly supposed from the usual descriptions which are given of it in books.

The *neck of the bladder* (cervix vesicæ) is that part of it which is surrounded by the prostate gland; as it comprises within its limits the greater part of the *trigone vésical*, and is continuous anteriorly with the prostatic portion of the urethra. In infancy this is the lowest part of the bladder; but, in the adult and old subject, the bas-fond most frequently lies upon a plane inferior to it.

The neck of the bladder is cut in the lateral operation of lithotomy.

The *ligaments of the bladder* are several in number, and admit of being divided into two classes, the *true* and the *false* ligaments. The first of these consist of the *anterior* and *lateral ligaments*, formed by the pelvic fascia, as already described. The urachus and the ligamentous remains of the hypogastric arteries also serve the purpose of ligaments by connecting the summit of the bladder to the umbilicus; while inferiorly the membranous portion of the urethra, with the dense sheath which it receives from the pelvic fascia covering the prostate gland, firmly fix its base behind the arch of the pubes.

The latter class, or the false ligaments, are formed by the peritonæum where it is reflected on each side from the posterior sur-

face of the bladder to the iliac fossæ, and by the little folds which project on each side of the recto-vesical cul-de-sac of the same membrane. It is obvious that these do not really deserve the name of ligaments of the bladder, inasmuch as they are rather calculated to facilitate the changes of position consequent upon its distension than to limit or restrict them.

Structure of the bladder.—The coats or tunics of the bladder are three in number; a serous, a muscular, and a mucous. These are united to each other by cellular tissue, which, according to some writers, should be enumerated as two additional coats.

The serous or peritonæal coat forms but a partial investment, since it only covers the posterior and a small portion of the lateral surfaces of the bladder. The extent of this covering upon the sides of the bladder appears to be determined by the course of the vasa deferentia, whilst the urachus limits it superiorly. The cellular tissue that unites the peritonæum to the muscular coat is of a very lax nature, so as to allow of the free motion of the bladder underneath it during its distension. The muscular coat is composed of three layers, each of which pursues a different direction; the fibres of the first set are disposed in a longitudinal course, and appear to extend from the neck of the bladder and anterior ligaments over the whole surface of the viscus. Some of these are also attached to the urachus and to the ureters for a little distance from the bladder. The fibres of the second set are for the most part arranged in a transverse direction, while those of the internal or third layer present a reticulated appearance. This arrangement of the muscular fibres of the bladder can be best seen in those cases where they have become increased in thickness and strength, in consequence of some obstruction to the easy exit of the urine, as in cases of inveterate stricture of the urethra. In such cases, the internal surface of the bladder frequently presents a honeycombed appearance from the large size of the muscular fibres.

Many persons have been deceived into the error of stating the existence of calculus in the bladder, when none in reality existed, by mistaking the sensation, which the rough internal surface of a bladder in this condition is capable of communicating to the touch, for that produced by the contact of the staff with a stone.

In some instances, the mucous membrane of the bladder is

protruded in the intervals between the muscular fibres in such a manner as to form distinct pouches or little sacs, in which calculi are sometimes deposited.

It may be mentioned, however, that the fibres of one stratum are not altogether distinct from those of the others; but that they frequently intermingle and are interlaced with each other at different points.

Some circular fibres have been noticed by Sir Charles Bell as surrounding the orifice of the urethra, and have been named by him the *sphincter muscle* of the bladder; but these are not always found to present very distinctly the appearance that he has described.

When the interior of the bladder has been laid open by a longitudinal incision made upon its anterior surface, the mucous membrane that lines it may be next examined. It is continuous with the mucous membrane which lines the ureters and the urethra. When the bladder is empty and contracted, the mucous membrane is thrown into numerous transverse folds or rugæ. It is very vascular, especially towards the neck of the bladder, where numerous veins are placed underneath it; when healthy, it is of a pale roseate hue. A large number of mucous follicles abound in the region of the neck of the bladder. Underneath the mucous membrane, a layer of cellular tissue is placed, which has been sometimes called the vascular or nervous coat.

The "*trigone vésical*" is the name that has been given to the small triangular space included between the orifice of the urethra in front, and those of the ureters posteriorly. The mucous membrane where it covers this triangular space is perfectly smooth, pale, and seems to be endowed with a more acute sensibility to impressions than any other part of it. The base of the trigone is situated posteriorly, and is formed by a line extending across from the orifice of one ureter to the other. Where the urethra commences, at the apex of the trigone vésical, a small eminence may be observed to project in the mesial line, which has received the name of "*luette vésicale*" or "*uvula vesicæ.*"

Sir Charles Bell has described two small fasciculi of muscular fibres which lie underneath the mucous membrane on each side of the trigone, and reach from the orifices of the ureters to the uvula vesicæ, into which they are inserted. These bands have

been named by him the "*muscles of the ureters;*" and may serve to maintain the obliquity of the course of the ureters through the coats of the bladder, notwithstanding the different degrees of distension to which it is subject.

The arteries of the bladder are furnished from the vesical branches of the internal iliac artery, besides a few ramusculi which come from the middle hæmorrhoidal and internal pudic arteries. These vessels are chiefly distributed upon the inferior surface and sides of the bladder.

The veins, which are few and small in the young subject, form in the adult a considerable plexus around the neck of the bladder and prostate gland. They receive the dorsal veins of the penis, with some branches from the sides of the prostate gland and the adjacent structures, and terminate by opening into the internal iliac veins. The veins forming this plexus are frequently varicose in old persons, and thus become capable of furnishing a considerable quantity of blood when cut in the operation of lithotomy.

The nerves of the bladder are partly derived from the sacral plexuses of the cerebro-spinal axis, and partly from the hypogastric plexuses of the sympathetic system.

The *ureters* are the long cylindrical-shaped tubes which serve to convey the urine from the kidneys into the bladder. Each ureter is about eighteen inches long, and of the size of an ordinary quill. In its course the ureter crosses over the upper part of the psoas muscle, passing underneath the spermatic vessels; opposite the base of the sacrum it crosses the common iliac artery and vein near their termination in the external and internal iliacs; and still lower down in the cavity of the pelvis it crosses the vas deferens, which lies upon its inner side near the point where it is about to enter the bladder. The ureters traverse the coats of the bladder very obliquely, and, on arriving upon its inner surface, terminate at the posterior angles of the trigone vésical. Where they pass through the coats of the bladder, the ureters are narrower than elsewhere. In their course the ureters are closely applied to the external surface of the peritonæum, and are carried along with this membrane when it is lifted up from the subjacent structures, as in the operation of placing a ligature upon the common iliac artery. The interior of the ureters is lined with mucous membrane which is continuous with that of the bladder. Some of the muscular fibres of the

bladder may be followed for a considerable distance upon the ureters. Occasionally there are observed two ureters upon one side, which sometimes unite with one another before their termination.

Urinary calculi, as they descend from the kidney to the bladder, frequently excite considerable pain and uneasiness in the upper part of the thigh and testicle, according to the degree of pressure which they exercise upon the nerves of the lumbar and spermatic plexuses as they are crossing over them. Calculi are sometimes arrested at the vesical orifice of the ureter, where they project partially into the bladder; and in this situation may attain a considerable size, and cause some delay and difficulty in their extraction, should the operation of lithotomy be performed under such circumstances.

Where a considerable obstruction has existed for any length of time to the evacuation of the urine, as in cases of old and close strictures of the urethra, stone in the bladder, disease of the prostate gland, &c. the ureters are frequently found to be greatly enlarged in their diameter, and otherwise diseased in their structure.

The *urethra*. — The internal surface of the urethra may be exposed to view and examined by opening the canal through the entire length of its course by an incision which should be carried along its superior wall: this incision is readily made with the scissors, one of the blades of which is to be introduced into the canal. If this is done before the penis and bladder are detached from the pelvis, the relations of the urethra to the surrounding structures, and the curved direction which it pursues, can be studied with much greater advantage than when they have been previously separated.

The urethra extends from the neck of the bladder to the summit of the glans penis, where it terminates by a vertical slit or aperture, which is named the meatus urinarius. The length of the urethra may be said to average between eight and nine inches, though in many instances considerable variations from this standard may be shown to exist. The diameter of the urethra is not exactly the same throughout its extent, but varies considerably at different points. The direction of the urethra is, strictly speaking, curved, though by a little tact a perfectly straight instrument may be carried along it into the bladder. As the penis hangs loosely in front of the scrotum, the urethra presents a

double curvature, which has been likened to the letter S reversed. The first of these curves, or that which is situated in front of the symphysis pubis, is readily effaced by raising the penis upwards until it forms a right angle with the axis of the body; it also disappears in the state of erection of the penis. The second curvature, however, is permanent, and is formed by the urethra bending underneath the arch of the pubis, towards which the concavity of the curve is directed. This last curvature, though constantly present, is not so great as has been imagined by many; but it is liable to be increased by several circumstances, and more especially by enlargement of the prostate gland. The urethra has been divided into three portions, which differ from one another in their structure as well as in their situation and extent; they are the *prostatic portion*, the *membranous portion*, and the *spongy portion*.

1. The *prostatic portion* commences at the neck of the bladder, and extends in an oblique direction from above downwards, and from behind forwards, about twelve or fifteen lines. This is, in the natural condition, the widest part of the urethra. In the middle of its floor a triangular-shaped eminence is observable, which is formed by a duplicature of the mucous and submucous tunics; this is the *verumontanum* or *caput gallinaginis*. On each side of this fold the urethra presents a deep depression — *sinus prostaticus*, into which the ducts of the prostate gland open. By compressing the gland between the fingers, these orifices may be more distinctly seen, by the whitish fluid, which is the secretion of the gland, being thus made to issue from them: they are about fifteen or twenty in number. The orifices of these ducts are sometimes considerably dilated, and then may become an obstacle to the passage of a small catheter, from the point of the instrument becoming entangled in them. A slight depression is to be seen upon the anterior surface of the verumontanum, which is named the *sinus pocularis*, and within the margins of which the common ejaculatory ducts open, commonly by two separate orifices which are situated one on either side of the mesial line. The extremity of a small catheter is sometimes obstructed in its passage at this point also; and, if force is used, a false passage will be the result. The extremities of the prostatic portion of the urethra are usually narrower in their diameter than the intervening space.

2. The *membranous portion* of the urethra extends from the apex of the prostate gland to the bulb; its length is about one inch, though, as has been mentioned previously, it appears to be less if measured upon its inferior surface, in consequence of the depending position of the bulb of the urethra. The membranous portion is the narrowest part of the urethra, its diameter seldom exceeding three or four lines. Its direction is slightly curved, the centre of the curvature being at the point where it passes through the opening in the triangular ligament of the urethra, the concavity being directed upwards.

3. The *spongy portion* is the longest of the divisions of the urethra, for it extends from the orifice of the urethra to the anterior surface of the triangular ligament, a distance of six or seven inches: placed in the greater part of its extent underneath the corpora cavernosa of the penis, it presents two remarkable enlargements at each extremity; the anterior of which forms the glans penis, the posterior the bulb of the urethra.

The bulb of the urethra occupies the greater part of the space which exists below the crura of the penis; and is formed mainly by a large quantity of erectile tissue, which chiefly abounds upon the inferior surface of the canal. The bulb is directed obliquely upwards and forwards, and is surrounded by the fibres of the accelerator urinæ muscle. It is continuous anteriorly with the spongy body of the urethra. Internally, the urethra presents a remarkable dilatation opposite the bulb, which is chiefly observable upon the inferior surface of the canal; this dilatation has received the name of the *sinus of the bulb*, and forms one of the principal obstacles to the introduction of the catheter. According to most writers, the usual situation of stricture of the urethra is between the bulb and the commencement of the membranous portion.

Where the urethra passes through the glans penis, it presents a considerable dilatation—the *fossa navicularis;* in the under surface of which is a large lacuna—the *lacuna magna*, which will frequently admit the point of a small catheter.

The external orifice of the urethra is, perhaps, the narrowest part of the canal, and certainly the least dilatable; which is owing to a layer of firm cellulo-fibrous tissue being placed around it, underneath the mucous membrane.

Structure of the urethra.—The internal surface of the

urethra is lined with a delicate mucous membrane, which is continuous with that which lines the interior of the bladder; it is naturally of a light colour, and presents, when the urethra is not artificially distended, numerous longitudinal folds or plicæ. A number of small foramina are observable upon various parts of its surface, the greater part of which are placed along the inferior wall, and are also rather larger than the rest; they are the orifices of the little mucous crypts or lacunæ of the urethra. These lacunæ open very obliquely upon the surface of the urethra, and are directed from behind forwards; so that the urine, in its passage along the canal, passes over them without entering into their cavities. The mucous membrane of the urethra is easily torn; but it is strengthened by a layer of condensed cellular tissue, which is placed externally, and separates it from the other structures which surround the canal. In the prostatic portion of the urethra, the mucous membrane is additionally supported by the firm structure of the prostate gland; in the membranous portion, by a layer of muscular and vascular tissue, and the sheath which it receives from the pelvic fascia. From the bulb to the external orifice, the erectile tissue of the corpus spongiosum surrounds it; though very little of this is found upon the upper part of the canal, except as it is passing through the glans.

When the urethra does not open, as is usual, upon the extremity of the glans penis, but upon some part of the under surface of the organ, the variety is called *hypospadias;* this abnormal state is much more frequent in its occurrence than that in which the urethra opens upon the dorsum of the penis, between the gland and the pubes, which deformity has received the appellation of *epispadias.*

Before the bladder and urethra are removed, the levator ani muscle and the internal pudic artery should be examined as they lie within the pelvis, together with such of the branches of the internal iliac vessels as are connected with the urinary organs.

To expose the inner surface of the levator ani, the bladder and rectum must be drawn downwards to the left side, and the pelvic fascia divided in the middle of the space between the point where it quits the side of the pelvis, and its reflection upon the sides of the bladder and rectum: by turning away on

either side the flaps of the fascia, the fibres of the muscles may be clearly displayed upon their inner surface.

The *levator ani* muscle arises in front from the posterior surface of the ossa pubis, a little above the arch, and, a little more externally, from a tendinous band which stretches from the symphysis pubis to the spinous process of the ischium; this band is placed in the angle that is formed by the separation from one another of the pelvic and obturator fasciæ. A few of the fibres of the muscle arise from the spine of the ischium itself, and are soon inserted into the side of the coccyx; those of the muscular fibres that spring from the tendinous band just now mentioned descend obliquely towards the mesial line, and are inserted into the raphé or fibrous band which extends between the extremity of the coccyx and the anus, where they are united with the corresponding fibres of the opposite side; the rest are inserted into the side of the rectum, near its termination, after passing between the muscular coat of the intestine and the external sphincter of the anus. The fibres from the ossa pubis descend upon the sides of the prostate gland and the membranous portion of the urethra, underneath which they unite with each other. This muscle is thick and fleshy in its middle, and at its insertions; a few tendinous fibres are intermingled at its origins. The superior surface of the levator ani is lined in great measure by the pelvic fascia, and supports the middle portion of the rectum, the bladder, and prostate gland; its external surface is covered with a thin fascia, which is prolonged upon it from the inferior border of the triangular ligament of the urethra, and which separates it from the adipose substance that occupies the ischio-rectal fossæ. This muscle assists by its action in the expulsion of the fæces and urine. Those of its fibres that descend upon the left side of the prostate gland are divided in the lateral operation of lithotomy.

Wilson's muscles (compressor urethræ) are two small bands of muscular fibres which arise from the posterior surface of the os pubis on each side of the symphysis, and, descending upon the sides of the membranous portion of the urethra, unite with each other underneath the canal.* These muscles are not

* See a description of two muscles surrounding the membranous part of the urethra. By James Wilson, F.R.S. Medico-chirurgical Trans. vol. i. p. 175.

always as distinct in some subjects as in others; and in most can scarcely be said to differ from the anterior fibres of the levator ani.

These muscles may, by a spasmodic contraction of their fibres, diminish the calibre of the membranous portion of the urethra, which they almost surround; and thus form a temporary obstruction to the exit of the urine, or to the introduction of a bougie or catheter into the bladder.

The muscle of the left side is divided in the lateral operation of lithotomy.

THE RECTUM.

The *rectum* is the last portion of the large intestine, and has probably derived its appellation from the straight form which it usually presents in the lower animals. In the human subject the rectum, although it is less curved than many other parts of the intestines, presents nevertheless several changes in its course which are deserving of notice, since they ought to be borne in mind during the introduction of bougies in the treatment of strictures of this part of the alimentary canal. The most remarkable of these curvatures are in the direction of the long axis of the bowel. The rectum is about twelve inches, sometimes a little more, in length; it extends from the termination of the sigmoid flexure of the colon, which is situated in the left iliac fossa, to the anus. At its commencement the rectum is placed opposite to the left sacro-iliac articulation; but as it descends it inclines a little towards the right; so as to reach the mesial line opposite the curved part of the sacrum, where it again changes its direction, which hitherto has been nearly vertical, and becomes horizontal; which new direction it continues to hold until it arrives opposite the extremity of the coccyx, where it again bends upon itself, inclining downwards and backwards to reach its termination at the anus. The two last-mentioned curvatures of the rectum may be said to divide the bowel into three portions, the direction and relations of which greatly differ from one another.

The first or superior portion is about five or six inches in length, and extends from the commencement of the bowel as far as opposite the lower third of the sacrum. Its direction is nearly

vertical, though it presents, as has been already mentioned, a slight inclination from left to right as it descends into the cavity of the pelvis. This portion of the rectum lies loosely in front of the sacrum, being invested for more than three-fourths of its circumference by the peritonæum, which is then reflected upon the sides of the pelvis, forming a large duplicature, the *meso-rectum*, between the layers of which the superior hæmorrhoidal vessels, with some nerves and cellular tissue, are situated.

The middle portion of the rectum is nearly horizontal in its direction, and is between three and four inches in length. It rests upon the lower part of the sacrum, the coccyx, and coccygeal muscles: its anterior surface is partially covered at first by the peritonæum; after which it is only separated by some cellular tissue from the vesiculæ seminales, vasa deferentia, and the small portion of the base of the bladder which lies between them; towards its termination it is in close contact with the prostate gland and the posterior part of the membranous portion of the urethra.

The peritonæum covers this division of the rectum upon its anterior and lateral surfaces only at its commencement, being soon reflected from it upon the posterior surface of the bladder, forming thus the *recto-vesical cul-de-sac* of the peritonæum. The remainder of this portion of the intestine lies imbedded in a quantity of cellular and adipose tissue, and receives an investment from the pelvic fascia which maintains it fixed in its position upon the sacrum and coccyx.

The third portion of the rectum is the shortest, as its length does not exceed one inch and a half; it extends, in an oblique direction downwards and backwards, from the extremity of the coccyx to the anus. It is surrounded by the fibres of the external sphincter and levatores ani muscles, and supported by the prolongation backwards of the triangular ligament of the urethra. In consequence of the direction backwards of this portion of the rectum, a small triangular-shaped interval is left between it and the bulb of the urethra *(the recto-urethral triangle)*; its base is formed by the cutaneous surface of the perinæum in front of the anus, and the apex is situated near the anterior extremity of the prostate gland. The first incisions in the bilateral operation of lithotomy are carried across this triangular space, which is occupied chiefly by some adipose tissue.

Internal surface.—The mucous membrane of the rectum is very thick and vascular; it is usually found to present a great number of folds or rugæ, the larger proportion of which are disposed transversely, while some others are directed longitudinally, and have been called the *columns of the rectum.* Some of the transverse folds are much more prominent than the rest, and have been described by Mr. Houston as having the appearance of valves.* Indigestible substances, that have been accidentally swallowed with the food, such as fish-bones, &c. the surfaces of which are irregular and pointed, are sometimes arrested in their progress through the rectum by some of the numerous depressions which abound upon the internal surface of the intestine, especially just within the anus: these foreign bodies excite irritation by their presence, and may lead to the formation of abscesses, which frequently end in the establishment of a fistula in ano. The middle portion of the rectum is much wider than either of the other divisions of the bowel, and occasionally mounts very high upon each side of the prostate gland, which then appears to be sunk as it were into the upper surface of the intestine. Near the anus the cavity of the rectum becomes suddenly constricted; hence the radiated appearance of the folds of the mucous membrane in this situation.

The mucous membrane of the rectum is connected with the middle or muscular coat by a layer of cellular tissue, so lax and extensible in its texture as to allow, not unfrequently, of the displacement of the first to a considerable degree, without being accompanied by any alteration in the position of the last. This is the case in most forms of prolapsus ani.

The *muscular tunic* of the rectum is formed of two layers of fibres which follow different directions; the external or superficial layer is composed of fibres disposed longitudinally;

* According to Mr. Houston, "*three* is the average number of these valves; sometimes four, and sometimes only two, are present in a marked degree. The position of the largest and most regular valve is about three inches from the anus, opposite the base of the bladder. The fold of next most frequent existence is placed at the upper end of the rectum. The third in order occupies a position about midway between these; and the fourth, or that most rarely present, is attached to the side of the gut, about one inch above the anus. The form of these valves is semilunar; their convex borders are fixed to the sides of the rectum, occupying in their attachment from one-third to one-half of the circumference of the gut."—See Observations on the Mucous Membrane of the Rectum, by J. Houston, Dub. Hosp. Rep. vol. v. p. 158.

these are very strongly developed, and present a uniform surface all round the intestine; the internal layer, on the contrary, consists of circular fibres, the most inferior of which being more closely aggregated together and stronger than the rest, have, in consequence of this difference, been sometimes described as the internal sphincter muscle of the anus.

The *arteries of the rectum* are furnished from three distinct sources: the inferior mesenteric artery furnishes the *superior hæmorrhoidal;* the internal iliac artery gives off the *middle hæmorrhoidal arteries;* and the *inferior* or *external hæmorrhoidal* come from the internal pudic arteries as they are running along the inner surface of the tuberosities of the ischia. The trunk of the superior hæmorrhoidal artery is placed upon the posterior surface of the first portion of the intestine, between the layers of the meso-rectum; the middle hæmorrhoidal run chiefly upon the lateral surfaces of the middle portion; while the inferior hæmorrhoidal ramify around the circumference of the anus.

The *veins* of the internal coat of the rectum form the radicles of the inferior mesenteric vein, and are thus continuous with the vena portæ; hence they are frequently dilated in diseases of the liver and of the heart: upon which circumstance is founded the practice, which prevails so much in France, and elsewhere upon the continent, of applying leeches around the anus in affections of these organs.

The *nerves* of the rectum are furnished partly from the hypogastric plexus of the sympathetic system, and partly from the sacral plexus of the spinal nerves.

THE INTERNAL PUDIC ARTERY.

THE *internal pudic artery* arises from the internal iliac almost immediately after the sciatic artery has been given off from that vessel. Sometimes, however, the internal pudic and the sciatic arteries spring together from a common trunk, which is a branch of the internal iliac. After a short course, the internal pudic artery leaves the cavity of the pelvis, passing out through the great sacro-sciatic notch, running, as it emerges, between the inferior border of the pyriformis muscle and the spinous process of the ischium. As it thus escapes from the

cavity of the pelvis, the great pudic artery lies internal and a little anterior to the sciatic artery and nerve. In this, the first part of its course, the artery is situated in front of the pyriformis muscle and the sacral plexus of nerves, and behind the posterior surface of the bladder and the vesicula seminalis, to both of which structures it furnishes a few small branches. In the second part of its course, the internal pudic artery crosses over the posterior surface of the spinous process of the ischium near to its extremity, and immediately afterwards re-enters the pelvis by the smaller sacro-sciatic opening, passing at the same time upon the inner surface of the tendon of the obturator internus muscle. Where the artery crosses the spine of the ischium, it is covered by the skin, some of the fibres of the gluteus maximus muscle, and by the great sacro-sciatic ligament. In this part of its course it gives off a few delicate branches, which ramify in the soft parts surrounding the hip-joint.

If an incision of three or four inches in length is made over the spine of the ischium in the direction of the fibres of the gluteus maximus muscle, by separating some of these fibres and cutting across the great sciatic ligament, the vessel can be exposed and a ligature passed around it. This is an operation, however, that has hitherto been practised only upon the dead body. In a case mentioned by Dr. Harrison, in his work upon the arteries, considerable benefit resulted from the employment of pressure over this part of the course of the internal pudic artery. The case was one that occurred in St. Thomas's Hospital, under the care of Mr. Travers; the patient was very emaciated, and much reduced by an alarming hæmorrhage from a phagedenic ulcer upon the glans penis, which had resisted all the topical means that had been previously employed.*

When the internal pudic artery has re-entered the pelvis, it runs forwards and a little upwards in a gently curved direction as far as the inferior border of the sub-pubic ligament, where it turns sharply forwards to reach the dorsal surface of the penis, along which it runs to arrive at the base of the glans penis, where it terminates by dividing into several small branches for the supply of it and the prepuce. Between the point where it re-enters the pelvis, and the junction of the branches of the ischium and

* See Surgical Anatomy of the Arteries, by R. Harrison, M. D. vol. ii. p. 101.

pubis, the artery lies very deeply, being placed against the inner surface of the obturator internus muscle, the fleshy fibres of which separate it from the bone. Here the artery, with its accompanying veins and nerve, are inclosed in a dense sheath, which is formed by the splitting into two layers of the fibres of the obturator fascia. The artery when injected may be felt with the finger about an inch above the lower edge of the tuberosity of the ischium, where it is completely removed from the direction of the incisions which are made in the lateral operation of lithotomy, so that there is no chance of its being wounded in this part of its course. But when the artery has arrived opposite the junction of the branches of the ischium and pubis, it approaches much nearer to the mesial line, and lies in the angle between the margin of the descending branch of the pubis and the triangular ligament of the urethra (as may be seen in the wood-cut at page 21), where it is in some degree overlaid by the crus penis. In this situation the artery has been frequently wounded during the operation of lithotomy, in consequence of the blade of the knife or gorget not having been directed sufficiently obliquely while making the section of the prostate gland and neck of the bladder; for if the edge of the instrument is directed transversely outwards instead of being inclined obliquely downwards, it is difficult to conceive how the requisite opening can be made into the bladder without wounding the artery at this spot.

When the internal pudic artery has been cut during the operation of lithotomy, and the hæmorrhage that ensued was serious, the vessel has been secured lower down by means of a flexible curved needle introduced deeply into the ischio-rectal fossæ, where it was carried round the vessel as it runs along the inner surface of the obturator internus muscle.

Branches of the internal pudic artery. — In addition to the ramusculi which the internal pudic artery furnishes in the first and second parts of its course, it gives off several large and important branches as it runs from the lesser sacro-sciatic notch to the under surface of the arch of the pubis; these are as follows:

1. The *arteriæ hæmorrhoidales externæ* are two or three in number, and spring from the trunk of the internal pudic artery as it is running along the external wall of the ischio-rectal fossæ; they pierce the obturator fascia immediately after their

origin, and cross the adipose mass which fills up the interval between the tuberosity of the ischium and the inferior extremity of the rectum, upon which they are finally distributed. In their course across the ischio-rectal fossæ, they furnish several small branches to the adipose tissue; whilst their terminal branches form a vascular chain around the anus by anastomosing with each other, the transversales perinæi, and the middle hæmorrhoidal arteries.

These arteries in the healthy state of the parts about the anus are very small, and when divided, as they sometimes are in the lateral operation of lithotomy, seldom give any trouble from hæmorrhage; but the case is different when they have been wounded in the operations which are performed for the cure of fistulæ in ano, or the removal of tumours in this region. In such circumstances they are frequently enlarged, and do not retract as usual in consequence of the thickened and condensed state of the tissues; and if care is not taken either to ligature them, or to close their orifices with a well-applied compress, the patient is almost sure to lose a considerable quantity of blood after he becomes warm in his bed, when the reaction consequent upon the operation has set in.

2. *Arteria superficialis perinæi.*—This is a branch of considerable size; it arises from the internal pudic artery opposite the posterior border of the transverse muscle of the perinæum, underneath which it commonly turns in its course to reach the triangular space between the accelerator urinæ and erector penis muscles, in which it runs in rather a tortuous manner until it reaches the scrotum, to the coats of which it is finally distributed. As this artery runs between the muscles above-mentioned, it gives small branches for the supply of both, as well as to the cutaneous coverings of the perinæum.

As the direction of the course of this artery is parallel to that of the external incision made in the lateral operation of lithotomy, it frequently escapes being wounded. No precise rule, however, can be given by which it may be surely avoided by the knife; which circumstance is the less to be regretted, as its division is seldom followed by any important hæmorrhage.

3. *Arteria transversalis perinæi* is sometimes a branch from the preceding, and given off from it as it is about to cross

the transverse muscle. This artery runs along the posterior edge of the muscle just named, until it reaches the central point of the perinæum, where it divides into smaller branches, which anastomose with the vessel of the opposite side, and with the external hæmorrhoidal arteries between the bulb and the rectum.

This vessel is cut across in the lateral operation of lithotomy; but its size is too insignificant to deserve any attention.

4. *Arteria corporis bulbosi* is the most important of the branches of the internal pudic artery; it is a short but large vessel, and is given off by the internal pudic as it is passing opposite the attachment of the crus penis to the bone. After its origin, it runs transversely inwards, placed between the layers of the triangular ligament; and, near the margin of the opening which transmits the membranous portion of the urethra, it enters the bulb, and is distributed to the erectile tissue of the corpus spongiosum urethræ. A little before *entering* the bulb, this artery gives one or two small branches to Cowper's glands. (See the wood-cut at p. 21, figures 6, 6.)

When the artery of the bulb pursues the course that has been just described, it is not liable to be divided by the knife in the operation of lithotomy, unless the incisions are made much too high, and the urethra opened upon the staff much further from the prostate gland than is proper. But in some instances the artery of the bulb arises from the internal pudic much nearer the tuberosity of the ischium, and then it runs so obliquely upwards and inwards in its course to reach the bulb, that, should the operation of lithotomy be performed, the vessel can scarcely escape being wounded.

It is believed by many surgeons, that the severe hæmorrhage which sometimes follows the performance of the lateral operation of lithotomy is more frequently the consequence of a wound of the artery of the bulb, than of the internal pudic, as commonly supposed.

5. *Arteria corporis cavernosi penis.*—This branch springs from the internal pudic artery as it runs under the inner edge of the crus penis, into which it immediately enters, and then runs forward in the corpus cavernosum, inclining towards the septum pecteniforme, upon which it ramifies. This artery supplies the

erectile tissue of the cavernous body of the penis, and anastomoses with the corresponding vessel of the opposite side, through the apertures of the septum.

6. *Arteria dorsalis penis.*—When the internal pudic artery has ascended as high as the inferior border of the sub-pubic ligament, it turns forwards, and, after traversing the suspensory ligament of the penis, runs along the upper surface of that organ as far as the corona glandis, where it divides into branches which are distributed to the prepuce and gland. In its course along the dorsum of the penis, the artery lies close to the mesial line; and is included, together with its accompanying nerve and vein, in a sheath formed of the fibrous investment of the corpus cavernosum penis. The dorsal arteries, and the arteries of the corpora cavernosa, usually require the employment of the ligature after amputation of the penis.

Varieties.—The most important variety of the internal pudic artery is that in which this vessel does not leave the pelvis by the great sacro-sciatic notch; but, instead of doing so, runs along the base of the bladder and side of the prostate gland. If the operation of lithotomy were to be performed upon an individual in whom this variety existed, the artery would certainly be cut, and death would probably ensue from the hæmorrhage. It is said that this accident occurred some years ago in one of the hospitals in London.

The *internal pudic veins* and *nerves* correspond in their course and distribution with the branches of the artery, with the exception of the dorsal vein of the penis, which passes through an aperture in the triangular ligament of the urethra immediately below the sub-pubic ligament, and then joins the prostatic plexus.

The *lymphatics* of the perinæum join with those of the scrotum, and open into the glands of the groin: those of the penis are divided into two sets; one of which is deep-seated, and follows the course of the internal pudic vessels, while the other set is superficial, and, commencing upon the surface of the glans and prepuce, runs along the dorsum of the penis, and joins the inguinal glands.

THE UMBILICAL ARTERIES.

The *umbilical arteries* form in the fœtus the continuation of the trunks of the internal iliac arteries, and are during that period much larger than the external iliac arteries. These vessels serve to carry the blood from the body of the fœtus back to the placenta, so that in their functions at least they more resemble veins than arteries. The umbilical arteries run along the sides of the bladder in a curved direction, the concavity of the curve being directed upwards; they extend from opposite the sacro-iliac symphysis to the umbilicus, where they emerge from the body of the fœtus, and constitute a part of the umbilical cord, being coiled in a spiral manner round the umbilical vein. On reaching the placenta they terminate in numerous ramifications, which enter the substance of that structure. In their course within the pelvis, these vessels lie in the cellular tissue which covers the sides of the bladder; as they pass from the summit of the bladder to the umbilicus, they are placed between the peritonæum and the recti muscles, where they may be observed to form two prominent lines, one on each side of the urachus, when the cavity of the abdomen has been laid open by a transverse incision.

After birth, that portion of the vessels which extends between the umbilicus and the sides of the bladder is gradually obliterated, and they assume the appearance of small but dense ligamentous cords, which may tend in some degree to maintain the bladder in its natural position. Posteriorly a very small portion of the artery, now much reduced in its size, remains pervious to the current of blood, which it distributes by several small branches to the inferior and lateral surfaces of the bladder. Thus the proportions that existed between the umbilical arteries and the external iliacs in the fœtus become completely reversed in the adult.

SECTION II.

DEVELOPEMENT OF THE PERINÆUM.

In the first stages of intra-uterine existence, the perinæum of the male presents an open hollow or cleft in the mesial line, which causes it to resemble at this period the vulva of the female. This condition of the parts may remain permanently, in consequence of an arrest of the progress of development, and then the individual will present the appearances which have been so frequently observed in one class of those persons who are exhibited to the public as hermaphrodites.

As the formation of the urethra proceeds gradually from behind forwards, its completion may be arrested at any point; and thus the external orifice of the canal, instead of being situated, as is usual, at the extremity of the glans penis, is placed upon some part of the inferior surface of the organ, constituting the malformation denominated *hypospadias*.

The urinary bladder, in the fœtus, is situated rather in the hypogastric region of the abdomen than in the cavity of the pelvis, and reaches nearly as high as the umbilicus. Sometimes the anterior surface of the bladder is wanting, and then the lower part of the linea alba is deficient also; so that the mucous membrane of the bladder protrudes upon the external surface, a little above the pubes, under the form of a red vascular tumour, near the centre of which the orifices of the ureters may be distinguished, and the urine seen to distil from them.* In such cases the urethra is commonly incomplete.

Several instances are recorded in which the urachus remained pervious after birth, and permitted the urine to escape from the umbilicus.

The lower part of the rectum is sometimes wanting, and this defect may be accompanied or not with the absence of all appearance of the anus. In these cases there is sometimes a communication between the rectum and the bladder. When the lower part of the rectum is thus deficient, the surgeon may

* In the course of last winter, a middle-aged man, who was the subject of this malformation, which is termed *extrophy of the bladder*, was for some time a patient, under Mr. Liston, in the University College Hospital.

occasionally succeed in his endeavour to reach the closed extremity of the bowel, by making an incision cautiously in the direction of the hollow of the sacrum, and so afford an exit to the fæcal contents of the alimentary canal. The child rarely survives the operation, however successful it has been, many days.

OF SOME OF THE MORBID CHANGES IN THE LOWER PART OF THE RECTUM.

THE term "hæmorrhoids" comprises several varieties of tumours around the lower extremity of the rectum. In some instances the tumour is simply a dilatation or true varix of one or more of the veins of the bowel; while in others it is formed by the extravasation of blood into the cells of the submucous cellular tissue, consequent upon a rupture of the affected vessel. The cavities thus formed may continue to communicate with the interior of the vessel that has been ruptured, and may increase in their size by a repetition of the extravasation; or they may cease to be connected with the interior of the vein, and assume the characters of an isolated and solid mass, by the condensation and thickening which result from repeated attacks of inflammation. In a third variety a vascular substance is generated in the cellular tissue surrounding the margin of the anus, which resembles, when it is cut with the knife, the structure of erectile tissue in many of its characters. Hæmorrhoids or piles are named external or internal, according as they are covered by the common integument of the margin of the anus, or by the mucous membrane of the intestine.

It is best to remove external piles by excision with the knife or scissors; but, when the tumour is within the bowel, the ligature is more advisable, as there is a great risk of severe hæmorrhage following the use of the knife in such cases. After the application of the ligature, considerable benefit results from the practice of cutting off the summit of the strangulated tumour.

Verrucæ circa anum.—These are soft, indolent, fleshy growths, which frequently occur about the anus in consequence

of irritation from discharges of different kinds. Thus they are very frequently met with in women who have suffered long from gonorrhœa. In many instances verrucæ around the anus are not to be considered as being produced in consequence of a constitutional venereal taint, while in others it can hardly be doubted that they are as much so as any other secondary symptom.*

Fistula in ano.—The majority of abscesses that form in the vicinity of the anus, when allowed to run their course uninterrupted, degenerate, after the discharge of their contents, into an indolent sinus, which extends to a variable distance alongside of the bowel. When the fistulous tract opens only externally, it is called a *blind external fistula;* and, on the contrary, when the sinus opens into the interior of the rectum, without having any aperture upon the surface, it is named a *blind internal fistula.* Sometimes the sinus opens by one extremity into the rectum, and by the other upon the skin; this constitutes a *complete fistula.* The operation for the cure of this disease consists in dividing the structures which intervene between the fistula and the cavity of the rectum, including the sphincter muscles, the action of which being thus suspended for a time, the surfaces of the wound remain at rest and heal by granulation.

Prolapsus ani usually consists in the protrusion through the anus of the relaxed mucous membrane of the rectum; but there are other conditions of the bowel which are sometimes included under this term, and in one of these the upper part of the intestine descends into the lower, resembling an intussusception: the mucous, muscular, and peritonæal coats of the gut form part of the protruded mass, which has been known to have been cut off, and the patient to lose his life in consequence of the opening thus made into the abdominal cavity.†

* M. Ricord, the surgeon of the Hôpital des Vénériens at Paris, considers that the verrucæ around the anus, which sometimes follow a chancre, are sufficient evidences of the constitution having become affected by the venereal virus. They are frequently accompanied by painful ulcerations in the clefts between the toes. The best treatment consists in the local application of the solid nitrate of silver.

† See a Treatise on the Diseases of the Urethra, Vesica Urinaria, Prostate, and Rectum, by Sir Charles Bell, Lond. 1822, description of plate v.

CHAPTER III.

OF THE INTRODUCTION OF THE CATHETER.

Among the number of those who are entering upon their studies in the schools, there are perhaps few to be found who are not ready to assert that they consider the introduction of the catheter as an operation of very trifling importance, and of such easy execution that they do not hesitate to undertake its performance with a perfect assurance of succeeding in their attempt: and although they are quite willing to admit that they are utterly unacquainted with the anatomy of the urethra, and the numerous structures by which it is surrounded, yet they possess, as they think, a sufficient ground for their opinion in the fact that they have already performed the operation many times without encountering any impediment. Nevertheless their success must be regarded as purely accidental, and unworthy of the degree of confidence which is placed in it; and it would prove of much advantage if students could be early persuaded of the necessity that exists of diligently turning their attention to the examination of the structure and direction of the canal, along which they propose to introduce an instrument into the bladder.

To a knowledge of the anatomy of the urethra should be added a frequent practice of the operation itself, and with this view every opportunity of introducing the catheter in the dead body ought to be taken advantage of; since by so doing the hand becomes accustomed to distinguish the different parts of the urethra, and the obstacles which they naturally oppose to the passage of the instrument; and thus are gained lightness of touch, and tact in adopting the best methods of avoiding these obstacles without doing an injury to the delicate lining membrane of the urethra,—acquirements which are of far more value and importance than all the information that can be derived from simply reading the descriptions of others.

By so acting, any one, when he has to treat a case in which

difficulties occur, owing to the alterations from the natural direction and dimensions of the urethra, which are so frequently induced by disease, will be at least able, if he cannot succeed in his endeavour to pass the catheter, to avoid doing more mischief by rude and ill-directed efforts than it may be in the power of his seniors in the profession to repair. "I do not know," says Mr. John Bell, "that even the operation of lithotomy itself is more difficult than that of introducing the catheter; more important it cannot be than an operation which gives relief in accidents and difficulties so extremely common and so very afflicting. There is no operation with which I should more earnestly entreat the young surgeon to make himself acquainted than this of introducing the catheter."*

Catheters are of various shapes and materials: some are flexible, others are inflexible; and these may be either curved or straight, according to the choice of the operator. The instrument in most general use is, as is well known, of silver, and of such a degree of curvature as nearly to correspond with the form of the canal along which it has to pass. Generally speaking, when other circumstances are not opposed to it, a large catheter is preferable to one of small size, as it distends the parietes of the urethra, and is much less likely to be obstructed by any of the irregularities which the internal surface of the canal presents at different points of its extent. Straight catheters have been more frequently used in late years, especially since the introduction of the operation of lithotrity, which has been very much indebted to this circumstance for its present improved condition.

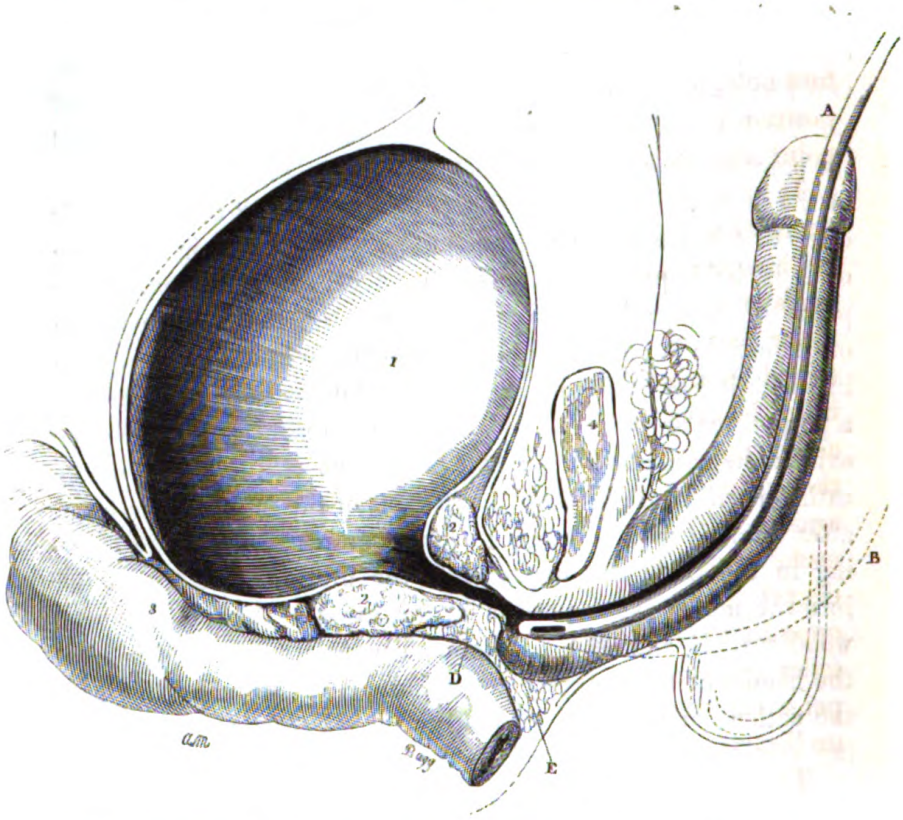
Introduction of the ordinary curved silver catheter.—Sometimes the instrument is introduced when the patient is standing, and then he ought to be placed in front of the surgeon, with his back to the wall, so that he may not change his position during the operation; when he is lying in bed, he should be placed flat upon his back, in a perfectly straight position, with the knees slightly raised and apart from one another. The operator, standing upon the left side of the bed, takes hold of the penis with the thumb and fore-finger of the left hand, and raises it gently, so as to efface the curve or angle which the penis forms

* Vide Principles of Surgery, by John Bell, Surgeon, vol. iv. p. 210.

where it bends down in front of the scrotum. Holding the catheter in his right hand, lightly poised between the thumb and two first fingers, the surgeon introduces its point into the orifice of the urethra, and continues to pass the instrument onwards until the point reaches the bulb, which is about an inch below the arch of the pubes. During this time, the concavity of the catheter is directed towards the symphysis pubis, while the straight portion of it is held parallel with the front of the abdomen. The point of the catheter having reached the bulb, the position of its handle is now to be changed from the horizontal direction in which it has hitherto been held, until it has been brought into a perpendicular position, and thus forms a right angle with the axis of the patient's body ; this movement of the handle of the catheter will cause its point to rise out of the sinus of the bulb, after which it may be safely pushed onwards through the opening in the triangular ligament of the urethra, and thus enter into the membranous portion of the canal. (See the annexed wood-cut, B and E.) By gradually depressing at this time the handle of the catheter a little more between the thighs of the patient, it will glide smoothly onwards through the remaining portion of the urethra into the bladder.

The operation, as has been just described, may be divided into three periods, as follows: — In the first period, the point and curved part of the catheter are held in a perpendicular position while it is introduced along the urethra as far as the bulb, at the same time that its handle and straight portion are maintained in a horizontal position parallel with the anterior surface of the abdominal parietes: in the second period, the handle is raised from the horizontal into the vertical position ; at the same time its point also rises a little, and is thus disengaged from the sinus of the bulb, and enters the membranous portion of the urethra, passing through the circular opening in the triangular ligament: in the third period, the handle of the instrument is still further depressed between the patient's thighs, while the point continues to ascend slightly, and, following the curve of the membranous and prostatic portions of the urethra behind the symphysis pubis, enters the bladder.

In this manner of introducing the catheter, it will be observed that the handle and point of the instrument describe each a curve at the same moment, the respective extent of which is



The engraving of the section of the pelvis represents the time when the handle of the catheter should be depressed in order to disengage its point from the sinus of the bulb. It is sometimes necessary to withdraw the catheter a few lines, and carry its point closer up along the superior surface of the urethra.

Figure 1, is the bladder. 2. 2. The prostate gland: the vesicula seminales is seen behind the gland. 3. The rectum. 4. The cut surface of the symphysis pubis. A. The catheter introduced into the urethra as far as the bulb. B. The dotted line which indicates the direction in which the handle of the catheter is to be depressed in order to disengage the point from the depression of the bulb. E. The inferior margin of the opening in the triangular ligament of the urethra, and against which the point of the catheter frequently hitches. D. is another point at which the catheter is sometimes obstructed.

very different: that is to say, the handle of the instrument describes a segment, nearly one-half of a large circle, in the same time that the point travels more slowly over a segment of a circle of much smaller diameter.

Many surgeons direct that, in the first period of introducing the catheter, the handle of the instrument should be turned at first obliquely towards the left groin of the patient, from which position it is gradually to be brought into the mesial line as its point approaches the bulb of the urethra.

It is by no means absolutely requisite to take hold of the penis with the left hand during the introduction of a catheter, as the operation can be done equally well without touching the penis at all. Where, however, there is a stricture in the anterior part of the urethra, considerable advantage will be obtained from holding the penis forwards with the left hand, as it renders the canal in front of the obstruction quite straight, and maintains it perfectly steady, so that the point of the catheter may be pressed with much greater exactness and effect against the obstacle. In these cases, also, it will be found useful sometimes to support the parietes of the urethra, by placing the fingers of the left hand underneath the canal externally, opposite the situation of the strictured part. Beyond the triangular ligament, it is evident that no degree of traction of the penis can exercise any useful influence upon that part of the urethra which intervenes between it and the bladder.

There is another mode of introducing the catheter, which, however, is seldom practised at the present day, though it used formerly to be in great repute; it has been named the *Tour de Maître*. This method possesses really no advantages over that which has already been described, and is perhaps rather calculated to render the operation less easy, by the chances which it affords to the point of the catheter of diverging from the direction of the axis of the urethra, at the moment when the attention of the operator is engaged by the movement which must be given to the handle. The *Tour de Maître* consists in introducing the catheter or staff, with its concavity at first directed downwards; the convexity of the instrument being turned towards the pubes. The catheter is held in this position until its point reaches the bulb of the urethra.

Here the point of the catheter must remain perfectly steady while the handle is carried round from left to right with a rapid sweeping movement, describing a large semicircular curve, the centre of which is represented by the point of the catheter as it rests in front of the circular aperture in the triangular ligament

of the urethra. When this rotatory movement has been executed, the handle of the catheter is to be depressed between the patient's thighs, as in the ordinary method, so that its opposite extremity may follow the direction of the curve of the membranous and prostatic portion of the urethra. The chief difficulty in the execution of the *Tour de Maître* consists in maintaining the point of the catheter perfectly steady during the rapid and sweeping movement of its handle, making it, as it were, the pivot or centre upon which the rest of the instrument revolves.

The *Tour de Maître* is most frequently employed when the staff is introduced after the patient has been bound in the position for the lateral operation of lithotomy.

Introduction of a straight catheter.—When the patient is lying upon his back, which is the position for the operation of lithotrity in which straight instruments are most frequently employed, the operator, holding the penis in the usual manner between the fingers of the left hand, raises it until it forms a right angle with the trunk of the patient's body; he then introduces the instrument into the urethra, in a perpendicular direction, until its point reaches the sinus of the bulb, when he lowers the catheter and the penis together, and brings them down between the thighs of the patient until they are reduced into the horizontal position; then, after first withdrawing the instrument about two or three lines in order to free its point from the sinus of the bulb, he pushes it gently onwards into the bladder, continuing, if it is necessary, to depress still more the handle of the instrument, which will frequently facilitate the passage of the point along the membranous and prostatic portions of the canal.

The natural obstacles which most frequently oppose themselves to the passage of the catheter are, first, the lacunæ of the urethra, and the sinus of the bulb; after which comes the margin of the opening in the triangular ligament. When these are passed, the anterior border of the prostate gland, the orifices of its ducts, and the sinus pocularis, may all serve to obstruct the introduction of a small catheter, by entangling its point; and, lastly, the elevated ridge which marks the commencement of the neck of the bladder. It will be observed, that nearly all these natural obstacles to the easy introduction of a catheter are situated upon the inferior surface of the urethra,

and therefore they will be best avoided by keeping the point of the catheter gently directed against its superior wall. The margins of the opening in the triangular ligament will not give any trouble if the situation of the circular aperture that transmits the urethra is accurately understood; it is nearly one inch below the arch of the pubes, and equi-distant from the descending branches of the same bones.* When the point of the catheter is arrested in either the membranous or the prostatic portions of the urethra, it will be found of considerable advantage to introduce the left fore-finger into the rectum, which will frequently enable the operator to distinguish the situation, as likewise the cause of the difficulty, and also to direct the instrument with greater certainty into the bladder.

There are two errors which are very frequently committed by those who are not experienced in the introduction of the catheter: the first of these is, to hold the catheter much too stiffly in the hand; for it is not an uncommon sight to observe the handle of the catheter grasped as firmly as one would a dagger, instead of handling it as lightly as a pen. The consequence of this error is, that if the point of the instrument should happen to be arrested by any obstacle to its passage along the urethra, it is immediately forced through the delicate lining membrane of the canal, and a false passage is thus commenced. The second error is, to observe the general rule of keeping the point of a catheter, during its introduction, directed against the upper surface of the urethra, too strictly, whereby it is liable to be arrested in its progress by the superior margin of the opening in the triangular ligament, or, if it passes here, at a little distance farther onwards by the edge of the prostate gland.

False passages are most commonly made where the surface of the urethra presents some inequality, either upon its surface or in the density of the structures which surround it. It is from these circumstances that they are most frequently commenced in the sinus of the bulb, or in the membranous and prostatic portions of the canal. False passages may also originate from the point of a small catheter being entangled in some one of the numerous lacunæ of the urethra. Where the canal is more constricted, and its parietes thicker and stronger at any

* See the woodcut at p. 21, fig. 7.

spot than is natural, as is the case in stricture of the urethra, false passages are frequently made in front of the diseased part. It requires the exercise of much less force than is commonly supposed to produce a false passage in the urethra. A peculiar grating sensation is communicated to the touch as soon as a catheter leaves the urethral canal, or enters a false passage that has been already made. In cases of enlarged prostate, a false passage is not unfrequently made through the diseased mass.

Some skilful surgeons have considered the formation of a new passage to be justifiable when the prostate gland is so much enlarged as to alter and distort the course of the urethra, where it traverses the gland, to such a degree that no instrument can be made to pass along it into the bladder. In several cases this practice of establishing a new route for the urine appears to have been attended with no bad results.*

The reason why false passages are so frequently made without any extravasation of urine occurring afterwards, is doubtless that the urine does not easily find an entrance, on account of their oblique direction from before backwards, which is the reverse of that of the stream of urine.†

Extravasation of urine may occur in consequence of a rupture of the bladder, or of the urethra: when the bladder is ruptured, the laceration is commonly situated in that portion of its surface which is covered by the peritonæum, and death is the certain result from the peritonitis which ensues. In other instances the bladder is torn either on the sides or at its base, and then the urine is extravasated into the subserous cellular tissue of the abdomen. In such cases, also, death generally soon follows the accident. If the rupture occurs in some part of the urethra, which is posterior to the bulb, and in front of the triangular ligament, the urine escapes into the cellular tissue which separates the muscles of the penis from the superficial fascia of the perinæum. The urine as it escapes is prevented from diffusing itself backwards towards the anus by the attachments of the superficial fascia

* It is said that the celebrated physician Astruc was thus treated by Lafaye, and lived a considerable time afterwards.

† Sir Charles Bell, who has offered this explanation in his excellent treatise upon the diseases of the urethra, illustrates it by contrasting the difference in this respect between a rupture of the urethra in front of a stricture, and one which takes place behind it.—*Hospital Reports, by Sir C. Bell, p.* 98.

to the triangular ligament of the urethra; and, on each side, by its insertions into the internal edge of the branches of the ischia and ossa pubis. In such cases the urine distends the perinæum, and then proceeds forwards, underneath the dartos, into the scrotum; thence, if the extravasation continues, it ascends upon the lower part of the abdomen, passing between the superficial fascia of the inguinal regions and the tendon of the external oblique muscles. This is the ordinary course of the extravasated fluid under these circumstances; but I have seen it spread backwards upon the buttocks and ischio-rectal fossæ, and downwards upon the thighs as far as the knees. The case is a desperate one when the urine is extravasated into the cellular structure of the corpus spongiosum urethræ.

In cases of extravasation of urine, early and free incisions should be made into the distended parts; and, where it can be done, a gum catheter should be introduced into the bladder, and allowed to remain there during the cure.

Sometimes a patient comes to the hospital who has received a blow upon the perinæum: he is in great pain and cannot pass his urine, and the perinæum and the scrotum are largely distended; the latter is also quite of a black colour. This appearance is owing to extravasation of blood following the rup ture of one of the arteries of the scrotum in consequence of the blow. In this case incisions need not to be made, as the blood will be quickly absorbed under milder treatment.

Puncture of the bladder from the rectum.—Cases of retention of urine may occur in which the catheter cannot be passed into the bladder, and the operation of puncturing the bladder must be had recourse to for the relief of the patient. When this operation is performed from the rectum, the patient is placed in the same position as for the operation of lithotomy; and the surgeon introduces the two first fingers of his left hand into the intestine, until he feels the posterior edge of the prostate gland. A long curved trocar is then carried along the fingers; and as soon as the extremity of the cannula has passed beyond the prostate, the handle of the instrument is to be depressed, and the stilette pushed onwards, so as to enter it into the bladder, passing through the small space which is included between the recto-vesical cul-de-sac of the peritonæum and the vasa deferentia. The cannula, or a piece of gum catheter, should be left in the wound for several hours after the operation, to

prevent the wound from closing too quickly. This operation should only be practised when the prostate gland is not very much enlarged.

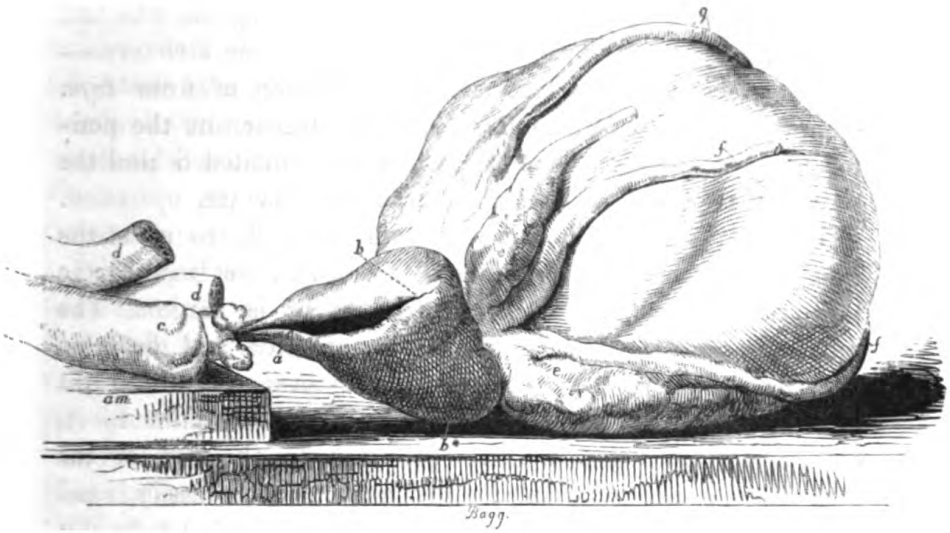
Of cutting down upon the urethra behind the stricture.—Some surgeons, in cases of complete retention of urine from stricture of the urethra, prefer making an incision in the perinæum, and opening the urethra where it is dilated behind the stricture, to the operation of puncturing the bladder.

For this purpose an incision is made in the course of the raphé of the perinæum, and is carried deeply down between the bulb and the rectum to the membranous part of the urethra. The urethra is exposed and opened where it is dilated, and the urine is evacuated through the wound, or by a gum catheter introduced by the incision into the bladder. In a very fat subject, or in one in whom the structures of the perinæum have become altered and condensed from previous disease, such as fistula in perinæo, abscesses, &c. this operation is by no means an easy one.

Puncture of the bladder above the pubis.—An incision, about two inches in length, is made through the integuments, immediately above the pubes, in the course of the linea alba. This incision is to be carried sufficiently deep between the edges of the recti and pyramidales muscles, to expose the anterior surface of the distended bladder where it is uncovered by the peritonæum. A trocar is then thrust obliquely downwards and backwards into the cavity of the bladder. After the trocar has been withdrawn, and the urine has been evacuated, the cannula should be fixed in the bladder until the inflammatory action following the operation has glued together the cells of the surrounding tissues, as the chief danger to be guarded against after the performance of this operation, is the escape of the urine into the subserous cellular tissue. After this time the cannula may be changed for a piece of gum catheter of appropriate length and thickness.

THE OPERATION OF LITHOTOMY.

Lithotomy still continues to remain, notwithstanding all the endeavours that have been made to improve it, one of the most difficult and dangerous of the operations of surgery.



This engraving represents the section of the left lobe of the prostate gland, which is made in the lateral operation of lithotomy. The parts have been dissected after having been separated from all their connexions. *a*. marks the incision, which, commencing in the membranous portion of the urethra, extends very near to the base or posterior edge of the left lobe of the prostate gland. *b*. The left lobe of the prostate gland. *b**. The right lobe of the gland. A slight projection in the posterior border of the gland marks the position and form of the third or middle lobe. *c*. The bulb of the urethra. Close behind are observed the two small granular masses named Cowper's glands. *d. d*. The crura of the penis. *e. e*. The vesiculæ seminales. *f. f*. The vasa deferentia. *g*. The ureter of the left side.

There are three principal methods of cutting into the bladder for the purpose of extracting a calculus from its interior: viz. first, by an incision through the perinæum; secondly, through the rectum; and thirdly, above the pubis. These various methods have been practised more or less extensively at different periods; though at the present day the two last-named are very seldom employed, and then only in consequence of some particular circumstances. It is thus that the operation of lithotomy above the pubis is usually reserved for those cases in which the calculus is of too large a size to admit of being safely extracted

through the perinæum, or in which the prostate gland is much enlarged. The employment of the recto-vesical method has been, in a great measure, confined to those surgeons who first introduced it.*

The lateral operation of lithotomy as performed with the knife. —The staff should be introduced into the bladder, and the stone felt previously to fixing the patient in the constrained position which is requisite for the safe performance of the operation. When the stone has been struck with the staff, the assistants may proceed to bind the patient's hands and feet together in the usual manner. The staff ought to be as large as the urethra will admit, and the groove as wide and deep as possible. The groove may be placed rather on the right side of the instrument, and should not extend quite to its extremity. The groove being placed upon the side of the staff enables the surgeon to cut into it more easily, and also to give that direction to his knife by which he divides the neck of the bladder and the prostate on the left side.*

The assistant now takes charge of the staff, grasping it firmly in his right hand, while with his left he raises up the scrotum from the perinæum. The handle of the staff should be held in a perpendicular direction, at right angles with the patient's body, at the same time that its curved part is drawn up closely underneath the arch of the pubes, in order to prevent its pressing too much downwards upon the rectum. The operator, before commencing his incisions, should feel for the prominence of the tuberosity of the ischium, and measure the distance between its inner edge and the anus.

The first incision. —This should be begun close to the left side of the raphé of the perinæum, and about an inch and a quarter in front of the anus: from this point it should be carried, in an oblique direction, downwards and outwards, so as

* As far as I know, M. Sanson, the surgeon of the hospital of La Pitié at Paris, has relinquished the recto-vesical method in favour of the bilateral operation. At all events, during a residence in Paris for a considerable period, I never saw him perform any other than the bilateral operation.

† Illustrations of the great operations of Surgery; by Sir Charles Bell, fol. 1821, page 117.

to pass midway between the inner edge of the tuberosity of the ischium and the left margin of the anus. In the adult, the length of this incision will be about three inches. While making the first incision, the operator fixes the integuments of the perinæum with the fingers of his left hand. The knife is struck at the first a full inch deep; and, as it is drawn downwards to the termination of the incision, it is gradually withdrawn from its deep position, in order to avoid wounding the rectum.*

The knife is now to be introduced a second time into the upper part of the wound; and the deep cellular substance, the transverse muscle, and a portion of the triangular ligament of the urethra and of the fibres of the levator ani are divided by repeated touches with the edge of the scalpel, until the membranous portion of the urethra is laid bare a little in front of the prostate gland. Feeling now the groove of the staff through the thin parietes of the urethra, the operator directs the point of his scalpel into it, guiding it along the back of the nail of the left index-finger. The opening of the membranous portion of the urethra should be sufficiently free to admit of the extremity of the finger-nail being easily placed into the groove of the staff.†

The point of the scalpel, or of the probe-pointed bistoury, if this instrument should be preferred, is now placed in the groove of the staff, and then carried slowly and steadily onwards into the bladder; dividing, as it passes along, the left lobe of the prostate gland in the direction of its longest diameter, which is obliquely downwards and outwards. The left index-finger depresses the rectum to the right side, so as to protect it from injury by the edge of the knife, while the membranous portion of the urethra is being divided to expose the groove of the staff, and, also, during the succeeding period, when the incision is made into the prostate gland, and neck of the bladder. As soon as the knife has entered the bladder, the urine escapes;

* Op. citat. p. 120.

† When the gorget or the bistouri caché is employed, this is the moment at which the knife is to be laid aside, and changed for one of these instruments, the beak of which is placed in the groove of the staff, guided along the finger-nail, and then carried onwards into the bladder.

the instrument is now to be withdrawn, and its place occupied by the fore-finger of the left hand, which serves to determine the size of the opening that has just been made, and also, if possible, the form and position of the calculus as it lies in the bladder. The staff should now be removed. If it is considered necessary to enlarge the wound, it may be done now, by cutting with a straight probe-pointed bistoury either in the direction of the original incision, or by dividing in a similar manner the opposite or right lobe of the gland: this last mode is the practice that is commonly adopted by Mr. Liston in his operations.

The forceps are to be introduced along the upper surface of the fore-finger, which still remains in the bladder, and serves as a conductor to these instruments. The blades of the forceps during their introduction should be kept closed, nor should they be expanded as soon as they have reached the interior of the bladder, but used at first as a searcher for the stone. As soon as the stone is felt, their blades may be opened upon it; by so doing, the stone will in general be very readily seized.

It sometimes happens that the stone cannot be felt with the finger on account of the great depth of the perinæum, nor can it be readily laid hold of with the forceps. Should the stone, under these circumstances, be lying deeply behind the prostate gland in the bas-fond of the bladder, considerable assistance may sometimes be obtained by the introduction of the fingers of the left hand into the rectum, which will serve to raise it up and place it within the reach of the forceps.

When the stone has been seized by the forceps, the efforts at extraction should be made slowly and gradually, with an alternating movement laterally of the instrument, observing to follow the direction of the axis of the inferior outlet of the pelvis, which is obliquely downwards and backwards.

It is advisable, when any difficulty occurs to the extraction of the stone, to introduce the finger into the wound for the purpose of ascertaining whether the calculus has not been seized by the forceps by its longest diameter; and, if such should be found to have been the case, to relax the hold which the blades of the forceps have upon it, while its position is altered for one that is more favourable for its removal.

The accidents which are most liable to occur in the performance of the operation are hæmorrhage and a wound of the rectum. The hæmorrhage may be furnished from the artery of the bulb,—from the trunk of the internal pudic, or from the smaller branches of it, the transversalis and superficialis perinæi. The artery of the bulb is avoided by not making the incisions, while exposing the membranous portion of the urethra, too high up towards the arch of the pubes. The trunk of the internal pudic ought not to be exposed to injury if the incisions are made in the proper direction, obliquely downwards and outwards; it is only by inclining the edge of the knife almost horizontally, and carrying it much too close to the margin of the bone, that this vessel is cut.

The rectum will not be wounded if care is taken to depress the bowel to the opposite side, with the finger of the left hand, while the membranous and prostatic portions of the urethra are being cut, and if the blade of the knife is sufficiently lateralised.

The structures that are divided in the first incisions of the lateral operation are, the skin, a portion of the superficial fascia where it covers the transverse muscle, and a part of the adipose tissue which fills up the ischio-rectal fossa. In the second incision, the transverse muscle and the small artery that runs along its posterior border, a portion of the triangular ligament, the membranous portion of the urethra, with the compressor urethræ muscle, are cut. A few of the most posterior of the fibres of the accelerator urinæ are sometimes divided. In the last incision, the left lobe of the prostate gland, with such of the fibres of the levator ani muscle as descend upon its side, together with the neck of the bladder, are divided.

It frequently occurs, after the operation of lithotomy, that the urine flows by the urethra on the second or third day, but soon afterwards it comes away only by the wound; this is owing to the temporary closure of the lips of the wound from the inflammatory swelling of the parts, which ensues after the operation.

When death follows the operation of lithotomy, and has not been caused by hæmorrhage, the principal post-mortem appearances will be found to be depending either upon peritonitis and inflammation of the bladder, or from diffuse inflammation of the loose cellular tissue which surrounds the base of the bladder and

is continuous with the subserous cellular tissue of the pelvis. This inflammation of the cellular tissue of the pelvis may be induced by the urine becoming extravasated into its cells, in consequence of not escaping sufficiently freely by the external wound; or it may arise independently of this cause, from the injury which it has sustained during the operation and the extraction of the stone.*

The bilateral operation.—This method, as practised at the present day, is but of very recent date, having been introduced by the late Baron Dupuytren.† The patient is placed in the same position as for the lateral operation of lithotomy. The staff having been introduced, it is given to an assistant, who holds it in such a position that its handle shall form a right angle with the patient's body; at the same time fixing it firmly against the inferior border of the pubic arch. The groove of the staff is placed upon its inferior surface. The operator then makes a curved incision across the perinæum, commencing between the tuberosity of the right ischium and the margin of the anus, but a little nearer to the former point, and terminating at the corresponding point upon the opposite side. The concavity of this incision must be directed towards the anus, and its centre should be situated upon the raphé of the perinæum, about six or eight lines in front of the anus. The skin, subcutaneous adipose tissue, superficial fascia, and anterior extremity of the external sphincter muscle having been divided, the index-finger of the left hand should be introduced into the centre of the wound, and the groove of the staff sought for, where it lies in the membranous portion of the urethra, between the bulb and the prostate gland. The urethra is to be opened here to the extent of three or four lines, when the extremity of the finger-nail should be inserted into the groove of the staff, to serve as a conductor for the beak of the lithotome. The operator now changes the scalpel for the lithotome, the point of which he places in the groove of the staff; taking care that the concavity of the instrument is directed upwards, and corresponds with the

* Vide Med. Chir. Trans. Lond. vol. viii. p. 206, for "Remarks on the best mode of making the incisions in the lateral operation of Lithotomy;" by Samuel Cooper, Esq. Surgeon to the Forces.

† The direction of the external incisions is similar to those of the operation described by Celsus.

curve of the staff. After assuring himself, by a slight movement backwards and forwards of the instrument, that the point is fairly lodged in the groove, he pushes it onwards into the bladder, lowering at the same time both the handle of the staff and the lithotome. As soon as the lithotome has been introduced into the bladder, its point is to be disengaged from the staff, which is now withdrawn. The lithotome is then turned round, so that its concave surface is directed inferiorly towards the rectum; after which it is to be drawn out (the blades being expanded by pressing on their handle) slowly and steadily, following the direction of the external incisions. As soon as the lithotome has been withdrawn, the fore-finger of the left hand is to be introduced by the wound into the bladder, to ascertain the situation and figure of the calculus, and to serve as a conductor to the forceps, which are to be carried, their blades being closed, along its upper surface. The staff is removed when the forefinger has been introduced into the bladder. The stone is then laid hold of, and extracted in the usual manner.

By this operation a much larger incision may be made in the prostate gland and neck of the bladder than in the lateral operation, without injury to the base of the gland, and the reflection of the pelvic fascia. It is alleged, also, by those who advocate the practice of this operation, that the risk of hæmorrhage is diminished, as well as of injury to the seminal ducts.*

Except in France, this operation has not been very extensively adopted.

The recto-vesical operation.—Two methods of performing this operation have been proposed and practised: in one, the membranous portion of the urethra, and the prostate gland, with a small portion of the anterior wall of the rectum, are divided; while, in the second, these structures, with a portion of the base of the bladder, are cut.

* It has been stated, that Dupuytren operated in this manner upon twenty-six cases in succession, in the Hôtel Dieu at Paris, without losing one; and that, out of seventy operations that he performed, only six terminated fatally. However this may be, MM. Sanson and Bégin, the editors of Dupuytren's posthumous work, give a table by which they show the mortality after the bilateral operation to have been as high as one in four and a half.—Vide Opération de la Piérre d'après une méthode nouvelle par le Baron Dupuytren; ouvrage terminé et publié par MM. Sanson et Bégin: folio, 1836, p. 12.

First mode.—A staff is introduced into the bladder, and is held by an assistant in the same manner as has been described in the account of the bilateral operation. The index-finger of the left hand is introduced into the rectum, and the staff felt as it lies in the membranous portion of the urethra in front of the prostate gland. The bistoury is now introduced into the bowel, its blade lying flat upon the finger; then, turning its edge upwards, an incision of about an inch and a half in length is made in the anterior wall of the rectum, and the external sphincter of the anus, as it is withdrawn. The bistoury is introduced a second time into the rectum, and the membranous portion of the urethra opened in front of the prostate gland; after which, the knife, its edge being now turned downwards, is pushed along the groove of the staff into the bladder, dividing as it enters the inferior portion of the prostate gland. The staff is now withdrawn, and the forceps introduced upon the finger, and the stone laid hold of and extracted.

Second mode.—This only differs from the preceding by the greater extent to which the incision that is made in the bladder is carried backwards. It is made to extend about one inch beyond the posterior edge of the prostate gland.

The advantages which have been urged in favour of the more general adoption of these operations are the simplicity of their execution, the freedom from all risk of hæmorrhage, and the ease with which very large calculi can be extracted from the bladder. But these advantages, important as they are, appear to be more than counterbalanced by the frequency of recto-vesical fistulæ, extensive suppurations within the pelvis, and injuries of the common seminal ducts. In one case, the recto-vesical cul-de-sac of the peritonæum was laid open.*

The operation of lithotomy above the pubis.—It will be recollected that, when the bladder is distended, the portion of its anterior surface which is uncovered by the peritonæum rises into the hypogastric region, where it is placed behind the recti muscles. In this situation it may be readily exposed by an incision through the inferior part of the linea alba. In performing this operation, the principal danger which requires

* Vide Nouveaux 'Eléments de Médecine Opératoire, par A. L. M. Velpeau; Paris, 1832, tom. iii. p. 793.

to be guarded against, is the wounding of the peritonæum as it is reflected from the summit of the bladder upon the posterior surface of the abdominal parietes.

Before the operation is commenced, the bladder should be moderately distended, either by the patient having retained his urine for some time previously, or, what is much better, by injecting a sufficient quantity of tepid water immediately before commencing the incisions. The patient is placed in the recumbent posture, with his shoulders gently elevated by some pillows laid underneath them ; while the legs are allowed to hang loosely over the lower edge of the table.

The operator, placing himself upon the right side of the patient, makes an incision of three or four inches in length upwards from the pubis, following the direction of the linea alba. When the skin and subjacent adipose tissue have been divided, the tendinous aponeuroses of the abdominal muscles (which by their intersection form the linea alba) are exposed, and must be cautiously divided to the same extent as the external incision ; a little cellular tissue now only remains to be cut, in order to expose the anterior surface of the bladder. It is during this part of the operation that great care is requisite lest, in carrying his knife too freely into the superior angle of the wound, the operator should open the sac of the peritonæum. When the bladder has been fairly exposed, it is to be opened either by plunging the knife into it at once, or by first transfixing it from within by a *sonde-à-dard*, which is introduced by the urethra for this purpose. The opening that is made in the coats of the bladder is to be enlarged by cutting towards the pubes ; after which, the finger is introduced into the bladder, with the double purpose of ascertaining the situation of the stone, and of preventing the collapse of the parietes of the bladder. Sometimes a blunt hook or crotchet is employed, instead of the finger, to sustain the edges of the opening in the bladder during the endeavours to seize and extract the stone. When the operation is concluded, a slip of linen or a cannula is placed between the edges of the wound, with the view of facilitating the exit of the urine.

The chief sources of danger after this operation, are the escape of the urine into the loose cellular tissue which surrounds the bladder, and the occurrence of inflammation and formation

of abscesses in the same structure. Several examples have been recorded in which hæmorrhage to a considerable amount has occurred after this operation; a circumstance which has been probably owing to some variety in the course and distribution of the vesical arteries.* The peritonæum has been frequently wounded in this operation, sometimes, fortunately, without being followed by any ill consequences.

* See Nouveaux 'Eléments de Médecine Opératoire, par M. Velpeau, tom. iii. p. 828.

ERRATA.

Page 18, line 18, *for* " pectiniforme " *read* " pecteniforme."
31, foot-note, *for* " strong hardness " *read* " stony hardness."

FINIS.

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THE

SURGICAL ANATOMY

OF

THE GROIN,

THE FEMORAL, AND POPLITEAL REGIONS.

BY

THOMAS MORTON,

FORMERLY ONE OF THE HOUSE SURGEONS OF UNIVERSITY COLLEGE HOSPITAL.

ILLUSTRATED WITH LITHOGRAPHIC PLATES AND WOOD ENGRAVINGS.

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ADVERTISEMENT.

THE present publication is intended to form, with the Surgical Anatomy of the Perinæum already published, part of a Work, which, when it shall have been completed, will contain a description of the Surgical Anatomy of some of the most important regions in the human body.

The drawings, from which the lithographic plates have been engraved, were very carefully made after my own dissections; as were also those from which the wood-engravings have been taken, with the exception of Nos. 4 and 5, which were accurately copied from similar plates in Hesselbach's Essay upon the Origin and Progress of Herniæ.

I take advantage of the present occasion gratefully to acknowledge my obligation to Sir Astley Cooper, who has kindly permitted me to copy the engravings which illustrate the description of the injuries of the hip-joint, from the plates relating to that subject in his Treatise on Dislocations and Fractures.

THOMAS MORTON.

UNIVERSITY COLLEGE,
APRIL 30, 1839.

THE SURGICAL ANATOMY

OF

THE GROIN.

CHAPTER I.

EXTENT OF THE REGION OF THE GROIN. — PRELIMINARY REMARKS.

The groin, or, as it has been more recently termed, the inguino-femoral region, comprises within its limits the triangular space or hollow which is observed at the upper part of the thigh where it bends upon the trunk, and is included between the ligament of Poupart above, and the sartorius and adductor longus muscles on either side. This space, the external surface of which is usually a little concave in its outline, especially when, in the living subject, the thigh is attempted to be flexed upon the pelvis, or when, after death, it is abducted and rotated outwards, may be compared in several respects to the depression of the axilla in the upper extremity. This hollow appearance of the region of the groin is extremely well seen in those persons who, originally possessed of a large muscular developement, have become rapidly emaciated in consequence of some wasting disease, as hectic, fever, &c.; but in very corpulent individuals the natural limits of the region are not so clearly marked out, nor can it be easily distinguished from the general contour of the limb, unless the muscles which bound it laterally are excited to a violent degree of contraction. The base of the triangular space is, as has been already described, formed by Poupart's ligament, and therefore corresponds exactly with the

deep linear depression which marks, externally, the flexure of the thigh upon the pelvis.

Preliminary remarks.—Before commencing the dissection of the groin, the following inequalities of its surface are deserving of notice; viz. at its most external limit is situated the striking prominence of the anterior superior spinous process of the ilium, to which the sartorius muscle and the iliac extremity of the crural arch are attached; beyond this, the projecting curved line of the crest of the ilium may be traced for a considerable distance until it ceases at the posterior superior spinous process: more internally than the anterior superior spine of the ilium is observed a smooth plain surface, which corresponds with the iliac portion of the fascia lata, where it covers the iliacus, psoas magnus, and rectus muscles; next to it is a hollow depression, more or less strongly marked according to the condition of the subject, whether it be corpulent or otherwise; it is occupied by a quantity of loose cellular and adipose substance, together with numerous lymphatic glands, underneath which, in the living person, the pulsations of the great femoral artery may be readily distinguished, as that vessel emerges from the cavity of the abdomen, passing underneath Poupart's ligament.†

It is in this situation that the interruption to the circulation of the blood through the trunk of the common femoral artery can be most easily effected, by the simple pressure of the thumb upon it as it runs over the horizontal branch of the os pubis, since it is only separated from that bone by a few of the fibres of the psoas magnus muscle.‡ (See the woodcut No. 2, at page 87, figs. *e*, *s*, and *u*.)

† To be well acquainted with the natural healthy appearance of the upper part of the thigh, will frequently prove of great advantage in the endeavour to establish a ready and correct diagnosis in several of the numerous obscure affections which occur in the region of the groin.

‡ In the hospital of University College, and in the French hospitals generally, it is the constant practice to employ pressure in this manner upon the trunk of the common femoral artery, during the performance of amputation of the thigh or leg, instead of using the tourniquet; but in private practice, and on other occasions when a sufficient number of intelligent and trustworthy assistants are not at hand, it is more advisable to take advantage of the security which the application of the tourniquet affords.

There yet remains to be observed a still deeper hollow, upon the pubal side of the great femoral artery and vein, which is limited superiorly and internally by the tuberosity of the os pubis and the adductor longus muscle. It is in the situation of this depression that the tumour of a femoral hernia protrudes externally. (See Plate IV. fig. 3, and also Plate VI. figs. 1 and 2.)

The principal diseases which, by their occurrence within its limits, demand from the surgical student a perfect and intimate acquaintance with the anatomy of the region of the groin, are, buboes and other abscesses, aneurism and wounds of the great vessels, varix of the saphena vein, with encysted and other tumours; the diseases and injuries of the hip-joint; and lastly, but not the least important, from the great frequency of its existence, and the delicate operations required for its relief, the femoral or crural hernia.

When we take up a dried preparation of the bones of the pelvis, from which all the soft parts that naturally invest them have been removed, with the exception of the ligaments, which are extended across from one bone to the other, and serve to connect them together, or to give attachment to muscles, we observe, on each side of the cristæ of the ossa pubis, a large, deep, and irregular excavation of the anterior margin of the ossa innominata, which extends outwards, as far as to the anterior superior spinous process of the ilium. (See the wood-engraving, No. 1. *a*, *b*, *c*, *d*, *e*, *f*.) If we trace the margin of the bone between the two above-mentioned points, we shall find that several eminences and depressions are situated along the border of the excavated space, which give rise to the inequality of outline alluded to: thus, for example, there is, a little distance from the anterior superior spinous process of the ilium (*a*), and separated from it by a deeply curved depression, another prominence (*the anterior inferior spinous process*, *f*,) which gives attachment to one of the tendons of the rectus muscle; passing along in a direction towards the mesial line, we soon meet with another elevation in the margin of the bone (*the ileo-pectineal eminence*, *e*,) situated immediately above the acetabulum, and indicating the junction of the bones of the ilium and pubis, which existed separately in the young subject, previously to the completion of the developement of the osseous system.

From the last-mentioned process of bone, the horizontal branch of the os pubis (*d*) constitutes the posterior boundary of the space as far as to the root of the spinous process or tuberosity (*b*). Between the ileo-pectineal eminence, and the spine of the pubis, the superior edge of the horizontal branch of the os pubis is remarkably thin and sharp, (*the pecten of the os pubis*,) and forms part of the brim of the true pelvis: it also constitutes a part of the ileo-pectineal line, and gives attachment to Gimbernat's ligament, and to the conjoined tendons of the internal oblique and transversalis muscles of the abdomen.

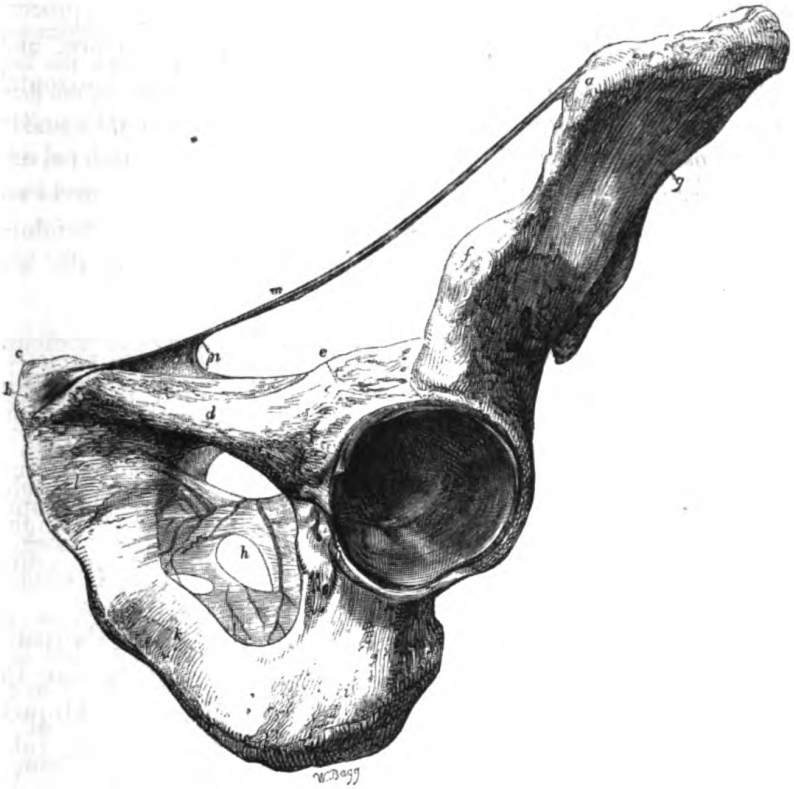
The *crural arch*.—The ligament of Poupart,† as it stretches across from the anterior superior spinous process of the ilium, to the spine, or tuberosity of the os pubis, bounds the excavation of the os innominatum anteriorly, and thus converts it into a wide hollow passage, or outlet, by which several large muscles and vessels issue from the cavity of the abdomen to the thigh; and hence the name which has been given to it, of the crural arch. (See the woodcut No. 1. fig. *m*, at page 85.)

Gimbernat's ligament.—Some of the fibres of Poupart's ligament will be noticed, on close examination, as leaving the direction which is pursued by the rest, and bending obliquely downwards and outwards as they approach towards the tuberosity of the os pubis, passing to be inserted into the pubal portion of the pecten, or ileo-pectineal line (*n*). This thin stratum of tendinous fibres, the dirction of which, in the erect position of the body, is almost horizontal, has been named Gimbernat's ligament,‡ and is commonly found rather larger in men than in women; its external margin is thin, sharp, and concave in its outline, and is directed towards the femoral vein, from which it is only separated by a small oval space, occupied by some loose cellular tissue, and occasionally a lymphatic gland. (Woodcuts Nos. 1 and 2, fig. *n*.)

† Also called the Fallopian ligament, ligament of the thigh, crural arch, tendon of the external oblique muscle.

‡ So named, after Don Antonio de Gimbernat, surgeon to the King of Spain, who accurately described its structure in 1768, and recommended its division with the knife for the removal of the stricture in cases of strangulated femoral hernia. *Vide* Nuevo Metodo de operar en la Hernia crural, por D. Antonio de Gimbernat; Madrid, 1779. A new Method of operating for the Femoral Hernia, translated by Thomas Beddoes, M. D.; 8vo. Lond. 1795.

No. 1.



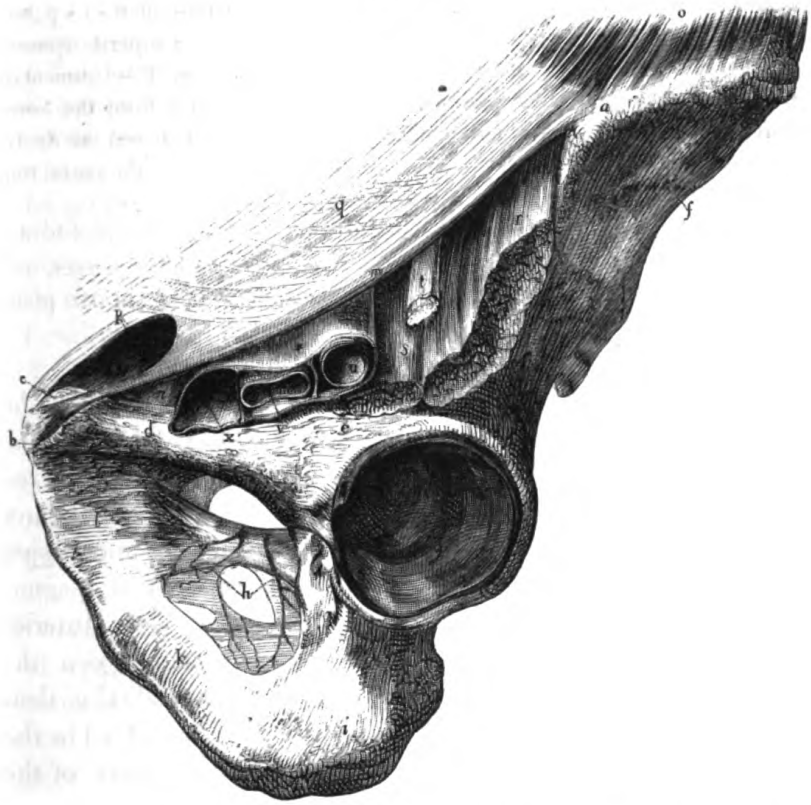
The wood-engraving represents the crural arch of the left side as it appears when all the soft parts, with the exception of the ligaments, have been dissected from the os innominatum. The irregularly curved line of the anterior margin of the bone is seen to be converted into a hollow outlet or passage by Poupart's and Gimbernat's ligaments, as they are stretched across in front of the excavated space. *a*. The anterior superior spinous process of the ilium. *b*. The spinous process or tuberosity of the os pubis. *c*. The angle of the os pubis; the space between *b* and *c* is the crista of the os pubis. *d*. The horizontal branch of the os pubis: superiorly, its margin is thin and sharp, and is named the *pecten* of the bone; inferiorly, it arches over the thyroid foramen, which is represented as being partially filled up by the obturator ligament. *e*. The ileo-pectineal eminence, which marks the junction of the os pubis and the ilium when the developement of the osseous system has been completed: it is against this prominence of the bone that the femoral artery may be securely compressed with the thumb, so as completely to arrest the current of the blood through the vessel. *f*. The anterior inferior spinous process of the ilium, to which one of the heads of the rectus muscle of the thigh is attached. *g*. The dorsum of the ilium. *h*. The thyroid foramen, partly closed up by the

obturator membrane. *i*. The tuberosity of the ischium. *k*. The ascending ramus of the ischium. *l*. The body and descending ramus of the os pubis. *m*. The ligament of Poupart, extended between the anterior superior spinous process of the ilium (*a*), and the spine of the pubis (*b*). *n*. The ligament of Gimbernat, which is chiefly formed by the reflected fibres from the lower edge of Poupart's ligament, and which should be divided between the dotted lines to remove the stricture when it is necessary to enlarge the crural ring in operations for strangulated femoral hernia. The crural arch (*m*, *n*,) is formed by the posterior edge of Poupart's ligament, and the lunated border of Gimbernat's ligament; and underneath it pass the muscles, nerves, and vessels, which issue from the cavity of the abdomen to the upper part of the thigh.

In the natural and undissected condition of these parts, the greater portion of the space, which is included between the posterior edge of Poupart's ligament and the irregular curved margin of the bone, is completely closed up by the structures that descend from the interior of the belly to the upper part of the thigh. The iliacus internus and psoas magnus muscles, together with the external cutaneous and anterior crural nerves, occupy the whole of the interval between the anterior superior spinous process of the ilium and the ileo-pectineal eminence. (See woodcut, No. 2. *r*, *s*, *t*.) On the inner or pubal side of these are placed, first, the trunk of the common femoral artery (*u*), and then that of the great femoral vein (*v*); so that there only remains a small and oval-shaped space (*x*), which is unoccupied, except by some loose cellular tissue (the *septum crurale* of M. J. Cloquet), and some lymphatic vessels, which, passing along the inner edge of the femoral vein, ascend into the cavity of the pelvis from the structures of the inferior extremity, to reach the absorbent glands which are situated upon the internal border of the psoas muscle, alongside of the external iliac vessels.

The wood-engraving represents, a vertical section of the limb having been made immediately below Poupart's ligament, the mode in which the greater part of the space that is included by the crural arch is filled by the muscles, nerves, and vessels which make their exit from the abdomen to supply the lower extremity, leaving only a small oval-shaped space (the crural ring), upon the iliac side of Gimbernat's ligament, unoccupied, except by some loose cellular tissue, absorbent vessels, and sometimes a lymphatic gland.

No. 2.



a. The anterior superior spinous process of the ilium. *b*. The spine, or tuberosity of the os pubis. *c*. The crista of the os pubis. *d*. The horizontal branch of the same bone. *e*. The ileo-pectineal eminence. *f*. The dorsum ilii. *g*. The cavity of the acetabulum. *h*. The thyroid foramen, filled up by the obturator membrane. *i*. The tuberosity of the ischium. *k*. The ascending ramus of the ischium. *l*. The body and descending ramus of the os pubis. *m*. Poupart's ligament, which, together with *n*, Gimbernat's ligament, constitutes the crural arch; beneath which, the iliacus muscle *r*, the psoas magnus muscle *s*, the anterior crural nerve *t*, the femoral artery *u*, the femoral vein *v*, and the crural ring *x*, are situated.† The femoral artery and vein, with the crural ring, are seen included within a membranous sheath or common investment, *, the anterior wall of which is formed by the fascia transversalis, and the posterior by the fascia iliaca. On each side of the femoral vein will be perceived a membranous septum which separates that vessel from the femoral artery on the one side, and from the crural ring on the other, at the same time serving to bind the anterior and posterior parietes of

† The femoral hernia descends from the abdomen through the crural ring.

the sheath more firmly together. *o.* marks the fleshy fibres of the external oblique muscle of the abdomen, where it is about to terminate in the tendinous aponeurosis *q*, near which some curved fibres are seen crossing, almost at right angles, the fibres of the aponeurosis, serving to bind together the pillars of the inguinal ring, and hence named the intercolumnar fibres. *p.* The external abdominal ring, which is situated just above the spine of the os pubis.

The *crural ring*† is the oval-shaped space which is bounded in front by the thin posterior edge of Poupart's ligament (*m*); behind by the *pecten*, or horizontal branch of the os pubis (*d*); externally by the great femoral vein (*v*), or rather the septum which separates that vessel from the lymphatics; and on the inner, or pubal side, by the lunated border of Gimbernat's ligament (*n*). It is owing to the larger size of the crural ring in women, combined as it is in them with smaller inguinal rings, as compared with the size of the same space in the male subject, that the more frequent occurrence of femoral hernia in the female sex is, in all probability, to be mainly attributed.‡

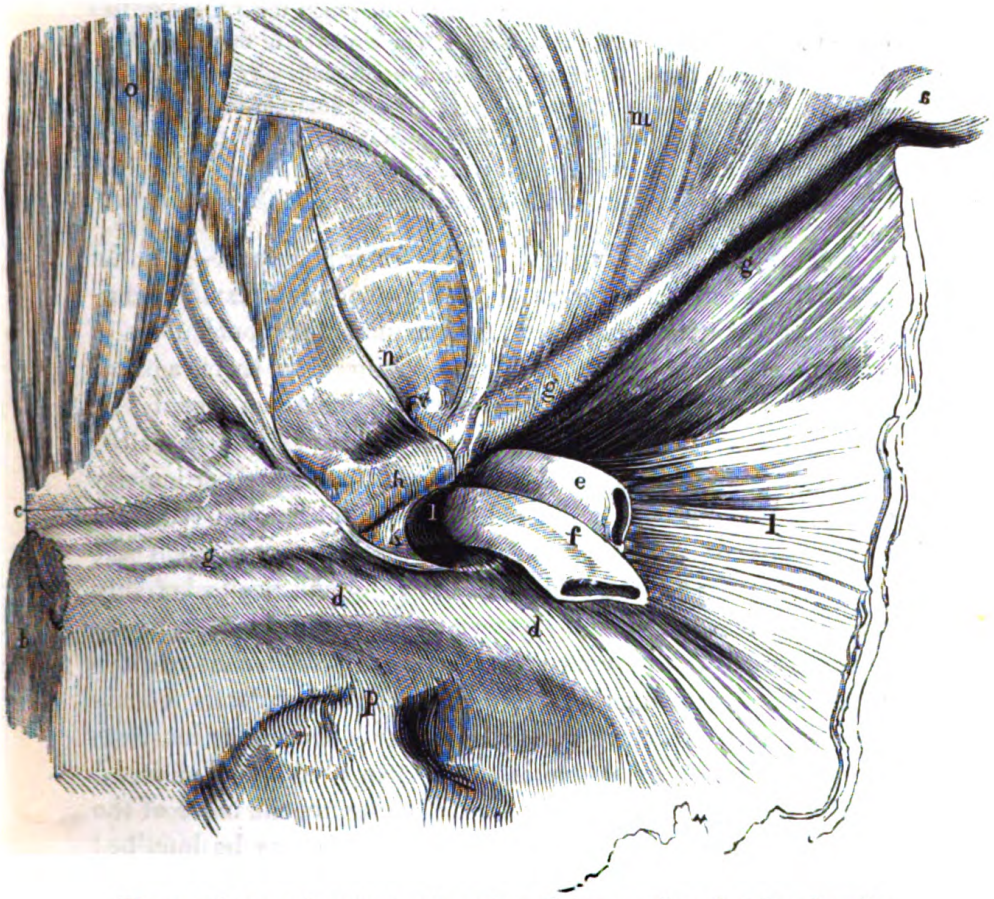
Upon making an examination of the crural arch from its internal surface, when the cavity of the abdomen has been fairly laid open to view by a crucial incision of its anterior parietes, it will be found, after the peritonæum and subserous cellular tissue have been removed from the internal surface of the transversalis and rectus muscles, and the iliac fossa, that the space between the anterior superior spinous process of the ilium and the external iliac vessels, in addition to being closed up by the nerves and muscles mentioned above, is greatly fortified by the peculiar manner in which the strong membranous expansion that binds down the psoas and iliacus muscles (*the fascia iliaca*) is connected to the posterior edge of Poupart's ligament, where it joins with a similar membrane investing the internal surface of the transversalis and rectus muscles (*the fascia transversalis*); the point of their conjunction being distinguished by a dense whitish line, or band, situated immediately behind and parallel with the crural arch. It is, doubt-

† The crural ring was described by Mr. Hey under the term of *the Femoral ring;* and by others as the *Upper*, or *Posterior, opening of the crural* or *femoral canal.* By Sir Astley Cooper it is called the *Femoral aperture.*

‡ *Vide* Observations on Crural Hernia, by Alex. Monro, jun. M.D.; Edin. 8vo. 1803, p. 55.

less, chiefly owing to this connexion of the fascia iliaca with the fascia transversalis behind Poupart's ligament, that a protrusion of any of the abdominal viscera is so rarely permitted to occur in the interval between the anterior superior spinous process of the ilium and the great femoral vessels. (See the wood-engraving, No. 3, fig. *g*, *g*, *g*.)

No. 3.



The wood-engraving represents a view of the crural arch, taken from behind, when the cavity of the abdomen has been laid open, and the peritonæum and loose subserous cellular tissue removed from the inner surface of the muscular parietes, so as to expose the *fasciæ iliaca* and *transversalis* where they invest and strengthen the several structures filling up that part of the crural arch which intervenes between the anterior superior spinous process of the ilium and the external iliac vessels. *a*. The anterior superior spinous process of the ilium. *b*. The symphysis pubis. *c*. the situation of the spine of the os pubis. *d*. *d*. The horizontal branch of the os pubis.

e. The external iliac artery. *f*. The external iliac vein. *g. g. g*. The posterior surface of Poupart's ligament, behind which the fascia iliaca (*l*) is seen uniting with the fascia transversalis (*m*). *h*. The fascia transversalis passing out of the pelvis upon the great vessels forming the anterior layer of their funnel-shaped sheath (seen in the woodcut No. 2, *). *i*. The crural ring, through which the femoral hernia descends. *k*. Gimbernat's ligament, covered by the fascia transversalis. *l*. The fascia iliaca, lining the psoas and iliacus internus muscles, and passing out of the pelvis underneath the iliac artery and vein, to form the posterior wall of the funnel-shaped sheath of the femoral vessels. *m*. The fascia transversalis, which lines the internal surface of the transversalis and rectus muscles. *n*. The situation of the internal abdominal ring: beneath the letter is seen the cut extremity of the round ligament of the uterus, which escapes here to enter into the inguinal canal. *o*. The rectus muscle dissected. *p*. The opening by which the obturator artery and nerve issue from the pelvis: the inner surface of the bone is here covered by the pelvic fascia, which is a continuation from the fascia iliaca.†

The funnel-shaped sheath of the femoral vessels.—As the external iliac vessels emerge from the abdominal cavity, passing underneath the crural arch, they assume the appellations of femoral artery and vein, and carry along with them a complete investment from the fasciæ which line the internal surface of the iliac region; this investment, or sheath, is, at the first, wide and loose around the vessels, and more particularly so upon the inner or pubal side of the great femoral vein, but it gradually contracts its dimensions as it descends upon the front of the thigh, (see Plate IV. fig. *t*, *t*,) and finally becomes intimately blended with the proper cellular tunic of the artery and vein opposite the point where the internal saphenous empties itself into the common femoral vein, and the profunda femoris arises from the common femoral artery. This production from the fasciæ which line the internal surface of the abdominal muscles has received, in consequence of its figure, the name of the *funnel-shaped sheath of the femoral vessels.* It may be described as being formed anteriorly by the fascia transversalis, and posteriorly by the fascia iliaca; it is also subdivided into three distinct compartments by the membranous septa which are situated one on each side of the femoral vein, and connect the anterior and posterior parietes of the sheath more firmly together. One of these septa is placed between the femoral artery and the vein, while the other lies on the inner or pubal side of the latter vessel, which it separates from the space that serves to trans-

† Vide the Surgical Anatomy of the Perinæum, page 29, et seq.

mit the great trunks of the lymphatic vessels of the lower extremity into the interior of the abdomen. (See the woodcut No. 2, *u*, *v*, *x*.; and Plate IV. fig. 1, 2, 3.) The most external of the subdivisions of the funnel-shaped sheath of the vessels contains the common femoral artery; the second, or middle division, is occupied by the great femoral vein; while the third, or that which is nearest to the tuberosity of the os pubis, corresponds with the crural ring, and is closed, in the natural condition of the parts, by some loose cellular tissue† and lymphatic vessels: occasionally, however, an absorbent gland will be found lying within it.

It is into the last-mentioned of the three subdivisions of the funnel-shaped sheath of the femoral vessels that the peritonæal pouch, which forms the sac of a femoral hernia, commences to descend when it is extruded from the abdominal cavity.

† The *Septum crurale* of M. Jules Cloquet. *Vide* Recherches Anatomiques sur les Hernies de l'Abdomen, par Jules Cloquet; 4to. Paris, 1837; page 74.

CHAPTER II.

SURGICAL DISSECTION OF THE PARTS CONNECTED WITH THE ANATOMY OF FEMORAL OR CRURAL HERNIA.

For making the dissection of the structures which are connected with the anatomy of femoral hernia, a female subject should be selected; and one that is rather lean and attenuated will be found to be much more suitable for this purpose than one which is more corpulent, as it is very difficult to demonstrate upon the latter, in a clear and satisfactory manner, the numerous layers of fasciæ described in the best treatises upon this disease.

Position of the subject.—The subject should be laid upon its back, and a moderately sized block of wood introduced underneath the loins: the thigh, upon which the dissection is intended to be made, is, in the next place, to be abducted and rotated outwards, with the knee a little bent, so that the leg and foot may rest upon their external surface. The first incision of the dissection should be commenced over the prominent crest of the ilium, a short distance from the anterior superior spinous process, and extended in a straight line, across the lower part of the belly, to a little above the symphysis pubis: from the termination of this first cut, let another be carried in a vertical direction downwards, along the inner border of the thigh half way to the knee; after which it may be made to incline with a gentle curve over the front of the thigh, and brought to a termination upon the outer aspect of the limb. (See the Plates I, II, and III.) The flap, which has been thus marked out, and consisting of the skin only, is now to be dissected carefully, by light touches of the scalpel, from the subjacent layer of cellulo-adipose substance, commencing the separation at the superior and internal angle, and continuing until the whole of it has been raised from its connexions; after which it may be thrown loosely over the external border of the thigh. (See Plates, I, II, and III.)

The *skin* of the region of the groin is very thin and delicate in its texture, and is slightly covered by the hair extending

from the external organs of generation, which should be removed with the razor previously to the performance of any operation upon this part.

Numerous sebaceous follicles are situated underneath the skin, particularly near to the angle of the flexure of the thigh; and it not unfrequently happens that in young children, and in adults who are exceedingly corpulent, these glands secrete a thin, acrimonious, and irritating matter, which, if not quickly removed, excoriates the adjoining surfaces, and from the continual chafing of the parts, which ensues upon the constant motions of the limb, gives rise to considerable irritation and annoyance of the patient. When this has happened, the most effectual treatment consists in the continued application of the Goulard lotion, with a strict attention to cleanliness by frequent ablutions of the affected parts, which greatly tends to prevent the secretion from lodging in the flexure of the thigh, and renders it thus much less acrid and irritating in its properties.

The process of cicatrisation of all ulcerations in this part is very frequently greatly retarded because sufficient attention is not paid to enforce absolute rest of the limb, and the maintenance of the thigh in that position which is most favourable to the gradual approximation of the edges of the sore, viz. flexed upon the abdomen by means of a large pillow placed underneath the knee. I have frequently seen instances in which many ulcerations situated in the groin, which had existed for a considerable length of time, and resisted all other means employed to cure them, assumed the healing process almost immediately upon the adoption of these principles in their treatment, viz. rest, and the flexed position of the thigh upon the pelvis.

Suppurated buboes, and other superficial abscesses of the groin, ought to be early opened by a free incision, which should be made in the direction of Poupart's ligament when the swelling is situated over it, but through their longest diameter when they are formed lower down upon the front of the thigh. When a bubo has been permitted to burst of itself, there frequently remains an obstinate indolent ulcer, the edges of which are thin, undermined, and of a dull purplish or leaden colour. When this is the case the edges should be freely incised at several points of the circumference of the sore, so as to allow of their free retraction, when they usually coalesce by granu-

lation with the subjacent surface of the ulcer; which, unless this were done, would obstinately resist all other endeavours to heal it. Well-applied pressure, by means of a graduated compress and the spica bandage, is worthy of being tried in the treatment of old and obstinate ulcerations of the groin.

In scrofulous subjects we frequently meet with cases in which, after an abscess in the groin has burst, or been opened, the sore is prevented from healing by the presence of a greatly swollen and indurated gland, which projects from the centre of the ulceration: when this occurs, it is better to destroy the gland by the repeated application of the potassa fusa, than to excise it with the knife; the powerful stimulus of this caustic acts very beneficially upon the naturally indolent ulcer, and its use is not likely to be attended with the troublesome hemorrhage which occasionally follows the removal of a gland with the knife from a sore so closely situated over the course of the great femoral artery.

All sinuses which burrow under the skin of the groin, and which frequently result from badly treated suppurations of the inguinal glands, should be freely laid open with the knife, unless they extend beneath important structures, such as the spermatic cord, the great vessels, &c.

The skin of the groin is sometimes the seat of fungoid carcinoma, the treatment of which by the stronger caustics, such as the chloride of zinc, nitric acid, &c. can only be successful when it has been actively put in force during the very first commencement of the disease, and before it has extended itself much as regards either its surface or depth.

The *superficial fascia.*—The subcutaneous layer of cellular tissue which is exposed by the dissection of the skin forms a part of the superficial fascia of the groin, which here consists of two distinct lamellæ, between which are situated the cutaneous vessels, and a considerable number of lymphatic glands. If the subject be rather emaciated, this disposition of the lamellæ of the superficial fascia may be very clearly demonstrated; but it becomes extremely difficult to show it upon those subjects in which the cellular tissue is much loaded with adipose substance, as the superficial fascia is then hardly distinguishable from the ordinary layer of subcutaneous adipose tissue.†

† In some persons, frequently females, the superficial fascia of the groin appears to be one or two inches in thickness, from the circumstance of so

The external or cutaneous lamella of the superficial fascia of the groin is a thin stratum of cellulo-fibrous membrane, of considerable density and firmness; it is traversed by a number of whitish lines, bands of condensed cellular tissue, which are disposed in a transverse direction, parallel with Poupart's ligament, near to which they appear most distinctly marked, as they gradually diminish towards the middle of the thigh, below which point they finally disappear. The external lamella of the superficial fascia of the groin extends over Poupart's ligament and the crista of the ilium, but without adhering closely to these structures, and is continuous with the corresponding layer of the superficial fascia which covers the abdominal parietes.†

The external lamella of the superficial fascia is, in the next place, to be dissected off from the cutaneous vessels and glands which lie beneath it, and then reflected over the outer aspect of the limb, in the same manner as the skin. (See Plate III. *z*.) Some care is required in doing this, in order that the subjacent structures may remain uninjured, as they rest upon the deep lamella which separates them from the fascia lata. With this view it is most advisable to commence raising the external lamella at the inferior and internal angle of the incisions, where it covers the saphena vein, and thence to pursue the dissection along the course of that vessel, and its numerous contributory branches which ramify underneath it. (See Plate I. figs. 1 to 9.)

EXPLANATION OF PLATE I.

This plate represents a view of the structures which are exposed when the skin and the external lamella of the superficial fascia of the groin have been dissected, and reflected over the outer border of the thigh. The margin of the saphenous opening of the fascia lata is partially exposed towards its upper and inner part.

a. The anterior superior spinous process of the ilium.

b. The spinous process, or tuberosity of the os pubis.

c. Poupart's ligament, which is stretched between these two points.

d. The iliac, or external portion of the fascia lata.

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great a quantity of adipose substance being deposited in the cellular tissue between its lamellæ.

† See Part III. the Surgical Anatomy of Inguinal Hernia.

e. The pubic, or inner portion of the fascia lata.

f. The fascia lata, single and undivided, below the entrance of the saphena vein.

h. The external abdominal ring.

i. The round ligament of the uterus, which is held aside by a hook, as it escapes from the external abdominal ring to become inserted into the fatty structure of the mons veneris. A small artery is seen upon its inferior surface.

k. The umbilicus.

l. The fascia lata covering the rectus muscle.

m. The fascia lata covering the sartorius muscle.

n. The fascia lata covering the adductor longus and gracilis muscles.

o. Hey's ligament, or the falciform process of the iliac portion of the fascia lata, called also the femoral ligament, and superior cornu of the saphenous opening. This frequently requires to be divided in operations for the relief of strangulated femoral hernia, in order to remove the stricture upon the protruded bowel.

1. 1. The internal or great saphena vein, which terminates by joining with the common femoral vein, about one inch below Poupart's ligament.

2. The anterior saphena vein. This branch does not always exist; but, when it does, it is worthy of notice, as it lies in front of the superficial femoral artery, where that vessel must be exposed in what is called Scarpa's operation.

3. The external circumflex ilii vein.

4. The superficial epigastric vein.

5. The superficial pudic vein.

6. The superior external pudic artery.

7. and 8. Two small vessels taking the course of the superficial epigastric artery.

9. The external circumflex ilii artery.

10. Three or four small lymphatic glands, which are situated immediately over Poupart's ligament, and are generally the seat of buboes from venereal sores upon the penis.

11. 11. Several absorbent glands situated alongside of the saphena major vein, which frequently swell and inflame, in consequence of some disease, or source of irritation, situated lower down in the leg, or foot. The highest of these may swell, and sometimes obscure the diagnosis of a femoral hernia.

12. A delicate lymphatic vessel, which has been injected with mercury.

A complete femoral hernia protrudes from the saphenous opening in the dark hollow which is included between the letters *e*, *o*, and the figure 11.

When the external layer of the superficial fascia has been in this manner dissected from its connexions with the saphena vein and the other vessels and glands, its structure may be more closely inspected: it will be found to consist, externally, of a loose cellular tissue, while its internal surface presents a uniform, smooth, and glistening appearance, resembling a thin but firm membrane spread over the superficial vessels and glands in this region, which it materially serves to bind down and support in their respective situations.

The numerous small arteries and veins which converge towards the centre of the groin, may now be more completely exposed by carefully removing the loose cellular tissue which surrounds them. The lymphatics which ascend from the integuments of the leg and foot may be shown by scratching through, with the point of the knife, the cellular substance along the external border of the great saphena vein, in the same direction as the course of that vessel; many of these delicate tubes will be thus observed to enter the inferior extremity of the conglobate glands of the groin (*vasa inferentia*), while as many leave on the opposite side (*vasa efferentia*), for the purpose of conveying the lymph onwards towards the centre of the circulation: they then pass through the saphenous opening of the fascia lata into the crural canal, and so into the cavity of the abdomen, where they join with the absorbent glands that lie alongside of the external iliac vessels. (See Plate I. figs. 11, 11, and 12.)

Several delicate lymphatic vessels may also be displayed in the same manner, which descend from the integuments of the abdominal parietes, and from the superficial coverings of the external parts of generation, to pass through three or four small absorbent glands, which are situated parallel with, and immediately over, Poupart's ligament. (See Plate I. fig. 10.)

It is by a reference to the course which is pursued by the lymphatic vessels, that we are enabled to explain the production of those enlargements of the glands in the groin which frequently follow the formation of irritable sores at a considerable distance from the swollen gland, and thus even to decide almost at the first view, from a consideration of the figure and situation of the enlarged gland, whence the primary irritating cause has arisen. If, for example, the swollen and inflamed

gland be situated just over Poupart's ligament, and more particularly if its greater diameter be disposed transversely to the direction of the long axis of the limb, then the swelling has, in all probability, been produced by some affection of the external genital organs,—it may be, a chancre upon the penis, or a gonorrhœal discharge from the urethra; while, on the other hand, if the tumour be situated lower down upon the front of the thigh, and its longest diameter be placed obliquely, and parallel with the course of the saphena vein, then we may feel tolerably well assured that the cause will be detected still lower down upon the limb, perhaps about the ancles, upon the heel, or between the clefts of the toes.

It should not, however, be overlooked, in the decision of doubtful cases, that an inflammatory swelling of the glands of the groin may be excited, and maintained, by diseases about the perinæum and region of the anus.

Inflammation of the superficial absorbents of the thigh frequently ensues after contused and lacerated wounds of the leg and foot; it is generally accompanied by very severe febrile disturbance of the whole system. The affection is indicated by numerous tortuous red lines, which are very tender under pressure, running chiefly in the same direction as the course of the saphena vein. If the disease be not very quickly checked in its progress, it is commonly followed by diffuse inflammation of the subcutaneous cellular tissue of the limb.

Veins.—The great or internal saphena vein commences from the plexus of smaller veins which exists upon the dorsum of the foot, and, after ascending in front of the inner ancle, and internal border of the leg, passes behind the inside of the knee-joint, whence it inclines upwards and forwards, until it terminates by joining with the trunk of the common femoral vein, about an inch, or an inch and a half, below Poupart's ligament, where it passes through the large oval aperture in the fascia lata, which has been named, from this circumstance, the saphenous opening. In its course the great saphena vein receives numerous branches from the integuments on either side; and it is not unfrequently joined near its termination by another vein of considerable size, which, commencing near the knee, ascends in a vertical direction along the front of the thigh (see Plate I. fig. 2). This vein, sometimes called the *anterior saphena*, is worthy of being noticed, when it is present, as

it lies exactly underneath the line of the first incisions that are usually made in Scarpa's operation of tying the trunk of the superficial femoral artery for the cure of popliteal aneurism; it must, therefore, be very liable to be wounded, (a circumstance which, from the great size of the vein, it would be very desirable to avoid,) if the first incisions be not made with a sufficient degree of caution. Immediately before its termination, the internal saphena vein receives three or four branches of smaller size, which converge to meet with it at this point: they are,—1. *Vena epigastrica superficialis;* 2. *Vena pudica externa;* and 3. *Vena circumflexa ilii externa.* These veins correspond in their course and distribution with the superficial branches of the femoral artery of the same name. (See Plate I. figs. 3, 4, 5.)†

After the superficial lymphatics and veins have been examined, attention should, in the next place, be turned towards the superficial branches of the common femoral artery, which ramify between the lamellæ of the superficial fascia. These are commonly four or five in number, and have been severally named as follows: 1. *Arteria epigastrica superficialis;* 2. *Arteriæ pudendæ externæ, superior et inferior;* 3. *Arteria circumflexa ilii externa.* (See Plate I. figs. 6, 7, 8, and 9; and Plate III. figs. r, s, t.)

1. *Arteria epigastrica externa,* vel *superficialis,*‡ is a small branch which springs from the trunk of the common femoral artery, a little below Poupart's ligament; and after emerging through the saphenous opening, or more frequently through a small aperture in the iliac portion of the fascia lata, ascends in an oblique course, upwards and inwards, over the crural arch, where it is placed between the two layers of the superficial fascia of the abdomen: it terminates near the umbilicus, by dividing into a number of ramusculi which anastomose with the branches of the deep epigastric and internal mammary arteries, which issue from numerous small apertures in the tendon of the external oblique muscle.

† Where it is convenient to do so, it is advisable to inject the saphena and femoral veins with melted wax, or tallow, by means of a pipe introduced into the former vessel as it passes behind the inner side of the knee-joint; the other veins may be also injected from smaller pipes introduced into them as they ramify upon the parietes of the abdomen.

‡ "*Arteria ad cutem abdominis.*"—Haller.

The course of this artery lies over the situation of the internal abdominal ring, and frequently crosses the upper part of the inguinal canal; so that it is occasionally divided in the first incisions of the operation for strangulated inguinal hernia, and sometimes, also, though not often, in that for the relief of femoral hernia.

2. *Arteriæ pudendæ externæ, superior et inferior.* — These arteries are usually two in number, though occasionally there may be three, or even more, which pursue the same course. The first of these runs superficially; for, escaping through the lower part of the saphenous opening of the fascia lata, it takes its course inwards and upwards towards the spine of the os pubis, where it crosses over the spermatic cord in the male subject, and the round ligament of the uterus in the female, as these structures issue from the external abdominal ring, or lower aperture of the inguinal canal. (See Plates I. and III. figs. 6 and r.) It is distributed by numerous branches to the integuments and dartos of the scrotum.

The inferior branch also passes out from the saphenous opening, where it will generally be found between the saphena and femoral veins, as it lies in the angle which is formed by the junction of these veins with one another. (See Plate III. fig. r.) It soon, however, dips downwards and gets underneath the pubic portion of the fascia lata, where it rests upon the fibres of the pectineus and adductor longus muscles, until it reaches near to the angle of the os pubis, a little below which it again pierces the fascia lata; and, after mounting over the spermatic cord, a little lower down than the preceding branch, it divides into several ramusculi for the supply of the integuments of the penis and scrotum in the male, and the structures of the mons Veneris and labia majora in the female.

3. *Arteria circumflexa ilii externa*, vel *superficialis*.—This is the smallest of these branches of the common femoral artery; it generally pierces the iliac portion of the fascia lata at some distance from the external margin of the saphenous opening, when it divides into several branches which are distributed to the integuments covering the crest of the ilium, where it anastomoses freely with the internal circumflex ilii, external circumflex and gluteal arteries. This artery sometimes springs from a common trunk with the superficial epigastric artery. (See Plate III. fig. t.)

Some of these arteries are very liable to be wounded in the operation of placing a ligature upon the common trunk of the femoral artery, if the edge of the knife be carried too freely upon the sides of the vessel preparatory to passing the needle around it. In such a case, as the hemorrhage is usually pretty smart, and continues even after the trunk has been tied above, another ligature should be placed below the point from which the wounded vessel has its origin, unless, indeed, the open mouth of the bleeding artery can be secured in the ordinary way.

In addition to the branches of the common femoral artery that have been just described, there are numerous smaller arteries, which issue from the saphenous aperture, or through other foramina that exist in the iliac portion of the fascia lata, and are distributed to the lymphatic glands of the inguinal region and the circumjacent cellular substance; but they are too insignificant in their size, and inconstant in their course and distribution, to deserve any farther notice.

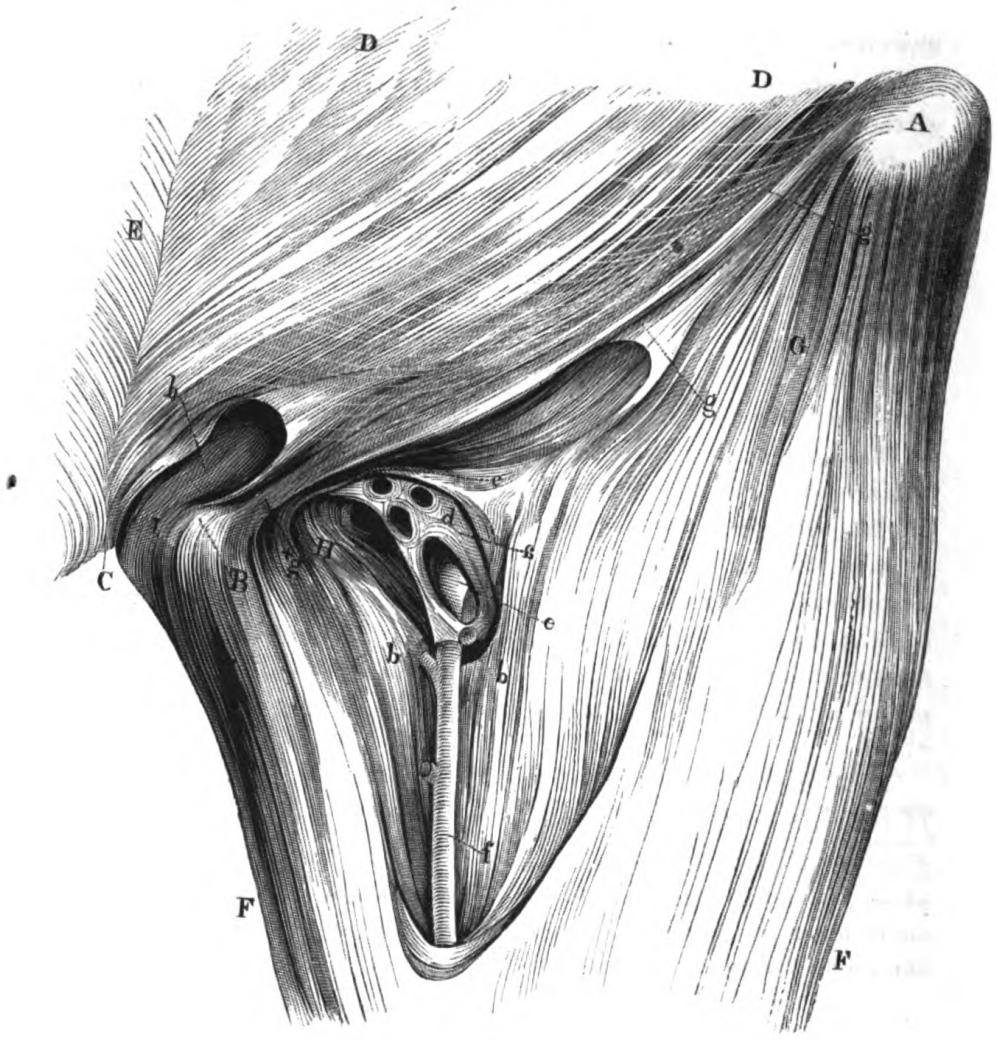
Nerves.—The cutaneous coverings of the region of the groin are supplied with nerves from the descending branch of the genito-crural, as well as by some filaments which are derived from the anterior crural and ilio-inguinal branches of the lumbar plexus.

The superficial vessels and lymphatic glands rest upon the deep lamella of the superficial fascia of the groin.—It will have been observed, in the course of the dissection, that the absorbent glands, lymphatics, and superficial vessels are not in immediate contact with the fascia lata, above which they are situated, but that they are separated from it by a thin stratum of loose cellular substance, which is interposed between them; this may be described as forming the deep lamella of the superficial fascia of the groin. It extends upwards as high as to the anterior and inferior margin of Poupart's ligament, to which it is attached; it will be found to be a little thicker in some subjects than in others.

It is in consequence of the yielding and extensible nature of the deep lamella of the superficial fascia, that the swellings which result from the enlargement of any of the inguinal glands, as in cases where buboes have formed, are so readily moved upon their bases by lateral pressure, and even allow of the tips of the fingers being pressed in underneath them, so as to lift them up, as it were, from the fascia lata of the thigh, upon which

they repose. These circumstances frequently prove of the highest importance and utility in the attempt to establish an accurate and correct diagnosis in obscure cases of tumours in the region of the groin, when accompanied, as they occasionally are, with all the rational symptoms of strangulation of some part of the alimentary canal; since npon a reference to these facts depends the principal means of distinguishing a simple enlargement of one of the lymphatic glands of the groin, from the tumour which is formed by the sac of a small femoral hernia, the basis or neck of which is seated much more deeply, and is more firmly fixed to one spot, than the swelling which is formed by a swollen gland is ever found to be.

No. 4.



The wood-engraving is intended to represent the saphenous aperture of the fascia lata covered by the *cribriform fascia*, which is extended over it, and adheres very closely to the crescentic margin of that aperture.

A. The anterior superior spinous process of the ilium. *B*. The spinous process, or tuberosity of the os pubis. *C*. The situation of the symphysis pubis. *D. D.* The tendinous aponeurosis of the external oblique muscle of the abdomen, upon which are seen some curved white lines representing the intercolumnar fibres. *E*. The linea alba. *F. F.* The fascia lata of the thigh, divided superiorly into *G*. the iliac, or external portion; and *H*. the internal or pubic portion. *I*. The crest of the os pubis. *a*. The *cribriform fascia* adhering to the crescentic margin (*b. b. c.*) of the saphenous aperture. *d*. Some of the apertures in the cribriform fascia, which serve for the transmission of several of the cutaneous vessels. *e*. The great femoral vein. *f*. The internal, or great saphena vein, which empties itself into the common femoral vein, after bending over the edge of the inferior cornu (*b. b.*) of the saphenous aperture. *g. g*. Poupart's ligament, which forms at *g*.* the inferior pillar of the external abdominal ring, which is marked *h*.

The *fascia cribriformis*.—This term is given to that portion of the deep lamella of the superficial fascia of the groin which is stretched over the saphenous opening of the fascia lata, and is traversed at numerous points of its extent by the several arteries, veins, and lymphatic vessels which pass through that opening in their course to join with the deep-seated vessels.†

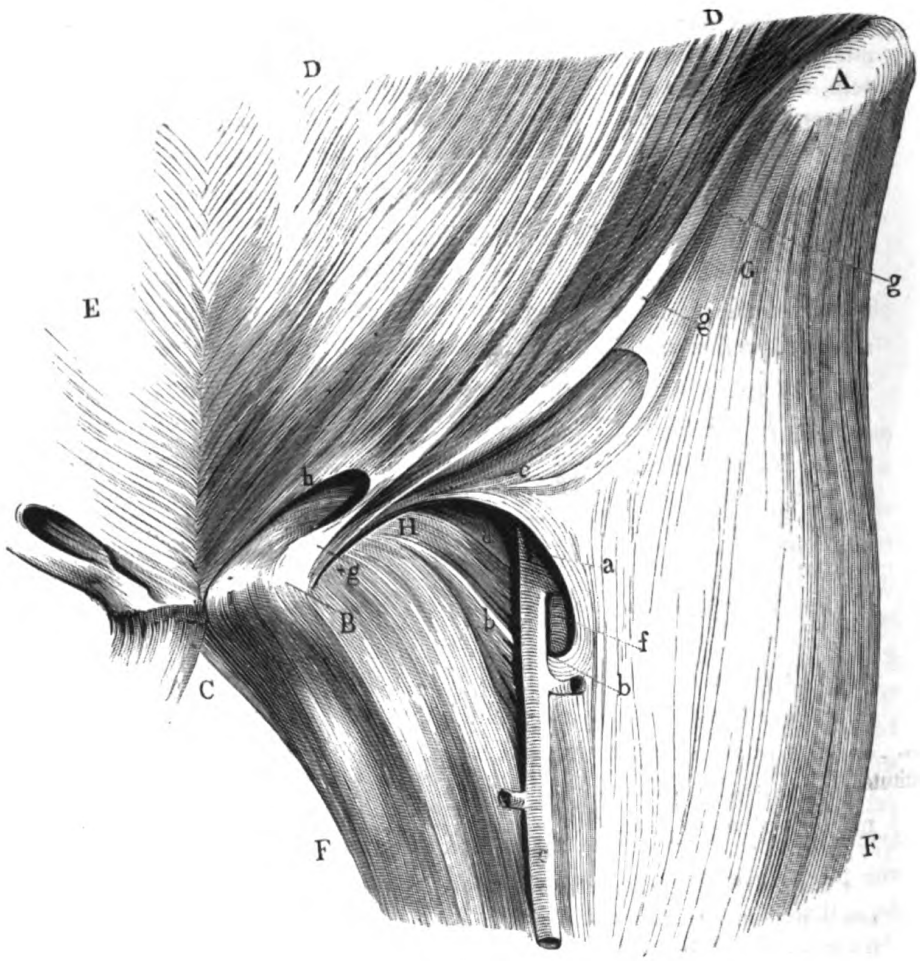
The fascia cribriformis adheres pretty closely to the margins of the saphenous aperture of the fascia lata; it is covered externally by the cutaneous vessels and superficial absorbent glands, while its internal surface is in apposition with the anterior part of the funnel-shaped sheath of the vessels, where it is formed by the process from the fascia transversalis.

The next stage of the dissection consists in removing the deep lamella of the superficial fascia, together with the subcutaneous vessels and glands which rest upon it (see Plate II.); or, if it should be preferred, the vessels may be permitted to remain with some of the glands (as in Plate III.), while the fascia is neatly cut away from the interspaces. When this has been done,

† If the area of the saphenous aperture in the fascia lata be estimated at one square inch in extent of surface, then the deep lamella of the superficial fascia of the groin must present in this situation a sieve-like appearance, from the great number of small vessels, besides the saphena major vein, which pass through it. In some of the schools of anatomy it is taught that the cribriform fascia is a part of the fascia lata of the thigh; but this, I believe, is not the most accurate view of the subject.

an oval-shaped aperture, of considerable size, is observed in the fascia lata, immediately below and a little external to the root of the tuberosity of the os pubis; the edge of which is sharp, and very clearly defined upon the external and inferior part of its circumference. This opening has received the appellation of the *saphenous aperture of the fascia lata*,† from the circumstance of the great saphena vein entering by it to join with the trunk of the common femoral vein.

No. 5.



† "Lacuna pro vasis cruralibus externa."—Hesselbach.

The wood-cut represents the saphenous opening of the fascia lata, when it is completely dissected. The cribriform fascia and all the small sub-cutaneous vessels have been removed, and there only remains the great saphena vein, as it is about to terminate in the trunk of the common femoral vein. *A.* The anterior superior spinous process of the ilium. *B.* The spine or tuberosity of the os pubis. *C.* The situation of the symphysis pubis. *D.D.* The tendinous aponeurosis of the external oblique muscle of the abdomen. *E.* The linea alba. *F. F.* The fascia lata of the thigh, which divides superiorly into *G.* the iliac portion, and *H.* the pubic portion. *a.* The crescentic or falciform margin of the saphenous opening, terminating inferiorly in *b.b.*, the inferior cornu; and superiorly in *c.* the superior cornu, which is attached to the pubic portion of the fascia lata, immediately above the letter *H.*, where it is seen to bend inwards underneath the pubal extremity of Poupart's ligament: the letter itself is placed upon the anterior wall of the crural canal, which is formed by the iliac portion of the fascia lata. *d.* The posterior wall of the crural canal, which is formed by the pubic portion of the fascia lata, where it passes upon the pectineus muscle behind the sheath of the vessels. *e.* The great saphena vein. *f.* The great femoral vein, which receives the preceding vessel. *g.g.g.* * Poupart's ligament, which i sinserted at *g.* * into the tuberosity of the os pubis, and there forms the inferior pillar of the external abdominal ring. *h.* The external abdominal ring: the letter is placed upon the edge of the superior, or internal pillar of the ring. *i.* The crista of the os pubis.

As the margin of the saphenous opening in the fascia lata is most clearly defined at the point where the great saphena joins with the femoral vein, it will greatly facilitate the neat exposition of the edge of the opening if the removal of the cribriform fascia be commenced at this point, and continued by carefully following, in a gentle curve, the sharp margin of the opening, (as represented in Plate II. figs. *l*, and 1, 2, 3; and in Plate III. figs. *g*, *h*, *i*,) upwards and inwards, towards the base of the tuberosity of the os pubis. It is advisable, also, in some instances, to use the handle, rather than the edge of the scalpel, to break up the delicate connexions of the cribriform fascia to the crescentic margin of the saphenous aperture and the sheath of the femoral vessels. Any of the small arteries, which may pierce the fascia lata at other points than the saphenous aperture, may be cut across close to the spot at which they emerge from underneath the fascia. When these directions have been properly executed, the cribriform portion of the deep lamella of the superficial fascia will have been entirely removed and the fascia

lata investing this part of the thigh completely exposed to view. (See Plates II. and III.)

The *fascia lata* encases the whole of the thigh from the knee to the pelvis and Poupart's ligament, sending off from its internal surface numerous processes, which serve to separate the muscles of the thigh from one another, and to maintain them in their oblique position during their various actions. Inferiorly, the fascia lata is attached to the bony prominences of the knee-joint, below which it is continuous with the fascia of the leg; posteriorly, the fascia lata is attached to the linea aspera of the femur by a very strong and thick process, which separates the vastus externus from the biceps flexor and adductor magnus muscles; superiorly, it is fixed into the outer labium of the crista of the ilium, the sacro-sciatic ligaments, the tuberosity and ramus of the ischium, the ramus of the pubis, as also into the symphysis and crest of the same bone.

At the point where the internal saphena vein terminates in the great femoral vein (which is about one inch and a half below the crural arch), the fascia lata, which, covering the front of the thigh, had hitherto presented an uninterrupted and uniform surface, divides into two portions; one of these ascends in front of the sartorius, rectus, psoas, and iliacus muscles, and the great trunks of the femoral artery and vein, to become attached to the lower edge of Poupart's ligament, in the space between the anterior superior spinous process of the ilium and the base of the tuberosity of the os pubis. (See Plate II. fig. *e*; and Plate III. fig. *c*.) The other division of the fascia lata ascends upon the gracilis, adductor longus, and pectineus muscles, to be fixed into the crest and ileo-pectineal line of the os pubis; and, after passing behind the femoral vessels, divides at the internal border of the psoas muscle into two lamellæ, which serve to inclose it and the iliacus muscle in a sheath; after which the deeper-seated layer is blended with the strong fibrous capsule of the hip-joint. (See Plate II. fig. *f.*; and Plate III. figs. *d*, *h*.)

The iliac and pubic portions of the fascia lata.—The division of the fascia lata, which ascends in front of the sartorius muscle and the femoral vessels, is called the *external* or *iliac portion* of the fascia lata; while that which rests upon the adductor longus and pectineus muscles, and passes behind the femoral

vessels and their sheath, is named the *inner* or *pubic portion.* These divisions of the fascia lata are continuous, as has been already mentioned, with one another, underneath the angle which is formed by the junction of the internal saphena with the common femoral vein.

The *external* or *iliac portion of the fascia lata* extends upwards and inwards, in a curved direction, from the point just now mentioned, to be inserted into the pubic portion, close to the root of the tuberosity of the os pubis, and in front of Gimbernat's ligament. This portion of the fascia lata is also strongly attached to the lower edge of Poupart's ligament, between the anterior superior spinous process of the ilium and the spine of the os pubis; it is in consequence of this connexion between these structures that the crural arch is rendered so much more tense and unyielding when the thigh is extended, abducted, and rotated outwards, than when it is placed in the opposite positions.

EXPLANATION OF PLATE II.

This plate represents a view of the saphenous opening of the fascia lata, when all the cutaneous vessels and glands (which are represented in Plate I.) have been removed, with the exception of the great saphena vein. The cribriform lamella of the superficial fascia has also been removed, with the inner wall of the crural canal, which was formed by the sheath of the femoral vessels, so as to render the crescentic margin of the saphenous opening more distinct.

a. The anterior superior spinous process of the ilium.

b. The spinous process or tuberosity of the os pubis.

c. The crista of the os pubis, which supports the round ligament as it issues from the external abdominal ring.

d. Poupart's ligament, which is stretched across between the spines of the ilium and os pubis.

e. The iliac, or external portion of the fascia lata. Three small foramina are seen here, which served for the exit of the superficial epigastric and circumflexa ilii arteries.

f. The inner, or pubic portion of the fascia lata, which covers the upper part of the adductor longus and pectineus muscles, and afterwards passes behind the great femoral vessels.

g. The external abdominal ring.

h. The fascia lata covering the sartorius muscle.

i. The fascia lata covering the rectus muscle.

k. The internal, or great saphena vein, which terminates at one

inch below Poupart's ligament, in the common femoral vein, which is marked *l*.

m. The external incision which must be made to take up the superficial femoral artery.

n. The chain and hook which hold aside the round ligament of the uterus.

o. The umbilicus.

p. The situation of the anterior superior spinous process of the ilium of the right side.

1. The inferior cornu of the saphenous opening of the fascia lata.
2. The superior cornu; it is seen to bend inwards underneath the pubal extremity of Poupart's ligament, and to be inserted in front of Gimbernat's ligament, into the pubic portion of the fascia lata, near to the ileo-pectineal line. It is sometimes called the femoral ligament, Hey's ligament, and the falciform process of the iliac portion of the fascia lata.
3. Gimbernat's ligament.
4. The tendon of the external oblique muscle of the abdomen, with the intercolumnar fibres marked upon it. Some of the fleshy fibres of the internal oblique muscle are seen through the intervals between the fibres of the tendon of the external oblique, which, commencing to split at 6, form by their divergence, as they proceed towards the spine and symphysis of the pubis, the external abdominal ring at *g*.
7. The mons, into which the round ligament of the uterus is inserted. The flap of the integument and superficial fascia, which is marked 5, has been reflected over the outer aspect of the limb.

*The saphenous opening of the fascia lata.**—This aperture, which is of an oval figure, is situated at the superior and inner part of the inguinal region, immediately external to the tuberosity of the os pubis, and at a little distance beneath the pubal extremity of Poupart's ligament. The longest diameter of the saphenous opening is about one inch and a half, and is directed obliquely downwards and outwards. When it is measured across, the breadth of the opening will rarely be found to exceed half an inch in extent. Slight variations from these admeasurements will, however, be occasionally found to exist in different subjects.

* *Foramen saphenum; Lacuna pro vasis cruralibus externa; L'ouverture inférieure du canal crural.*

The margin of the saphenous opening is thin, and very sharply defined, particularly underneath the internal saphena vein, where that vessel is about to empty its contents into the common femoral vein; and, if it be carefully traced upwards on either side from this point, will be found to terminate in two elongated processes, or *cornua*, each of which is slightly incurvated towards the centre of the aperture; so that the edge of the opening has been commonly termed the *crescentic margin.*

The *inferior cornu* inclines obliquely upwards and inwards, and soon becomes blended with the pubic portion of the fascia lata covering the pectineus muscle. (Plate II. fig. 1.)

The *superior cornu* is much longer than the preceding, and is also more curved in its direction; for, after it has ascended in front of the femoral vessels, it bends down underneath the pubal extremity of Poupart's ligament, and terminates by being inserted into the pubic portion of the fascia lata at its attachment, in front of Gimbernat's ligament, to the ileo-pectineal line. The superior cornu of the saphenous opening is particularly deserving of attention; since it must, in consequence of its attachments and curved direction, arch completely over the neck of the sac of a complete femoral hernia, and moreover has been frequently described by many eminent surgical writers as forming the principal seat of stricture in cases of strangulated crural hernia. (See Plate II. fig. 2.; and Plate III. fig. i.)

The late Mr. Hey, of Leeds, named it the *femoral ligament*,† and strongly recommended its division as the means of removing the stricture of the gut in the operation for strangulated femoral hernia. Since the period at which he wrote it has been commonly described by other writers under the appellation of *Hey's ligament.*

Mr. Allan Burns, also, has described the superior cornu very

† Mr. Hey, who was accustomed to divide the stricture of femoral hernia in an oblique direction upwards, writes thus: "The union of the falciform process of the fascia lata with Gimbernat's ligament, together with the sheath of the great vessels, form a ring, through which the femoral hernia descends, and by which it is compressed in the strangulated state."—See the explanation of Plate VI. and also of Plate V. marked *b*; Plate IV. fig. *g.*; in Mr. Hey's Practical Observations in Surgery. Second Edition, 8vo. 1810.

minutely, and proposed to call it the *falciform process* of the fascia lata; which denomination is now very generally adopted in the schools.†

The margin of the saphenous opening is naturally not so distinctly and clearly defined as it is represented in the drawing which has been made of the dissection (see Plate II. figs. 1, 2,), for at this point the iliac portion of the fascia lata is doubled slightly upon itself, so as to become intimately adherent to, if not continuous with, the funnel-shaped sheath of the great vessels; the removal of the cribriform fascia has also contributed, in a great degree, to give the sharpness of outline that is figured in the plate.

It is in a great measure owing to the connexion that exists between the margin of the saphenous opening, and the sheath of the vessels, that the fundus of the sac of a complete femoral hernia is usually prevented from descending any further downwards upon the thigh, but is rather turned, or tilted forwards and upwards, so as to rest upon the falciform process and the lower part of the aponeurosis of the external oblique muscle of the abdomen.

EXPLANATION OF PLATE III.

This plate represents the anatomy of the saphenous opening of the fascia lata in the male subject. The superficial fascia has been removed, and only the superficial vessels and absorbent glands permitted to remain upon the fascia lata.

a. The anterior superior spinous process of the ilium upon the right side:

b. The spine or tuberosity of the os pubis.

c. The external, or iliac portion of the fascia lata of the thigh.

d. The internal, or pubic portion of the fascia lata.

e. The tendinous aponeurosis of the external oblique muscle of the abdomen.

f.f. Poupart's ligament.

g. The inferior margin of the saphenous opening, which, after passing underneath the great saphena vein, terminates at *h*. the inferior cornu of the aperture.

i. The superior cornu, or falciform process, which is seen very distinctly in this drawing to be attached to the pubic portion

† Vide Observations on the Structure of the Parts concerned in Crural Hernia. By Allan Burns. With two plates, illustrating the description. 1 vol. Edin. Med. and Surg. Journ. July 1806, p. 274.

of the fascia lata, underneath the pubal extremity of Poupart's ligament, and anterior to Gimbernat's ligament. In many cases of strangulated femoral hernia this process must be divided, in order to relieve the stricture upon the protruded intestine contained within the sac.

l. The great, or internal saphena vein, which opens into the great femoral vein (*q*.) about one inch below Poupart's ligament.

m. The anterior saphena vein.

o. The superficial epigastric vein.

p. A vein which frequently joins the great saphena, and comes from the inner and back part of the thigh.

q. The trunk of the great femoral vein, which has been exposed by removing the internal wall of the crural canal, or sheath of the great vessels.

r. The external pudendal arteries, which issue from the saphenous opening, and cross over the spermatic cord in their course to the integuments of the scrotum. These vessels are divided in the first incisions of the operation for strangulated scrotal hernia.

s. The superficial epigastric artery.

t. The superficial external circumflex ilii artery.

u. u. u. Several of the superficial lymphatic glands of the groin, which frequently swell and suppurate from disease about the heel and lower part of the leg and foot. Several absorbent vessels are seen running through these glands.

v. The penis.

x. The spermatic fascia which covers the cremaster muscle upon the cord and testis.

y. The external abdominal ring.

z. The superficial fascia of the groin dissected up, and reflected, with the integuments, over the outer border of the limb.

1. The fleshy fibres of the external oblique muscle of the abdomen.
2. The intercolumnar fibres.
3. Gimbernat's ligament. On the iliac side of this, and between it and the femoral vein, may be seen a dark oval-shaped hole, which is the crural ring, or superior aperture of the crural canal, and through which the sac of a femoral hernia is at first protruded. Between this opening and the edge of the falciform process (*i*) is situated the crural canal, the anterior wall of which is formed by the superior cornu of the saphenous opening of the fascia lata, as it arches over the front of the great vessels to be attached to the pubal extremity of Poupart's ligament.

If the innermost compartment of the funnel-shaped sheath of the great vessels be opened, as it descends obliquely from within the lunated edge of Gimbernat's ligament, to become blended with the external cellular coat of the femoral vein, at the point where the internal saphena vein opens into that vessel, a hollow space or cavity (the *crural canal*) will be exposed to view, but which in the undissected condition of the parts is occupied by some loose cellular tissue and lymphatic vessels. An absorbent gland will, occasionally, be found lying within this part of the sheath of the vessels. When these structures have been removed, the little finger may be introduced into the aperture made in the sheath of the vessels, and with the employment of a gentle force may be easily passed upwards into the cavity of the abdomen; a slight resistance only being offered to its progress by the cellular tissue which lines the external surface of the peritoneum, where it is stretched across the superior aperture of the crural canal.

The *crural canal* is the short passage which extends between the saphenous opening of the fascia lata and the crural ring. It is formed by the innermost of the three compartments into which the funnel-shaped sheath of the great vessels is subdivided; the other two divisions of the sheath being completely occupied by the trunks of the common femoral vein and artery. (See the woodcut No. 2, *u*, *v*, *x*, and *.) The anterior wall of the crural canal seldom exceeds half an inch in extent, and is formed by the fascia transversalis, covered by the falciform process of the iliac portion of the fascia lata. The posterior wall is formed by the fascia iliaca, and is considerably longer than the anterior wall, for it measures nearly one inch in length; it is supported by the pubic portion of the fascia lata, which here binds down the fibres of the pectineus muscle. The external wall is formed by the femoral vein, or rather by the septum, which, lying along the pubal side of that vessel, serves to separate it from the trunks of the absorbent vessels of the lower extremity, and to connect the anterior and posterior parietes of the canal more firmly together. The internal wall is constituted by the fasciæ transversalis and iliaca, as they unite with one another to complete the inner part of the funnel-shaped sheath of the vessels. (See the woodcut No. 2, x.) It is supported there by the cribriform fascia.

The crural ring.†—When the finger is introduced into the crural canal so as to reach its superior extremity, or the opening by which it leads into the cavity of the abdomen, it will be easy to demonstrate the structures which bound what is termed the *crural ring*. The thin and sharp lunated border of Gimbernat's ligament is situated towards the mesial line; the posterior edge of Poupart's ligament lies in front, the femoral vein is external, and the ileo-pectineal line of the os pubis, covered by its ligament, behind. (See the woodcut No. 2, *d*, *m*, *n*, and *v*.)

The figure of the crural ring is oval, its long diameter being directed transversely, and, in the healthy state of the parts, about half an inch, or a little more, in extent. The crural ring is rather larger in women than in men, which circumstance may be considered in some degree sufficient to explain the more frequent occurrence of femoral hernia in the female sex.‡

In the male subject, the spermatic cord, as it lies within the inguinal canal, is situated close above the anterior margin of the crural ring; a fact which should always be borne in mind while operating for strangulated femoral hernia, since (as some very eminent authorities direct us to divide the stricture directly upwards) if the incision be not very limited the spermatic artery may be wounded.§

In the female, the round ligament of the uterus bears the same relation to the crural ring, (and consequently to the neck of the hernial sac,) as the spermatic cord does in the male, but it is not of the same importance.

The internal, or deep epigastric artery, as it ascends from its origin from the external iliac artery towards the region of the umbilicus, runs obliquely along the superior and external angle of the crural ring, and must be exposed to imminent risk of being wounded if the edge of the bistoury be carried too freely upwards and outwards while enlarging the ring in the operation.

When the obturator artery is given off from the epigastric,

† Femoral ring,—lacuna pro vasis cruralibus interna,—l'ouverture supérieure du canal crural. (See the woodcut No. 2, at page 87, fig. *x*. and also the woodcut No. 3, at page 89, fig. *i*.)

‡ Vide Observations on Crural Hernia. By Alexander Monro, junior, M.D. 8vo. Edinburgh, 1803, page 52.

§ Scarpa on Hernia, translated by Wishart, p. 262; and Arnaud, Mem. de Chirurgie, tom. i. p. 758.

(a variety that occurs about once in three subjects,) it most frequently descends upon the pubal side of the external iliac vein to reach the thyroid foramen; and, when it does so, will always be placed upon the iliac or external side of the crural ring, and therefore altogether removed from the edge of the knife as commonly directed in the operation for femoral hernia.† (See Plate V. figs. 5 and 6.)

It is, however, by no means an unfrequent occurrence to meet with the obturator artery arising from the epigastric, and taking a more sweeping course, when it runs for a short distance along the superior margin of the crural ring, and then descends behind the lunated border of Gimbernat's ligament in its way to reach the thyroid foramen, through which it passes to be distributed to the adductor muscles of the thigh.‡ (See the wood-engraving No. 6, page 115.)

If a femoral hernia were to be formed in an individual in whom this variety in the course of the obturator artery were present, the neck of the sac would then be surrounded for, at least, three-fourths of its circumference, by large and important vessels, to avoid injuring which a very great deal of caution must be observed in introducing the probe-pointed bistoury, no matter in which of the several directions that are prescribed by surgical writers the edge of the knife is carried.§

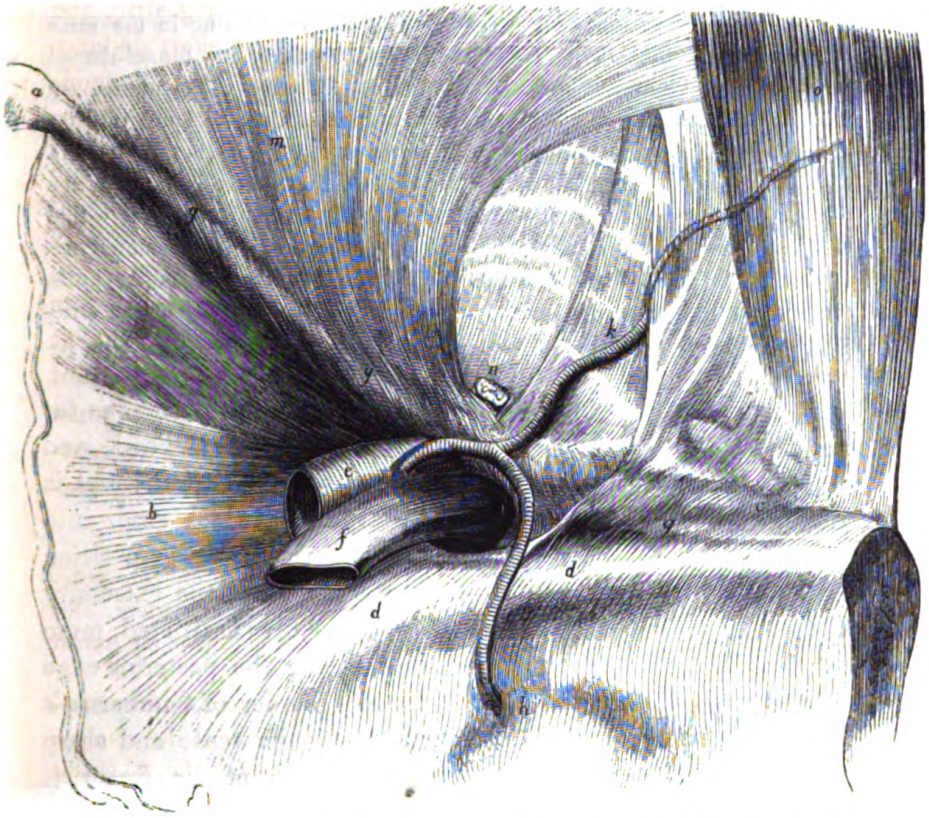
† In twenty-one preparations of crural hernia, possessed by Sir Astley Cooper, there are six which have this variety of the obturator artery. Sir Astley Cooper has never dissected a case in which the obturator ran round the neck of the sac.

‡ The relation which the course of this variety of the obturator artery bears to the crural ring would appear to depend upon the length of the common trunk, which divides into the obturator and epigastric arteries; for, when the obturator springs from the epigastric soon after its origin from the external iliac artery, then it descends along the external side of the crural ring, as was the case in the subject from which the drawing of Plate IV. was taken; but if, on the contrary, it does not arise from the epigastric so near to the origin of the latter, then it takes a more circuitous course, and runs round nearly three-fourths of the circumference of the crural ring, as is seen in the woodcut, No. 6, fig. *h*.

§ For cases of this kind see Sir Astley Cooper's work on Crural Hernia, second edition, page 26; and Plate VIII. fig. 4, in which Dr. Barclay's preparation is engraved; also a paper by Mr. Wardrop, in the Edinburgh Medical and Surgical Journal, for April 1806, page 203, with a drawing.

The wood-engraving represents a view of the crural ring, taken from the interior of the abdomen; the obturator artery is seen springing from the epigastric, at some distance from the origin of the latter vessel, and then taking its course, in a curved direction, along the upper and internal margins of the crural ring, in its way to reach the thyroid foramen. The course of the obturat orartery, which is here represented, forms a striking contrast to that which is figured in Plate V.

No. 6



a. The anterior superior spinous process of the ilium. *b*. The cut surface of the symphysis pubis. *c*. The situation of the spine or tuberosity of the os pubis. *d. d*. The horizontal branch of the os pubis, covered by the fasciæ transversalis and iliaca. *e*. The external iliac artery, about to emerge from the cavity of the abdomen, with *f*, the external iliac vein. These vessels receive a sheath or funnel-like investment from *l*, the fascia iliaca, and *m*, the fascia transversalis. *g. g. g*. The posterior edge of Poupart's ligament, obscurely seen through the fasciæ which cover its internal surface. *h*. The obturator artery, descending to pass through the thyroid foramen. The

artery is seen to arise from a common trunk with the internal epigastric, and to run round the superior and internal edges of the crural ring. *i.* The crural ring. *k.* The internal or deep epigastric artery, giving off *h*, the obturator artery, as it is running over the superior and external angle of the crural ring. *l.* The fascia iliaca, which joins with the fascia transversalis (at *g. g.*) between the anterior superior spinous process of the ilium (*a*), and the external iliac artery (*e*); it is seen to pass underneath the iliac artery and vein, and thus to form, by passing out with them through the crural ring, the posterior part of the funnel-shaped sheath of the femoral vessels. *m.* The fascia transversalis, which covers the internal surface of the abdominal muscles, and, passing out of the crural ring in the same manner as the fascia iliaca, forms the anterior wall of the funnel-shaped sheath of the femoral vessels. *n.* The round ligament of the uterus, cut across as it emerges through the internal abdominal ring, to enter into the inguinal canal. *o.* The rectus muscle uncovered of the fascia transversalis. If a femoral hernia were formed in an individual in whom this variety from the usual course of the obturator artery existed, the neck of the sac would be surrounded by important vessels upon three-fourths of its circumference, requiring that great caution should be exercised in the use of the knife, while enlarging the margins of the crural ring for the removal of the stricture in the operation for the relief of strangulated femoral hernia.

If the finger be again introduced into the crural canal, as far as the crural ring, while the leg and thigh are extended, and abducted from the mesial line, at the same time that the foot is rotated outwards, all the tendinous structures which enter into the formation of this canal and its orifices will, in this position of the limb, be found very firm and resisting, and the extremity of the finger which is in the canal very sensibly constricted, more particularly so at the superior orifice, where the posterior edge of Poupart's ligament, with the lunated border of Gimbernat's ligament, may be plainly distinguished by the tense and sharp margins which they present when the pulp of the finger is directed either towards the anterior or internal boundaries of the crural ring. Still keeping the finger in the crural canal, let the position of the limb be changed, the thigh be raised upwards and bent upon the belly, at the same time that the knee is rotated inwards and towards the opposite side: when this has been done, the parietes of the crural ring will be observed to be immediately relaxed to a remarkable degree, so that the extremity of the finger, which previously was introduced with difficulty, may now be moved freely within the canal. This alteration in the relative position and degree of tension of the parietes

of the crural canal is to be attributed to the influence which the movements of the lower extremity are capable of exercising over them, through the medium of the iliac portion of the fascia lata, which is connected to the inferior border of Poupart's ligament, between the anterior superior spinous process of the ilium and the tuberosity of the os pubis; and of the falciform process or superior cornu of the saphenous opening attached to the pubic portion of the same membrane, close to the base of the latter process of bone. (See Plate II. figs. 2 and 3, and Plate III. fig. *f. i.*) When the thigh is extended and rotated outwards, the iliac portion of the fascia lata drags downwards the crural arch, and thus tends to constrict the dimensions of the crural canal and diminish the magnitude of its superior and inferior apertures; but when the limb has been placed in the opposite position, it has no longer any such influence. The relaxed condition of the fibres of the psoas and iliacus muscles, when the thigh is bent upon the abdomen and rotated inwards, must also have some share in the production of these changes in the state of the tendinous structures surrounding the canal.

From the foregoing examination it will be perceived that this must be the most favourable position in which we can place the limb when about to attempt the reduction of a strangulated femoral hernia by the *taxis*, before an operation is considered absolutely necessary; or, in the performance of the latter, when endeavouring (after division of the stricture) to replace the protruded viscera.†

† If the blade of the scalpel be introduced by the saphenous opening, passed up the crural canal, and thrust through the peritonæum, (which naturally forms a sort of pouch or depression opposite the crural ring,) the cavity of the abdomen may be opened, and a piece of the small intestine drawn down through the canal without much difficulty; so that several of the peculiarities of a femoral hernia may thus be more aptly illustrated by this than by any other proceeding. The fold of the small intestine which has been thus drawn out of the cavity of the abdomen will be seen, when it is artificially distended, to project forwards, and to be tilted upwards over the edge of the superior cornu of the saphenous opening, so that its greater convexity actually rests upon the falciform process of the iliac portion of the fascia lata and the lower part of the aponeurosis of the external oblique muscle, and consequently over the neck of the tumour, with which it is united at an acute angle. Hence it follows, for the safe and successful employment of the taxis in cases of strangulated complete femoral hernia, that the fundus of the tumour should be first brought down from its position upon the tendon of the external

Dissection to expose the funnel-shaped sheath of the great femoral vessels.—The funnel-shaped sheath of the femoral vessels may now be dissected, and its structure examined. (See the woodcut No. 2, at page 87, fig. *.) For this purpose the iliac portion of the fascia lata should be cut away from its connexion with the lower edge of Poupart's ligament, and its internal extremity, or the falciform process, detached from its insertion into the pubic portion of the fascia lata in front of Gimbernat's ligament; the triangular-shaped flap which is thus marked out may be carefully raised from the subjacent structures, and reflected downwards and outwards over the lower part of the rectus and vastus externus muscles. The fleshy fibres of the sartorius, iliacus, and psoas muscles, on the external or iliac side of the vessels, must be neatly exposed by removing the condensed cellular tissue that invests them; at the same time, the anterior crural and external cutaneous nerves, with the superficial femoral artery and vein, may be displayed as is seen in Plate IV. fig. 1, 2, 3.† The pectineus, adductor longus, and gracilis muscles, are to be shown by removing the pubic portion of the fascia lata.

The funnel-shaped sheath of the great vessels.—When these directions have been followed, the femoral vessels will be found to be inclosed in a perfect sheath, or membranous investment, which is formed in front by the prolongation upon them of the fascia transversalis, which descends behind Poupart's ligament.

oblique muscle into the hollow at the centre of the groin, before any endeavour is made to push it upwards into the belly. It is manifest that the employment of the *taxis* must be very injurious, and extremely dangerous, if continued for ever so short a time, unless the angle, which the fundus of the sac forms with the neck in cases of complete femoral hernia, be effaced by thus bringing down the chief bulk of the tumour from the situation in which it is placed. The delicacy of the manœuvre of introducing the point of the bistoury under the edge of the stricture for its division in cases of strangulated hernia may also be illustrated in this manner, and the necessity shown of protecting the folds of the intestine which lie within the sac, with the fingers of the left hand, during this important step of the operation, lest they should slip before the edge of the knife, and be wounded as it is raised to enlarge the deep-seated ring. The protruded portion of the intestine may, in the next place, be gently replaced within the abdomen, as after the operation has been performed in the living subject.

† The sheath of the vessels is very well displayed in Plate XIV. fig. *c*, *c*, of Sir Charles Bell's Dissections. folio. Edin. 1799.

(See Plate IV. fig. *t*, *t*.) The fascia iliaca descends in a similar manner behind the great vessels, and is joined with the fascia transversalis closely along the iliac side of the common femoral artery; but on the opposite, or pubal side, they are united with each other at a little distance from the great femoral vein. (See Plate IV. fig. 3.) The form of this sheath has been compared to a funnel, whence its name; for it is much wider superiorly than inferiorly, where it becomes blended with the external cellular coat of the vessels opposite the point where the saphena major joins with the femoral vein.

Let an incision be now made, in a vertical direction, through the anterior wall of the sheath, over the centre of the great femoral artery, and when that vessel is uncovered by a few movements of the scalpel on each side of it, it will be seen to lie in a distinct compartment. (Plate IV. fig. 1.) A similar incision may be made over the course of the great femoral vein, (Plate IV. fig. 2,) and a third over the centre of the front wall of the crural canal. (Plate IV. fig. 3.) When this has been done, the femoral vein is shown to be separated from the artery, which lies on its iliac side, by a thin septum or membranous process, which connects together the anterior and posterior walls of the sheath, and also from the lymphatic vessels and glands, which are situated within the crural canal, by a similar septum. (See Plate IV. fig. *u*, *u*.)† Thus of the compartments into which the funnel-shaped sheath of the great vessels is subdivided, the external and middle are completely occupied by the common femoral artery and vein, so that no hernia can occur into them; whereas the third, or that which is nearest to the pubes (Plate IV. fig. 3), being only loosely filled by some lymphatic vessels,‡ and cellular tissue, will readily admit of a portion of the intestines being protruded into it, as happens in cases of femoral hernia.

† See also the woodcut No. 2, at page 87, figs. *u*, *v*, *x*, and *.

‡ Some lymphatic vessels run upon the coats of the femoral artery and vein, but by far the greater number are confined to the crural canal.

EXPLANATION OF PLATE IV.

This plate represents the funnel-shaped sheath of the great femoral vessels, as it is exposed by removing the fascia lata covering the muscles of the upper and anterior part of the thigh, and dissecting the subjacent vessels and nerves. The sheath of the vessels has been laid open in such a manner as to show the three compartments into which it is subdivided by the septa, which, springing up on each side of the femoral vein, connect the anterior and posterior parietes together.

a. The anterior superior spinous process of the ilium.

b. The spinous process of the os pubis.

c. c. Poupart's ligament.

d. Gimbernat's ligament.

e. The deep crescentic arch which is formed by a connexion between the fascia transversalis (*t. t*.) and some tendinous fibres which lie parallel with and behind Poupart's ligament.

f. The sartorius muscle.

g. The adductor longus muscle.

h. The pectineus muscle.

i. The iliacus muscle.

k. The psoas muscle.

l. The gracilis muscle.

m. The rectus and vastus internus muscles covered by the fascia lata of the thigh.

n. The fleshy fibres of the external oblique muscle of the abdomen.

o. The tendinous aponeurosis of the same, which is crossed by the intercolumnar fibres.

p. The external abdominal ring.

q. The spermatic cord held aside by a pin. The spermatic artery is seen as it runs along the posterior side of the cord.

r. The trunk of the anterior crural nerve dividing into a lash of branches, two of which (the long and short saphenous nerves) accompany the superficial femoral artery.

s. The external cutaneous nerve.

t. t. The anterior wall of the funnel-shaped sheath of the vessels, which is formed by the fascia transversalis. (See the wood-engraving No. 3, at page 89, fig. *.) It has been cut open in order to show the compartments that contain the femoral vessels and the crural canal.

u. u. The thin membranous septa, or partitions, which connect the anterior and posterior parietes of the sheath together, and separate the common femoral vein on one side from the artery, and on the other from the crural canal.

1. The trunk of the common femoral artery.
2. The trunk of the common femoral vein.
3. The crural canal, through which the sac of a femoral hernia is protruded from the cavity of the abdomen.
4. The superficial femoral vein.
5. The superficial femoral artery. It is just below the situation of this figure that the ligature is placed upon this vessel, in the modern operation, originally recommended by Scarpa as an improvement upon the method of John Hunter.
6. The saphena major vein, which, after receiving the anterior saphena, joins itself with the common femoral vein a little below Poupart's ligament.
7. The external circumflex artery, which is here given off by a common trunk with the profunda femoris.
8. A branch of the external circumflex artery, supplying the sartorius and tensor vaginæ muscles.
9. The external pudic artery, which in this instance arose from the femoral artery several inches lower down than usual.
10. The iliac portion of the fascia lata, which had covered the vessels, reflected downwards and outwards.
11. The superficial epigastric artery cut across.
12. The umbilicus.

A femoral hernia descends in the innermost of the three compartments into which the funnel-shaped sheath of the femoral vessels is subdivided: this has already been described as the crural canal, and contains naturally some loose cellular tissue and lymphatic vessels, with occasionally an absorbent gland.

CHAPTER III.

DISSECTION TO EXPOSE BY AN INTERNAL VIEW THE STRUCTURE AND RELATIONS OF THE CRURAL RING.

THIS is, perhaps, the most important of the dissections which it is necessary to make in order that a complete and accurate knowledge may be obtained of the surgical anatomy of femoral hernia; since the relative position of the great femoral vessels, and their more important branches, to the crural ring, and consequently to the neck of the sac of a femoral hernia, will be better understood by it than from any other view. For this purpose the parietes of the abdomen, together with the peritonæum lining their internal surface, should be cut through by an incision carried from the crest of the ilium, a little distance beyond the anterior superior spinous process, to the linea alba, where it may terminate above the umbilicus; and thence in a vertical direction downwards to the symphysis of the pubes. The triangular-shaped flap thus marked out should be held upwards and forwards, at the same time that the small intestines are removed from the cavity of the pelvis, so that the internal surface of the peritonæum as it lines the iliac fossa may be more clearly seen. (See Plate V.)

The peritonæum presents a strongly marked depression immediately on the pubal side of the great external iliac vessels, as they are about to emerge upon the upper part of the thigh after passing underneath Poupart's ligament. This depression, or fossa, corresponds with the lower part of the external inguinal pouch, and, if the extremity of the forefinger be firmly pressed upon this point, the peritonæum will gradually yield, and may be easily forced downwards for some way into the crural canal, so as to represent very closely the mode in which it is protruded before the intestines in cases of femoral hernia: with a little perseverance, the extremity of the finger may thus be

made to carry the peritonæum so far before it as to allow of its being plainly perceived upon the outer surface of the groin, where it projects through the lower aperture of the crural canal, —the saphenous opening of the fascia lata.

The peritonæum should, in the next place, be removed from the internal surface of this portion of the abdominal parietes, in order that the external iliac vessels, together with the fasciæ which cover the psoas, iliacus, and transversalis muscles, may be completely exposed.

The peritonæum is connected to these fasciæ (*the fascia transversalis and fascia iliaca*) by some loose cellular tissue, which readily allows of the peritonæum being dragged down from the iliac fossa to a great extent, so as to form the sac in cases of large femoral herniæ.

This layer of cellular substance, which lies externally to the peritonæum, has been named the *subserous cellular tissue*,† and in corpulent subjects is frequently found to be of considerable thickness, and to resemble very much in its appearance the omentum, for which, indeed, it has sometimes been mistaken by the most experienced surgeons during the progress of operations for the exposure of the sac in cases of strangulated femoral hernia. In some instances the subserous cellular tissue will be found to furnish a large, thick, and tolerably firm process of a pyriform figure, which, descending through the crural canal, projects by its larger extremity through the saphenous opening, where it forms a distinct tumour, possessing all the external characters of a portion of the omentum inclosed within a delicate sac, so that it is easily mistaken at the first view, and before the complete dissection of the parts, for an example of femoral hernia containing omentum.‡

Cysts containing a clear albuminous, or sometimes, sanguinolent fluid, have been found in the subserous cellular tissue lying over the sac of a strangulated femoral hernia, so as to render the operation a much more delicate proceeding than it is usually found to be.§

† Fascia propria of the French anatomists.

‡ Several preparations illustrative of these appearances of the subserous cellular tissue are preserved in the Museum of University College.

§ See a clinical lecture by Mr. Cooper, which is reported in the London Medical Gazette of March 2, 1839, p. 836.

EXPLANATION OF PLATE V.

Fig. 1.

This plate represents the internal view of the structure and relations of the crural ring. The parietes of the lower part of the abdomen have been laid freely open by a crucial incision, and the triangular-shaped flap on the left side is held upwards and forwards by means of a hook, while the flap of the opposite is thrown over the upper part of the right thigh. The small intestines, with the sigmoid flexure of the colon, have been removed from the iliac fossa and cavity of the pelvis; after which the peritonæum and subserous cellular tissue were carefully detached from the fasciæ and great vessels of this region.

a. The situation of the anterior superior spinous process of the ilium.

b. The symphysis pubis.

c. The pecten of the horizontal branch of the os pubis.

d. Poupart's ligament.

e. Gimbernat's ligament; the thin and sharp lunated edge of which regards the external iliac vein, from which it is distant about half an inch, which is the usual width of the crural ring.

f. *g*. The fascia transversalis, which at *f* covers the rectus muscle, and at *g* the transversalis.

h. *i*. The fascia iliaca, which covers at *h* the iliacus internus muscle, and at *g* the psoas magnus. The fasciæ, iliaca and transversalis, unite with one another along the internal surface of Poupart's ligament, in the interval between the spine of the ilium and the great vessels, the line of their junction being indicated by a whitish tendinous band. When they have arrived at the iliac border of the artery, they separate from each other, the fascia transversalis passing in front of the vessels, and the fascia iliaca behind them, so as to form the anterior and posterior walls of the funnel-shaped sheath of the femoral vessels; they afterwards reunite with each other upon the inner surface of Gimbernat's ligament. The dark space between the lunated edge of Gimbernat's ligament and the femoral vein is the *crural ring*, through which a femoral hernia commences its descent from the abdomen. The anterior boundary is formed by the posterior border of Poupart's ligament; internally, by Gimbernat's ligament; posteriorly, by the ileo-pectineal line of the os pubis; and externally, by the external iliac vein and artery. The deep epigastric artery runs obliquely upwards along the superior and

external angle of the ring. In the subject from which the drawing was taken, the obturator artery, which came off from a short common trunk with the epigastric, descended along the external edge of the opening, and, therefore, would not be exposed to any injury from the edge of the bistoury used for dividing the crural ring upwards and inwards in an operation for the removal of the stricture in strangulated femoral hernia, an accident which might happen in the case represented in the wood-engraving No. 6, at page 115, where the obturator and epigastric arteries arise from a common trunk, which is rather longer than in the present instance. In the male subject the spermatic cord, as it descends through the inguinal canal, lies just above the crural ring, and, therefore, is liable to be injured if an incision directed upwards be not very carefully made. In the female the round ligament of the uterus holds the same relation to the front of the crural ring, but it is not of the same importance as the spermatic cord, along the posterior surface of which a large artery and duct (the spermatic artery and vas deferens) run in their course to the testicle.

k. The linea alba: the incision has divided some of the innermost fibres of the rectus muscle of the right side (*o*).

l. The urinary bladder, which, being empty, is contracted into the pelvis.

m. The small intestines, removed from the left iliac fossa.

n. The transversalis muscle of the right side.

o. The rectus muscle of the right side.

1. The external iliac artery.
2. The external iliac vein, which runs along the inner side of the artery.
3. The external pudic, or genito-crural nerve, which lies upon the sheath of these vessels.
4. The common trunk, which, soon after its origin from the external iliac artery, divides into the deep epigastric artery, 5, and the obturator artery, 6.
7. The obturator nerve.

The round ligament of the uterus has been cut across, just as it enters into the inguinal canal; its divided extremity is seen projecting over the curve of the deep epigastric artery at its commencement.

8. Is a probe-pointed bistoury, which is used in the operation of enlarging the crural ring in cases of strangulated femoral hernia.

The crural ring should be enlarged in the operation for strangulated femoral hernia, when the seat of the stricture is situated here, by dividing the lunated border of Gimbernat's

ligament obliquely upwards and inwards, at its junction with the posterior edge of Poupart's ligament; in this step of the operation very great care should be observed that no part of the instrument but its probe-point should project *within* the cavity of the abdomen.

Fig. 2.

Shows a piece of the ileum which had been strangulated for three days within the crural canal. The case was one of femoral hernia occurring in the male subject, and was attended with other circumstances which rendered the diagnosis exceedingly difficult. Mr. Quain, being consulted upon the third day, performed the operation, but the patient sank in a day afterwards under an attack of peritonitis, which had commenced previously.

a. The portion of the small intestine which had suffered from constriction within the superior aperture of the crural canal. It did not comprise more than one-half of the entire calibre of the gut; but the acute angle at which the remainder of the intestine was bent, was quite sufficient to prevent the passage of the fæces along the canal. The strangulated portion was very dark-coloured, with shreds of coagulable lymph effused upon its surface; there were small ecchymoses under the peritonæal coat, but it had, nevertheless, retained its vitality.

b. The upper end of the ileum, which was more inflamed, and greatly distended with fæcal matter.

c. The lower extremity, which was scarcely altered from its natural character and appearance.

d. The mesentery.

e. The portion of the calibre of the gut (about one-half of the circumference) which had not been compressed into the crural ring.

The septum crurale.—The superior orifice of the crural canal (the *crural ring*) is naturally closed by a layer of condensed cellular membrane, which is sufficiently strong and resistent in most subjects to afford a considerable obstacle to the formation of a femoral hernia; while, in others, it is very thin and weak. This structure adheres to the tendinous margins of the crural ring, and may be regarded as forming part of the inner layer of the fascia transversalis. It has received from M. Cloquet, who first described it minutely, the appellation of the *septum crurale*.† The superior surface of the septum crurale is a little

† *Vide* Recherches sur les Hernies, par J. Cloquet; 4to. Paris, 1817, p. 74.

concave, and supports the peritonæum and subserous cellular tissue; frequently, a small oval-shaped lymphatic gland will be found upon it. The inferior surface, on the contrary, is convex, and projects downwards into the crural canal. The septum crurale is traversed by the numerous lymphatic vessels which have already been described as ascending by the inner side of the great femoral vein from the inferior extremity to the cavity of the abdomen, where they terminate in the absorbent glands, which are situated on either side of the external iliac artery and vein.

The deep crescentic arch.—This may be described as consisting of a band of tolerably strong tendinous fibres, which are situated under Poupart's ligament; it appears to be formed, on the iliac side of the great vessels, by a connexion between the fascia transversalis, and the tendinous origins of the obliquus internus and transversalis, with part of Poupart's ligament; and on the pubal side by the same fascia, in union with the conjoined tendons of these two muscles, as they descend to be inserted into the ileo-pectineal line behind Gimbernat's ligament.

There is a good deal of dissection to be made to show this deep arch as a distinct structure, and it may be very fairly criticised as in some degree artificial. After having made the dissection of the tendinous aponeurosis of the external oblique muscle, and of the crural arch, as is usually recommended for the display of the structures connected with the anatomy of the inguinal canal, the flap of the tendon of the external oblique should, in the next place, be held up and dissected from the internal oblique muscle, as far down as the edge of Poupart's ligament. The ligament is then to be divided into two laminæ, by forcing the handle of the scalpel between the external and internal oblique muscles, where they are attached to the ligament: by pushing the handle of the knife towards the thigh, it will pass under the iliac portion of the fascia lata; then, by moving it in a horizontal direction, between the os pubis and the ilium, the tendon of the external oblique muscle and the iliac portion of the fascia lata, (which are connected together through the medium of the superficial part of Poupart's ligament,) will be completely separated from the parts underneath, so that the ligament will appear to be formed by them only. If the attachment of the aponeurosis and Poupart's ligament to the

anterior superior spinous process of the ilium be now cut through, a view will be obtained nearly similar to that which has just been destroyed, for the deep crescentic arch has almost the same form as the superficial arch.†

† See the Appendix to Part I. p. 5, of A System of Dissection, by Sir Charles Bell; folio, Edinburgh, 1799: A Memoir on the Crural Arch, by Mr. Liston; 4to. Edinburgh, 1816, page 13: and A Manual of Anatomy, by John Shaw; 8vo. London, 1822, third edition, page 59; from which work the above description has been taken.

CHAPTER IV.

Section I.

FORMATION AND PROGRESS OF A FEMORAL HERNIA.

Femoral Hernia is of much more frequent occurrence in women than in men; yet there is reason for believing that the comparative rarity of this disease in the male sex is by no means so great as was once supposed, and commonly described in the writings of the best authors, towards the close of the last, and in the commencement of the present, centuries.† It is extremely probable that this erroneous impression arose in consequence of the existence of the affection in the male subject having been frequently permitted to pass unobserved, on account of the very trifling size which the tumour generally attains in men, when compared with its ordinary magnitude in women.‡

When a femoral hernia is at first formed, that portion of the peritonæum which lines the internal surface of the abdominal parietes over the crural ring, and which in the natural condition of the parts presents an obvious depression, corresponding with the lower part of the external inguinal pouch, is protruded before the intestines into the crural canal, and thus placed within the innermost of the three compartments into which the funnel-shaped sheath of the femoral vessels is subdivided.

The peritonæum, as it thus descends before the hernial protrusion, pushes before it the subserous cellular tissue, and the septum crurale, with what cellular and adipose substance there may be present within the crural canal.

Incomplete femoral hernia.—So long as the hernial sac is lodged within the crural canal, and does not project through the

† See the Practical Observations in Surgery, by Wm. Hey, second edition, p. 151. Also the works of Morgagni, Arnaud, Scarpa, and others.

‡ M. Breschet says that he has seen more than thirty examples of femoral hernia in the male subject during a few years that he followed the clinical instruction of the late Baron Dupuytren, at the Hôtel Dieu of Paris. Thèse sur la Hernie Femorale, par G. Breschet, p. 82.

inferior aperture or outlet of that passage, the disease is said to form an *incomplete femoral hernia.*†

The peritonæum forming the sac of this variety of hernia is now covered by the structures which have just been described as being pushed down before it,‡ and rests upon the pubic portion of the fascia lata, only separated from it by the fascia iliaca, forming the posterior wall of the crural canal: in front of it is the superior cornu of the saphenous opening, or falciform process of the iliac portion of the fascia lata; it is separated on its external side from the femoral vein by the septum, or membranous process, which is naturally interposed between that vessel and the mass of the absorbents of the inferior extremity; and on the side which is next the pubes, it is limited by the internal wall of the funnel-shaped sheath of the vessels.

The incomplete femoral hernia forms a tumour of very small size, and is a dangerous variety of the disease, since its presence cannot always be clearly ascertained, particularly in corpulent persons, by any manual examination, however carefully and skilfully conducted; for the swelling is greatly obscured by being so firmly bound down by the falciform process constituting the anterior wall of the crural canal.

Numerous cases have been recorded of patients having lost their lives in consequence of the strangulation of a small knuckle of the intestine within the neck of the sac of an incomplete femoral hernia; but which, as there was no external tumour present to which the symptoms could be satisfactorily referred, were regarded as instances of ileus, peritonitis, or some other internal affection of the alimentary canal, and treated as such, but of course, without any success.§ On the examination of the body after the death of the individuals thus affected, a very small part of the small intestine, not exceeding, in the majority

† This variety is described by Sir Astley Cooper as the hernia within the sheath of the crural vessels.—Cooper on Crural Hernia, p. 25.

‡ These membranes become blended together by the pressure of the tumour, and are united into one, which has been termed by Sir Astley Cooper the *fascia propria* of the sac.—Op. citat. p. 2.

§ For cases of this kind see Surgical Observations, by Sir Charles Bell, Part II, p. 181; Nouveaux Eléments de Médecine Opératoire, par Alf. L. M. Velpeau, t. ii. pp. 330-1; Mr. Else's case in the Med. Obs. and Inq. vol. iv. p. 355; and Mr. Lawrence's work on Hernia, 4th edit. p. 493.

of instances, one-third of the whole calibre of the bowel, has been found tightly embraced by the margins of the superior orifice of the crural canal. In such cases, the contents of the bowel are effectually prevented from passing along the intestinal tube, by the acute angular fold which is produced by the retention of even so small a portion of the circumference of the gut within the neck of the sac.† (See Plate V. fig. 2d, *a*.)

Complete femoral hernia.—When the lower part, or fundus of the sac of a femoral hernia protrudes through the saphenous opening, or inferior aperture of the crural canal, it immediately projects forwards, and extends itself in every direction, but more particularly outwards, over the great femoral vessels, where it forms an obvious tumour in the fold of the groin, which is of an oblong shape, the longest diameter being disposed transversely, parallel with Poupart's ligament, upon which its fundus frequently rests. This change in the direction of the course of a femoral hernia is owing to the close adhesion of the superficial fascia of the thigh, and of the funnel-shaped sheath of the great vessels, to the inferior margin of the saphenous opening of the fascia lata, which prevents the further descent of the tumour upon the front of the thigh; and also to the greater laxity of the cellular substance superiorly, which readily allows of its extension upwards: to these influences should be added the constant motions of the limb, which must greatly tend to tilt the fundus of the sac over the falciform process. Sometimes, indeed, the fundus of the sac of a femoral hernia ascends so high that it rests not only upon the falciform process of the fascia lata and Poupart's ligament, but also upon the lower part of the aponeurosis of the external oblique muscle of the abdomen, where it might be mistaken, from its figure and position, for an inguinal hernia.‡ In very few instances are the superficial vessels, which occasionally issue from the saphenous opening of the fascia lata, spread over

† A case of this kind occurred in a female servant of Dr. Copland. See Dict. of Pract. Medicine, Part II. p. 367.

‡ Sir Astley Cooper once went with a physician into the country to operate, as he was told, on a case of inguinal hernia; but, when he examined the patient, he found that the hernia was crural, and had been for three days strangulated, during which time repeated attempts had been made to reduce it by pressing the tumour towards the spinous process of the ilium. It was reduced in five minutes by employing pressure proper for the crural hernia. *Vide* Cooper on Crural Hernia. 2d edit. part ii. p. 4.

the sac of a complete femoral hernia; and, therefore, it is erroneous to attribute generally its ascent to any influence exercised by them upon the tumour. In the greater number of cases of femoral herniæ these vessels will be found to pursue their course under the base of the tumour, and are hence seldom divided in the operation, even when the first incisions are made in the same direction as Poupart's ligament, at right angles to their course. (See Plate VI. figs. *l*, *m*, *n*.)

The crural ring is not unfrequently considerably dilated by the protrusion through it of a femoral hernia. The situation of the femoral vein is but little altered, for it lies along the external and inferior side of the tumour: the deep epigastric artery runs over and is frequently in pretty close contact with the superior and external angle of the neck of the sac. In a complete femoral hernia the semilunar edge of the falciform process of the fascia lata is also pushed upwards and outwards, so as to be converted into a well-formed tendinous arch, which, through the medium of its connexion with the pubic portion of the fascia lata, encircles the greater part of the neck of the sac.

EXPLANATION OF PLATE VI.

This plate represents the situation of the femoral hernia externally, when the integuments and the superficial fascia have been removed by dissection from the front of the thigh.

a. The anterior superior spinous process of the ilium.

b. The spinous process or tuberosity of the os pubis.

c. The anterior border of Poupart's ligament, where it stretches across between the spine of the ilium and the tuberosity of the os pubis. It will be observed how the ligament is drawn downwards, and the crural arch made tense, by the position of the limb, which was abducted, and rotated outwards, previously to making the dissection.

d. The iliac or external portion of the fascia lata of the thigh, which is attached, superiorly, to the lower edge of Poupart's ligament.

e. The pubic portion of the fascia lata covering the pectineus and adductor longus muscles.

f. points, by a dotted line, to the situation of Gimbernat's ligament, and of the superior extremity of the falciform process of the iliac portion of the fascia lata, where the latter arches over the neck of the hernial sac.

g. The fascia lata covering the rectus muscle.

h. The fascia lata covering the sartorius muscle.

i. The fascia lata covering the adductor longus muscle.

k. The saphena major vein, which receives several contributory branches from the integuments covering the inguinal region.

l. The superficial epigastric vein, which runs along under the base of the hernial tumour, in its course to join with the great saphena.

m. The superficial epigastric arteries, which, in this subject, were two in number.

n. The superficial or external pudic artery.

o. o. o. o. Several lymphatic glands, which lie upon the fascia lata in the course of the saphena major vein, and which frequently swell, and inflame from irritation, in cases of disease about the leg and foot.

p. Two smaller absorbent glands, lying over Poupart's ligament, which are frequently the seat of venereal buboes, consequent upon chancres situated on the external organs of generation.

q. A lymphatic vessel, which ascends alongside of the great saphena vein, and passes through the inguinal glands.

r. The middle anterior cutaneous nerve of the thigh.

s. The skin and superficial fascia of the groin, dissected off, and folded over the external border of the limb.

t. The umbilicus.

1. 1. The fascia propria of the femoral hernia, which is formed by the subserous cellular tissue, and the sheath of the vessels. It is sometimes extremely similar in its appearance to the omentum, for which it has been mistaken, and so induced the surgeon to reduce the sac into the belly, with its contents still strangulated by the neck of the true sac. (See the case at page 150.)

2. 2. The peritonæal membrane which forms the sac of the femoral hernia. It is very thin, and seems almost transparent.

3. A portion of the small intestine contained within the hernial sac, and strangulated; its colour was of a deep purple.

4. The round ligament of the uterus, held aside by the hook between the points where it emerges from the external abdominal ring, and is inserted into the fat covering the pubes.

It is evident, from the drawing, that any attempt to employ the taxis in a complete femoral hernia should be preceded by first withdrawing the hernial tumour from above the aponeurosis of the external oblique muscle of the abdomen, and the falciform process upon which it has been tilted.

5. marks the situation and extent of the first incision made in the operation for placing a ligature upon the common femoral artery.

6. indicates the first incision which is made in Sir Astley Cooper's method of performing the operation for tying the external iliac artery.

Section II.

VARIETIES OF FEMORAL HERNIÆ.

Besides the natural divisions of femoral herniæ into those that are complete and incomplete, both of which are sufficiently frequent in their occurrence to be observed almost every day, there are yet other varieties which are much more rare, and deserving of some notice here.

M. Cloquet possesses a preparation in which the deep epigastric artery is seen to run along the inner border of the sac of a femoral hernia which had descended in front of the great femoral vessels.†

Hesselbach mentions an instance in which the sac had descended behind the crural arch, in the interval between the anterior superior spinous process of the ilium and the great vessels. In this case the fundus of the sac lay beneath the iliac portion of the fascia lata, and its neck was crossed anteriorly by the internal circumflex ilii artery. In another case, which is mentioned by the same author, the epigastric took its origin from the profunda femoris, and ran along the inferior and internal border of the neck of the sac of a femoral hernia. Mr. Macilwain, one of the surgeons to the City of London Truss Society, says that he has known of not less than six instances, which are recorded in the books of the society, in which the hernial sac was protruded upon the iliac side of the vessels.‡ Mr. Stanley, surgeon to St. Bartholomew's Hospital, has dissected two cases of femoral herniæ, in which the sac descended from the abdomen, by the outer side of the femoral vessels, but close to them. In one of these instances, the epigastric artery arose from the femoral, and gave origin to the obturatrix artery. The common

† "L'artère épigastrique peut se trouver en-dedans du sac de la hernie crurale; celle-ci descend alors au-devant des vaisseaux fémoraux. Je ne possède qu'une seule observation de ce cas."—Recherches Anatomiques sur les Hernies, page 85, proposition xlviii.

‡ *Vide* Macilwain on Hernia, p. 293.

trunk, and its division into the epigastric and obturator branches, were placed anteriorly to the sac. The sac, about the size of a walnut, was situated directly in front of the femoral artery and vein.†

The variety in which the neck of the sac is surrounded by the obturator artery coming off from the epigastric, has already been fully noticed in a preceding part of this work.‡

M. Cloquet has seen an instance in which the hernial sac had passed through an opening in the posterior part of the sheath, so that it lay immediately on the pectineus muscle, having in front of it the femoral artery and vein, from which it was separated by the pubic portion of the fascia lata.§

Sometimes the sac of a femoral hernia is multilocular, or divided into several compartments, which communicate with one another. Hesselbach delineates, in his work upon hernia, a remarkable instance of this kind, in which the surface of the tumour was rendered extremely irregular by dense bands stretched across it in various directions as it emerged from the saphenous aperture.‖

Sometimes the tumour is of an hour-glass figure, which appearance may arise from the constriction produced by a large vessel crossing over the exterior of the sac.¶

The size of the femoral hernia seldom exceeds a pigeon's egg; but occasionally instances have been seen in which it had attained a much greater magnitude, and then it generally descended upon

† *Vide* Lawrence on Hernia, 5th edit. p. 486; London, 1838.

‡ *Vide* p. 114, and the wood-engraving No. 6.

§ "J'ai vu le sac s' engager par une ouverture de la paroi postérieure du canal crural. Il reposait immédiatement sur le muscle pectiné, et avait au-devant de lui l'artère et la veine fémorales, dont il était séparé par le feuillet profond de l'aponévrose *fascia lata.*"— Recherches sur les Hernies, p. 85, prop. xlvi.

‖ Hesselbach de Ortu et Progressu Herniarum, p. 45. Plate xiii.; and also Observations on Crural Hernia, by Alexander Monro, M.D. Plate ii. fig. 2; in which the sac is seen divided into four compartments, three of them communicating with each other.

¶ Dr. Macfarlane, in his excellent reports of the surgical practice of the Glasgow Infirmary, relates two instances in which the tumour of a femoral hernia was rendered of an hour-glass shape by a large vessel, probably the external pudic, crossing over the front of the sac. Edinburgh Medical and Surgical Journal, 1837, p. 37.

the front and inner side of the thigh towards the knee, instead of being tilted upwards as is usual in ordinary cases. The largest femoral herniæ seen by Sir Astley Cooper were of the size of the fist, and occupied the entire of the hollow from the anterior superior spinous process of the ilium to the tuberosity of the pubes. Professor Thompson mentions a case of irreducible femoral hernia in a woman, which extended half-way down the thigh, and in which the parietes of the sac were so thin that the peristaltic motion of the intestine could be distinctly perceived.† In the spring of the year 1836, a woman who laboured under symptoms of incarceration of the contents of an immense femoral hernia on the right side, was admitted into the College Hospital, under the care of Mr. Cooper ; the tumour, which was as large as as a man's head, reached about half-way down to the knee. Its contents were chiefly intestine, and could, with some difficulty, be reduced into the belly ; but it was not easy to retain them there. This enormous hernia had ensued upon the performance of the operation for a strangulated femoral hernia, on the same side, about eight years previously, since which time she had neglected to wear her truss constantly.‡

Section III.

DIAGNOSIS OF FEMORAL HERNIA.

The affections of the groin which are most liable to be confounded with femoral hernia, and to render the diagnosis obscure, are inguinal herniæ, enlargements of the inguinal glands, varicose enlargement of the femoral vein, encysted tumours, and lumbar abscess.

A femoral hernia, so long as it remains in a simple reducible state, is easily recognised by the situation of the tumour, more particularly of its neck or deep-seated part—by reference to the history of its origin and progress—by the increase of size and

† *Vide* Cooper on Crural Hernia, 2d edit. p. 1 ; and Plate III. fig. 3, Plate VIII. fig. 2. Much useful and valuable information will be derived from a perusal of the fourth chapter of Sir Astley Cooper's work on Crural Hernia, 2d edit. p. 25, entitled " Of the Varieties of Crural Hernia "

‡ Several similar cases are related by Mr. Lawrence as having occurred either under his own observation, or in the practice of others. *Vide* Lawrence on Ruptures, 5th edit. p. 488.

the impulse which ensue upon the patient coughing, or making any similar exertion—by its disappearance, frequently with a distinct gurgle, under pressure — by the possibility (after this has been effected) of insinuating the tip of the finger into the lower part of the crural canal, which now appears empty from the reduction of the contents of the sac — and by the quick reappearance of the swelling as before, as soon as the pressure has been remitted, and the patient coughs or makes any exertion.

Too much attention cannot be paid to the precise situation which the neck of the sac of a femoral hernia occupies; it is *under* Poupart's ligament, placed between the tuberosity or spine of the os pubis on the one hand, and the point where the great femoral artery may be felt pulsating on the other. This is by far the most important point to be determined in establishing the diagnosis in difficult and obscure cases of femoral herniæ.

Femoral hernia, when large, has been mistaken for inguinal hernia; but this mistake is not very likely to occur if attention be paid to the preceding remarks, as the neck of an inguinal hernia is seated *above* Poupart's ligament, and in femoral hernia the external abdominal ring will be found free, so as to admit the extremity of the finger. Cases may, however, be met with, in which inguinal and femoral herniæ occur together, accompanied by other circumstances which render the diagnosis exceedingly difficult, and only to be effected by a nice discrimination of the characteristic features of each.† (See Plate VI.)

The diagnosis of a femoral hernia, from an enlargement of one of the superficial glands of the groin is not always as easy as might be supposed, although it may be of paramount importance to the safety of the patient that the diagnosis should be early and clearly established. Of all the other affections which have their seat in the region of the groin, none are so likely to complicate the diagnosis of a femoral hernia, and render it difficult and obscure, as an enlargement of one of the superficial inguinal glands which lie over or within the crural canal. Indeed, many cases have occurred in which it was impossible to decide, without an operation, whether the tumour present in the groin was really only an enlarged absorbent gland, or a strangu-

† For a case of femoral hernia in a man rendered obscure by an inguinal hernia, and the patient lost by the unimpressive character of the symptoms, see the Surgical Observations by Sir Charles Bell, Part II. pp. 187—9.

lated femoral hernia; moreover, the two may occur together—and it is of importance to remember that a femoral hernia may be situated, and its contents become strangulated, behind an enlarged gland.†

In the greater number of cases, however, a glandular enlargement may be distinguished from a femoral hernia by the greater mobility of the swollen gland upon its base, and the extent to which it may be easily moved from side to side, at the same time that it is frequently possible to grasp and lift up the tumour in such a manner that the tips of the fingers may be inserted underneath it; circumstances which, joined with the history of the case, will go far to prove that the swelling cannot be a hernia.‡

It has now become an established maxim in the practice of surgery, when there is present a tumour in the situation of a femoral hernia, the nature of which cannot be satisfactorily determined, and there supervene symptoms of strangulation of

† Mr. Cooper mentions a case which occurred in his own practice, in which the diagnosis was rendered more than usually difficult by a mass of diseased fat and glands; but on dissecting deeply, the sac, which was very small, was detected lurking behind several large glands, and the stricture divided. The woman got quickly well, Mr. Cooper remarks, as most patients do in whose cases the operation is not deferred till too much inflammation and other mischief have had time to take place. *Vide* the First Lines of the Practice of Surgery, 6th edit. p. 504.

‡ If the following cases be contrasted with each other, it will show how contradictory symptoms will sometimes prove, and how much must be left, in similar instances, to be decided by the particular tact and judgment of the surgeon:—

Mr. Macilwain, surgeon to the Truss Society of the City of London, was requested to visit a woman who had laboured for several days under all the rational symptoms of strangulated intestine, such as hiccough, nausea, vomiting of stercoraceous matter, and absolute constipation; in addition to which there was a firm, smooth, and somewhat elastic tumour, occupying the situation of the crural ring; the skin covering the swelling was quite natural. Mr. Macilwain considered that, under all the circumstances, it would be best to cut down to the swelling, which he accordingly did immediately, but only found an enlarged gland with a suppurating cavity in the centre. The woman eventually recovered under the exhibition of purgatives combined with opium. *Vide* Surgical Observations, by G. Macilwain; 8vo. London, 1830; p. 308.

Sir Astley Cooper was called to a lady who had laboured under symptoms of strangulated hernia for several days, during which time she had been

the intestine, that the operation should be performed as though it had been clearly decided that the swelling was actually a hernia; since the use of the knife is, in a case of this kind, a source of little or no additional danger to the patient, and will frequently prove to be the best and surest means of preventing the repetition of those fatal cases in which patients have been permitted to die, unrelieved from strangulation of the small intestine, under the belief that the swelling in the groin could not be a hernia.†

Varix of the femoral vein.—This case is not of frequent occurrence, but it has been mistaken for a femoral hernia;§ and under that impression trusses have been applied for its relief, but, as might be expected, without any benefit. The enlargement appears to be seated where the saphena major pours its contents into the great femoral vein, and forms a tumour of an oblong shape, about the size of a walnut, which

attended by a physician and an apothecary for *ileus*, to whom she had not mentioned that she had a tumour in the groin. Another surgeon, who had been consulted upon the case, discovered a swelling in the right groin, which was firm, and did not feel to him like a hernia. Upon examination Sir Astley Cooper found a gland, enlarged to the size of a pullet's egg, and very moveable; but, upon feeling behind this gland, he could perceive an elastic tumour distinct from the swollen gland. This hernia was reduced by the taxis after ten minutes, when all symptoms of strangulation disappeared, and the lady quickly recovered.—Cooper on Hernia, Part II. p. 3, 2d edit.

A surgeon in considerable practice ordered a poultice to be applied to promote the suppuration of a tumour in the groin, which he supposed to be a venereal bubo; the poultice was applied for three days, after which the man was sent into Guy's Hospital, where the operation was immediately performed, but the intestine was found mortified.—Op. cit. p. 3. Mr. Lawrence has mentioned in his work a case in which a hospital surgeon mistook a strangulated femoral hernia for a bubo.

† See the cases recorded by Mr. Else in the fourth volume of the Medical Observations and Inquiries; Sir A. Cooper's work, Part II. p. 3, 2d edit.; Lawrence on Ruptures, 6th Edition, p. 493. M. Velpeau mentions a case in which the surgeon passed a ligature around the base of an enlarged gland in the groin, and destroyed his patient's life. The thread had embraced a piece of the small intestine in a sac behind the gland.—Velpeau, Méd. Opér. tom. ii. pp. 330, 331, 333.

§ Cases of this kind, which were treated as femoral herniæ, will be found in the Gazette Médicale, Dec. 1836; Petit's Traité des Malad. Chir. tom. ii. p. 299; Sir A. Cooper's work, Part. II. p. 4, second edition; and the Surgical Observations, by Mr. Macilwain, p. 300.

is increased in the erect posture, and receives an impulse upon coughing; but its nature is quickly recognised by the facility with which the finger may be pressed into the vein, by the thinness of its coats, and, after it has been reduced, (the patient lying in the recumbent posture,) by the reappearance of the tumour as soon as he rises, although the finger is kept firmly applied to the crural ring, so as effectually to prevent any protrusion of the contents of the abdomen by that aperture. Last summer there was shown to me a well-marked case of this kind, in the wards of La Charité, in Paris, under the care of M. Velpeau; but, as that surgeon remarked, it was impossible for any properly educated person, who paid the slightest attention to the characteristic appearances of the affection, to be deceived as to its actual nature. An instance of this varicose condition of the saphena and femoral veins, at their junction with each other, was met with in the dissecting-rooms of the College this winter. The tumour was of the size of a pigeon's egg.

Adipose and encysted tumours, occupying the situation of the bend of the thigh, have been mistaken for femoral hernia, as happened in the case which is recorded by Desault, and in another mentioned by Mr. Macilwain.†

The history of the case, the fluctuation which is perceptible in the tumour, and its situation, which is commonly upon the iliac side of the femoral vessels, will always be sufficient to enable a surgeon to distinguish psoas abscess from a femoral hernia.‡

† *Vide* Desault's Chirurgical Journal, tom. i. p. 252; and Macilwain's Surgical Observations, p. 314.

‡ Mr. Cooper mentions having seen a case of psoas abscess which had been mistaken by another practitioner for a femoral hernia. *Vide* Dict. of Pract. Surgery, 7th edit. p. 944.

Section IV.

OF THE EMPLOYMENT OF THE TAXIS FOR THE REDUCTION OF A FEMORAL HERNIA.

This operation forms a very important part of the treatment of a strangulated femoral hernia, since, whilst its judicious employment will often prevent a severe operation, and rescue the patient from the most dangerous circumstances, it yet frequently happens, from its misapplication, that so much injury is inflicted upon the tender coats of the inflamed intestine as to frustrate all other attempts to afford relief, however skilfully they may afterwards be administered. The most dangerous error, and which is nevertheless by no means the most unfrequent in its occurrence, is that of mistaking a femoral hernia for an inguinal hernia ; which not only involves a failure in obtaining the end sought for—the reduction of the intestine—but also must expose the patient to the dangers attendant upon contusion and even laceration of the swollen tunics of the strangulated portion of intestine.†

The patient should be placed upon his back, the shoulders and head elevated, and the thigh of the affected side flexed upon the abdomen, with the knee rotated inwards, in order that the crural arch shall be rendered as perfectly free as possible from all tension communicated to it either from the fascia lata or from the abdominal muscles. Sometimes additional benefit is obtained by ordering the opposite limb to be flexed and rotated inwards, in a similar manner, at the same time. During the employment of the taxis it is also useful to keep the patient engaged in conversation, which greatly tends to diminish the resistance of the muscular parietes of the abdomen. The surgeon then grasps the hernial tumour with the fingers of the right hand, and, if it be large, and have risen so much upwards as to have been tilted over the falciform process of the fascia lata, and upon the surface of the

† See Sir Charles Bell's Operative Surgery, vol. i. Plate VII. fig. *f.*; in which a representation is made of the injury which the coats of the bowel may receive from being too rudely pressed against the stricture: also the Medical Gazette, vol. xiii. p. 926, in which the hernial sac, with its contents, had been reduced by the taxis, but the strangulation still continued, and produced the death of the patient.

aponeurosis of the external oblique, draws it downwards into the centre of the upper part of the thigh, in order to obliterate the angle which is formed between the fundus and neck of the swelling. When this has been done, he steadies the parts about the neck of the sac with the fingers of the left hand, while he makes a gentle but gradually increasing pressure upon the whole of the contents of the hernia with his right hand. The direction of this pressure upon the tumour should be (when the angular reflection of it described has been effaced) upwards, with a slight inclination outwards, so as to avoid compressing the contents of the sac against the spine of the pubis and Gimbernat's ligament. If there be any gurgling sensation perceived in the tumour during the employment of the taxis, it is an encouragement to continue in our efforts to reduce the intestine, as it probably arises from the passage of some of the fluid and gaseous contents of the gut from the strangulated into the unaffected part of the alimentary canal. It is much better to maintain the pressure gently for a considerable time, than to act with more haste and to employ a greater degree of force, in a shorter period. Moving the neck of the tumour a little from one side to the other, and endeavouring to draw it outwards, as it were, sometimes prove very useful in altering the exact relations of the strictured part of the bowel to the neck of the sac, and in this manner facilitate the return of a portion of its contents, after which the whole will in general quickly follow. I have known the taxis to succeed almost immediately in a great number of cases sent into the hospital for the express purpose of being submitted to the operation with the knife, and in which the first attendants had tried the taxis most indefatigably for an unusual length of time, but without success, simply because the patient had not been placed in that position which is most favourable to effect the relaxation of the structures attached to and composing the crural arch. It is extremely injurious to persevere very long in the employment of the taxis, as it it can be readily ascertained by any one who is qualified to estimate the resistance, whether there is any likelihood of the hernia being reduced without a previous division of the stricture; indeed, it is the deliberate opinion of many of the best writers in surgery, that the taxis has been productive of much more harm than good, in consequence of the long-continued and persevering efforts to re-

duce, at all risks, the contents of a strangulated hernia, rather than to have recourse to the knife. When the abdomen is swollen, and there is tenderness of it and of the tumour under pressure, the taxis should not be persevered in; but immediate recourse had to the operation with the knife, which the history of surgery amply proves to be followed by success, in exact proportion to the gentleness and short duration of the efforts previously employed in the attempt to reduce the strangulated intestine by the taxis.† The taxis sometimes succeeds, although it may have failed a short time before, after the exhibition of such active remedies as are well known to reduce the vascular action and muscular tone of the individual to whom they are administered; these are the hot bath, free venæsection, tartar emetic,‡ and the tobacco enema; all other remedies are of very little avail, and therefore need scarcely ever be employed in cases of acute strangulated femoral hernia.

Section V.

THE OPERATION FOR STRANGULATED FEMORAL HERNIA.

The taxis, aided as it may have been by the hot bath, &c. having been fairly tried, and the hernia still remaining unreduced, it is of the utmost importance that the operation for the removal of the stricture upon the strangulated bowel should be delayed no longer; for it is very generally admitted, if it be not completely proved, that a fatal amount of injury is much earlier inflicted upon the tunics of the intestine by the stricture in cases of femoral herniæ, than in any other kind of rupture. Sir Astley Cooper mentions, in his work on hernia, two cases; in one of which death occurred in eight hours, and, in the other, in twenty-one hours from the commencement of the symptoms: although he says, at the same time, that he has known the operation to have succeeded when it has been performed as long as eight days

† *Vide* the works of Desault, Richter, Pott, Hey, Velpeau, Lawrence, and many other equally distinguished surgeons, who are unanimous in deprecating violent and long-continued attempts to reduce strangulated herniæ by the taxis.

‡ A considerable number of cases of strangulated hernia have been successfully treated in the hospital of the College, by prefacing the taxis with nauseating doses of tartar emetic: of course, if vomiting be produced, the action of the abdominal muscles might be productive of much harm; the doses of this medicine should therefore be very moderate.

from the first accession of the strangulation. The principal guide, then, in deciding as to the proper moment for relinquishing the employment of the taxis, and other milder remedies for the operation, appears to be the degree of tenderness and tension of the belly; for if this be at all considerable, and especially if increasing, then it is evident that no time is to be lost. The justly celebrated Mr. Hey writes thus: "I have now performed the operation forty times; and have often had occasion to lament that I performed it too late, but never that I had performed it too soon."†

The bladder should be emptied before the operation is performed, as instances have occurred in which it was wounded while dividing the stricture.‡

The operation may be done as the patient lies in bed, or he may be placed upon a table properly prepared for the purpose. The surgeon places himself on the same side as the hernia, and commences the first incision one inch above the situation of the crural ring, extending it obliquely downwards and outwards, over the centre of the tumour below the crural arch. The object of beginning the incision so much above the superior edge of the tumour, is to obtain plenty of room over the neck of the sac, which must be freely exposed, so as to permit of its division with the probe-pointed bistoury, in a latter part of the operation, with greater ease and safety. The least painful and most expeditious way of making this incision, is to pinch up the integuments, so as to make a fold obliquely across the tumour, through which fold the bistoury should be passed with its back turned towards the tumour, and then carried, at one stroke, outwards to the surface.

Many surgeons prefer making the first incision over the tumour parallel with Poupart's ligament, and then meeting it at the centre by another cut, which is carried obliquely upwards and inwards over the neck of the sac, so as to resemble the letter ⅃ reversed; while others, again, recommend a crucial incision. The form of the incision is, however, of little importance, provided that it is made in such a manner as to disclose freely the neck of the sac at its upper and internal part.§ If it be a large hernia, the

† Hey's Surgery, 2d edit. page 130.

‡ Op. citat. p. 156; in which a case in the practice of a surgeon of some eminence is mentioned, where this accident actually occured.

§ Mr. Cooper's Surgical Dictionary, p. 738, 7th edit.

incisions need not extend over the whole of the tumour, which would be very inconvenient, but only over the upper part.

It seldom occurs, in making these incisions, that any of the superficial arteries of the groin are injured; though, no doubt, a case may be met with occasionally, in which either the superficial pudic or epigastric arteries running over the tumour might be divided, when, if the vessel bleeds freely, it should be secured by a ligature before proceeding any further in the operation.

The investments which the sac receives from the superficial fascia and the fascia propria, are in the next place to be divided, either with the hand unsupported, as is recommended by Scarpa and Mr. Liston,† or upon the director, which is to be introduced under them, after pinching up a small fold with the forceps, and making a slight horizontal cut with the scalpel.

The number of layers which cover the hernial sac appears to vary in almost every case, since they greatly differ from one another in their thickness and density, as well as according to the particular method of operating which may be adopted by the surgeon with regard to the use of the scalpel and director; but, where a director is not used, these may in general be reduced to three, viz. the integuments, the superficial fascia, and the fascia propria.

When the superficial fascia has been divided, an oval-shaped fatty body presents itself, which, on being slightly moved, may be insulated from the adjacent structures, and which, in fat persons, resembles a portion of the omentum, having precisely the same shape and size as the hernia; so that a doubt is apt to arise in the minds of those present, whether the hernial sac has been opened or not, and whether the hernia is really omental. But, on pressing gently this fatty tumour, a certain resistance and elasticity is felt, which is not proper to the structure of the omentum. Therefore, on laying hold of it with the points of a pair of forceps, and dividing layer after layer, the hernial sac at last appears under this fatty capsule, from which it may be distinguished by its smooth thin texture, and its transparency. This is one of the most delicate steps of the operation for femoral hernia in both sexes; and more particularly so, because, in general, the hernia, on being stripped of its coverings, is of small size, sometimes very small, so that it requires,

† *Vide* Operative Surgery, by Mr. Liston; 2d edit. p. 482.

on the part of the surgeon, unusual information and great dexterity, to separate this fatty sheath from the true hernial sac, without dividing the latter, and injuring the viscera contained in it.†

In several instances, the fascia propria has been mistaken for the sac itself: and thus it has happened, even in the practice of the most skilful and experienced surgeons, that the margins of the crural ring have been cut external to the sac, which was then forcibly pushed back into the belly, with its contents, which, being still tightly girt by the thickened neck of the sac, remained strangulated, and caused the death of the patient. After these operations, the unopened hernial sac, with its contents, have been shown to have been pushed up into the loose cellular tissue which connects the outer surface of the peritonæum to the fasciæ lining the iliac fossa.‡

It should be recollected, also, that cysts, having many of the appearances of the proper hernial sac, may be met with in the subserous cellular tissue, (which, indeed, is a part of the fascia propria,) and might cause some embarrassment, if their nature be not recognised by the operator. An interesting case of this kind occurred in the hospital of the College during the course of last winter, in the practice of Professor Cooper, in which several cysts filled with a clear sanguinolent fluid were opened before the hernial sac was arrived at.§

The peritonæal sac having been exposed, a small piece of it is to be held up between the fingers, or the blades of the forceps, taking very great care to exclude any portion of its contents,

† *Vide* Scarpa on Hernia, translated by H. Wishart, p. 271; 8vo. Edin.

‡ For cases of this kind, see Sir Astley Cooper's work on Crural Hernia, 2d edit. p. ii. p. 11; the works of Le Dran, obs. 58; De La Faye, in Dionis's Surgical Operations, 5th edit. p. 324; and Arnaud, Traité des Hernies, tom. i. p. 96; Cloquet, Recherches, pp. 112-16; Scarpa, translated by Wishart, p. 143; London Medical Gazette, vol. i. pp.485-6, and vol. xiii. p. 926; the Dictionnaire de Médecine et de Chirurgie Pratiques, tom. ix. p. 571, article Hernie: also Mr. Lawrence's valuable Treatise on Ruptures, 5th edit. pp. 92 and 150.

§ *Vide* the London Medical Gazette for March 2, 1839, p. 835. It would seem that Sir Charles Bell has met with the same appearances, for he says that "Sometimes the sac is covered, not only with lymphatic glands, but with vesicles of serum, and these give to the tumour a great irregularity: they require a careful dissection.—Illustrations of the Great Operations of Surgery, by Sir Charles Bell, p. 41, folio; also, Médecine Opératoire, par M. Velpeau, tom. iii. pp. 362-3.

and an opening cautiously made with the scalpel held horizontally. The director, or the probe-pointed bistoury, is then to be introduced into the opening, between the inner surface of the sac and the intestine, and the former laid freely open, more especially in a direction upwards towards its neck.

When the contents of the sac have been examined, the stricture should be divided, in order to admit of the easy return of the strangulated intestines. For this purpose, the left forefinger should now be gently introduced between the inner surface of the sac and the bowel, and the stricture sought for at the upper and inner angle of the wound. The tip of the finger-nail, should be insinuated underneath the band which forms the stricture, and the blunt extremity of the probe-pointed bistoury (placed flat upon the finger) glided just within the sharp margin of the stricture; after which the edge of the knife is to be turned upwards, and, the handle being raised, the tendinous band which resists the return of the bowel will be easily divided. If a director be used, its point should be very carefully passed underneath the stricture, and the knife carried along its groove, and raised as just mentioned,—but the finger is preferable, for, at the same time that it guides the instrument, it serves to protect the bowel. Generally speaking, a cut of about two or three lines in extent will suffice to remove the stricture.† There is no fear of wounding any of the vessels which may take their course over the neck of the sac, unless the probe-point of the bistoury be carried much too far within the crural ring.‡

† Sir Astley Cooper recommends the incision of the neck of the sac to be made upwards and with a slight obliquity inwards, so as to divide the fascia transversalis and the posterior edge of Poupart's ligament; Pott, Hey, Dupuytren, and Hesselbach, cut upwards. Gimbernat, Langenbeck, Scarpa, Todd, and Lawrence have found the division of the internal edge of the crural ring sufficient to remove the stricture; while Professors Cooper, Liston, Syme, and many others, cut obliquely upwards and inwards. It will be readily admitted, however, that it is not so much the direction of the incision, as its extent, that forms the essential point of practice in this part of the operation; and it is very fortunate that a slight cut of from two to three lines is usually sufficient for the removal of the stricture, by dividing the several parts which have been regarded by these writers as the seat of the strangulation, at the same time that it does not reach any of the vessels which may perchance run over the neck of the sac.

‡ Mr. Guthrie states that he has been made aware of more than one in-

It may be asked what is the seat of the stricture in femoral hernia? The answer to which question is, that it is not the same in all cases, though, in by far the greater number of instances, the constriction is relieved by the division upwards and inwards of the falciform process of the fascia lata and the lunated edge of Gimbernat's ligament, where they join with each other. In some instances it will be the fibres of the deep crescentic arch; in others, again, the neck of the sac itself, and produced by a thickening and contraction of the subserous and peritonæal membranes where they lie within the circumference of the crural ring.

The stricture having been divided in an oblique direction upwards and inwards, the contents of the sac may be returned, provided there be no contraindicating circumstances; in effecting the reduction attention should be paid to the position of the limb, which ought now to be flexed upon the trunk, and rotated inwards, so as to relax more completely the crural arch, at the same time that great care is taken to handle the intestine with extreme gentleness. If both have been protruded, the bowel should be returned before the omentum. If the omentum presents the appearance of a large and hard mass, and of such a form as not to be readily passed back through the crural

stance of the obturator artery, surrounding the neck of the sac, having been wounded in operations for strangulated femoral herniæ, which were performed by some of the best anatomists and surgeons in London, and that the patients subsequently bled at intervals until they died from hemorrhage.—(*Guthrie on Crural Hernia*, 4to. *p.* 36.) Dr. Trüsted, of Berlin, mentions a case in which the surgeon wounded the obturator artery, while cutting the crural ring inwards, and the patient died eight days after the operation; six ounces of putrid blood were found in the cavity of the pelvis.—(*See Cooper's Dict. of Pract. Surg. p.* 741; *7th edit.*) M. Velpeau has recorded a similar case which occurred in the hospital of La Charité, Paris, in which the hemorrhage was arrested by a graduated compress, the furthest extremity of which projected into the iliac fossa; it was kept there for five days, and then removed without being followed by any return of the hemorrhage. —(*Méd. Opér. tom. ii. p.* 489.) Mr. Hey wounded a large vessel, probably the epigastric, when cutting directly upwards, in the case of an old woman, and not on that side of the intestine which was most distant from the femoral artery. The incision was, however, half an inch in length, which is rather longer than is necessary. Mr. Hey found it impracticable to ligature the vessel, but placed a piece of sponge, supported by a firm compress, upon the bleeding spot, which he kept there for fourteen days, when it was removed. This case

ring into the belly, it may be either left in the sac, or cut off with the knife, taking the precaution of tying each of the bleeding vessels, as they are divided, with a small thread. If the omentum should be gangrened, the mortified portion may be excised, and such vessels as bleed ligatured; the remainder may then be reduced into the neck of the sac, where it is to be retained by the ends of the ligatures which hang out at the external wound.

Before the operation is concluded, the extremity of the little finger should be introduced into the neck of the sac, in order to ascertain with certainty that the hernia has been fairly reduced into the belly; as instances have occurred in which operations, in all other respects well performed, have failed in affording relief, in consequence of the intestine being entangled at the neck of the sac, or even pushed up between the peritonæum and the fasciæ lining the iliac fossa.† The operation having been finished, and the intestines fairly reduced, the edges of the wound should be brought together with one or two points of suture, after which a pledgit of lint may be applied, supported by a compress and spica bandage.

Treatment after the operation.—The principal circumstance requiring attention after the reduction of the intestine, is the

also did well.—(*Pract. Obs. p.* 161; *2nd edit.*) Arnaud relates the case of a young man who died a few minutes after the operation for strangulated femoral hernia, in whom it was afterwards found that the artery of the spermatic cord had been divided.—(*Mém. de Chirurg. tom. i. p.* 758.)

Sir Astley Cooper mentions a case in which the surgeon, mistaking a femoral for an inguinal hernia, cut the stricture at the crural ring in a direction towards the ilium, and in consequence wounded the femoral vein. The venous hemorrhage was very profuse, and delayed the operation fifteen minutes, and was stopped with very great difficulty. He also mentions another case, in which the surgeon cut outwards, acting under the same mistaken impression, and narrowly escaped destroying his patient.—(*Sir Astley Cooper on Crural Hernia, p.* 4; *2nd edit.*)

† The following case illustrates the importance of attending to this rule:—An old woman, who had laboured several days under symptoms of strangulated femoral hernia, submitted to the operation. The surgeon, having exposed the sac, divided the stricture formed by Poupart's ligament; but the sac itself was not opened at the first, for it was considered to be the intestine. It was endeavoured to reduce the hernia satisfactorily, but in vain; when, on closer examination, it was found that the peritonæal sac had not been divided. The sac was now fully opened, and, as the stricture had been divided

procuring of evacuations from the alimentary canal. The best method of producing these is to throw up a copious enema, which will, in the greater number of instances, be speedily followed by plentiful evacuations, with a marked relief to the pain, sickness, and vomiting. It may be sometimes necessary to accelerate the action of the intestinal canal by purgatives administered by the mouth; and of these a table-spoonful of castor oil with a few drops of laudanum, or dram doses of the sulphate of magnesia in peppermint-water, given every hour, are the best. The earliest appearances of peritonæal inflammation should be anxiously watched for during the first few days after the performance of the operation; and, should they supervene, combatted at their commencement by venæsection, if the patient's strength will admit of it, and leeches to the belly, which may be followed by fomentations, and a large blister. In cases where the operation has been had recourse to early, the patient will most frequently recover, without any bad symptom occurring after the relief of the strangulated bowel; but, on the contrary, when the operation has been long deferred, and especially after persevering and violent efforts have been employed in the attempt to reduce the hernia by the taxis, nothing, I believe, will avail to prevent a fatal termination. In these cases the coats of the

externally to it, there was supposed to be no occasion to divide it at the neck; nor was the intestine drawn down to be looked at, but it was readily returned, as the surgeon said, into the abdomen. The wound was then closed by a suture. Three days after the operation had been performed, during which time the symptoms of strangulation obstinately persisted, the woman died. On opening the abdomen, the intestine was found very firmly constricted by the mouth of the peritonæal sac, and on looking into the sac from the wound in the thigh, no intestine was at first perceived; but, when examined more closely from within, it was found pushed up between the peritonæum and the sheath of the femoral vessels: so here it had remained, and of course the symptoms continued. (*Vide* Sir Astley Cooper on Crural Hernia, note at the bottom of page 11, 2nd edit.) In Plate VII. fig. 4, of the same work, is a representation of the hernial sac, which had been returned into the abdomen unopened, in a case in which death ensued from the strangulation of the intestine by the neck of the sac still continuing unrelieved. Similar cases are recorded by Scarpa, Sir Charles Bell, Lawrence, Dupuytren, and Breschet. See a very interesting Clinical Lecture, by Sir Charles Bell, on Femoral Hernia, in the 13th vol. of the Medical Gazette, p. 926; London, 1834.

intestine have suffered so much injury from the long duration of the constriction, and the violence of the taxis, that they fall into a state of chronic inflammation, which ends, frequently, after the lapse of several weeks, in the death of the patient. In such a case, the portion of the intestine which had been strangulated may be readily distinguished from the rest of the alimentary canal by the dull iron-grey tint or slate-colour which it presents, and sometimes also by numerous petechial spots which are perceptible upon various points of the surface, being situated underneath the peritonæal coat.

A truss should be applied before the patient is allowed to get up from bed; for it is a general observation that femoral herniæ are much more liable to recur after an operation, than inguinal, and, when this has happened, to become very much larger than before.

There is reason to believe that death ensues in some cases of strangulated hernia, although the stricture has been divided, and the intestine safely returned into the belly, from the portion of gut which had been down in the sac still refusing to act: for its muscular coat has suffered so much injury by the long continuance and violence of the strangulation, that it is no longer able to propel the fæcal contents of the intestinal canal; or, in other words, that the part of the bowel which had been included within the stricture is paralyzed, and thus, though freed from all constriction, may, nevertheless, remain a cause of obstruction and death.†

The appearances which are observed after death, when an individual dies from strangulated hernia, unrelieved by any operation.—When the abdomen is opened, the intestines are found inordinately distended, inflamed, and discoloured; and the inflammation of the peritonæum is not confined solely to that portion of it which invests the alimentary canal, but extends also to that which lines the inner surface of the abdominal parietes.‡ There is, at the same time, usually present in the cavity of the abdomen, a greater or less quantity of serum, mixed with numerous flocculi of recently effused coagulable lymph; the effusion not unfrequently presenting the appearance

† *Vide* a Clinical Lecture on Cases of Hernia, by Sir Charles Bell, in the 13th vol. of the Lond. Med. Gaz. p. 925.

‡ Op. citat. p. 984.

rather of a sero-purulent fluid than of a pure serosity. The convolutions of the intestines around the strangulated portion are commonly adherent to one another by coagulable lymph which is poured out upon their peritonæal surface. The portion of the intestinal tube which intervenes between the stomach and the strangulated part, is greatly distended with air and fæcal matter, and also violently inflamed; while that which is situated beyond the stricture is comparatively empty, and retains its natural appearance. The piece of the bowel which is included within the grasp of the stricture is of a reddish-brown or deep purple tint; sometimes it is even black; and, in the more advanced stages, frequently of a grey slate, or greenish hue.† Sometimes there are evident spots of mortification present here and there, and the whole of it may be so soft and pulpy as to break down readily under the simple pressure of the finger. Occasionally the intestine will be found to have given way directly opposite the stricture, and the fæces to have been extravasated into the abdomen.

In those instances in which death ensues, notwithstanding that the stricture upon the intestine has been removed by an operation, the morbid appearances are much the same as in the preceding case, though they may be, perhaps, somewhat less intense in degree. The portion of the bowel which has been the subject of the strangulation is, however, always readily distinguishable from all the rest of the alimentary canal by the greater depth of its colour, which has been frequently known to persist as long as fifteen or twenty days from the time at which the strangulation was removed by the division of the stricture. The peritonæum at the seat of stricture is usually found puckered and drawn into folds, which, adhering to one another by their opposite surfaces, close the orifice of the hernial sac, the lower part of which in some instances becomes distended with a serous fluid, so as to resemble a simple cyst.‡

† *Vide* a Paper by the Author, on the Symptoms of Strangulated Intestine, in the London Med. Gaz. p. 507-8; December 1837.

‡ *Vide* a Clinical Lecture by Professor Cooper, in the London Medical Gazette for the 11th of May 1839, p. 253.

CHAPTER V.

OF SOME OF THE DISEASES WHICH FREQUENTLY OCCUR IN THE GROIN.

Bubo.—This term is sometimes restricted, though improperly so, to the swelling which is produced by an inflammatory enlargement of one of the lymphatic glands in the groin in consequence of venereal ulcerations, or discharges affecting the external organs of generation, since these glands may swell and inflame from many other causes, independently of any syphilitic taint.

The venereal bubo, when it follows the presence of a chancre upon any part of the penis, has its seat commonly in one of the superficial lymphatic glands which lie parallel with, and upon Poupart's ligament. (See Plate I. fig. 10.) The longer diameter of the swelling is directed transversely to that of the limb; and its situation, which is exactly in the bend of the thigh, explains the great pain and difficulty which are experienced by the patient on walking, or using any similar exercise.

A swelling of one of these glands may be caused by a simple gonorrhœa, but then it seldom proceeds to suppuration.

The glands which lie alongside of the great saphena vein (Plate I. fig. 11.) frequently inflame and become swollen in consequence of ulcers or some similar source of irritation situated lower down upon the limb; as, for example, between the toes, upon the ancle, heel, and lower part of the leg and thigh. The inflammation, which is at first situated in the lymphatic vessels and one of the absorbent glands, may become diffused by extending itself to the surrounding cellular and adipose tissue, and terminate in a large and deep abscess of the groin. These glands are also occasionally found to become enlarged from disease about the anus, and the perinæal and glutæal regions, which should be removed before we can expect much benefit to follow the application of remedies to the swelling itself. In all these cases the long diameter of the tumour is parallel with the course

of the saphena vein, which alone will frequently be sufficient to indicate the origin of the affection. In persons of a scrofulous habit of body the inguinal glands may enlarge and suppurate without any other obvious cause than some violent exertion of the limb.

All buboes, as soon as suppuration is fairly established, should be freely opened by a neat incision, which should be made to extend through the whole length of the tumour in the direction of its longest diameter. There are, however, some cases in which it is better to employ, for the purpose of opening a bubo, a finely pointed pencil of the potassa fusa; for example, some of the buboes which occur in scrofulous persons, or in individuals possessing a hemorrhagic diathesis, in whom it would be extremely dangerous to employ the knife.†

When the sore resulting from the opening of a bubo does not heal, but remains indolent, and its edges are high and callous, much benefit will frequently result from the use of well-applied pressure by means of a compress and the spica bandage; but if, on the contrary, the edges be thin and undermined, and of a purplish colour, they should be either freely incised at several points, so as to allow of their retraction upon the parts underneath,—removed with the knife,—or destroyed by the application of the potassa fusa. When a large indurated gland remains in the centre of the sore, and interferes with the due progress of cicatrisation, it should be destroyed by repeated applications of the caustic potash, as its removal with the knife may be followed by very unpleasant hemorrhage, which may prove exceedingly difficult to control, since a ligature cannot always be made to hold upon the bleeding vessel, the coats of which, being softened by the previous disease, readily give way when the knot is drawn. A small hernial sac, it must also be recollected, may lie close underneath an enlarged gland, and might be laid open were the tumour to be cut away with the knife.‡

† A man of the name of Ploughwright was admitted about a month since into University College Hospital, under the care of Mr. Liston, on account of a large bubo in the left groin, which was opened in this manner with the caustic potash; for it was deemed dangerous to employ the knife, as he had several times nearly lost his life by hemorrhage from the most trivial wounds.

‡ M. Velpeau recites a case of this kind, in which death ensued from the injury done to the intestine that was contained in the sac. *Vide* Nouveaux

Sometimes an inguinal gland becomes swollen, and remains enlarged for a long time, without any change taking place in its condition: in such a case the repeated application of blisters, followed by the employment of pressure, will frequently succeed in procuring its rapid removal by absorption.

Psoas abscess.—This affection, while in its early stages, might be mistaken, in a cursory examination, for a femoral hernia; but the history of the symptoms, the fluctuation which is perceptible in the tumour, and very frequently its situation, which is usually much nearer to the spine of the ilium than that of a femoral hernia, will always afford sufficient grounds upon which a correct diagnosis may be founded.†

Steatomatous tumours.—Fatty tumours are frequently met with in the groin, and in some instances, owing to the coexistence of many of the symptoms of strangulated intestines, have, from their small size and their situation, been mistaken for femoral herniæ, accompanied with symptoms of strangulated intestine.‡ I have seen several adipose tumours of very considerable size situated in this region. In general their removal by the knife is easily effected, as they seldom adhere very closely to the sheath of the great vessels, which lie beneath them.§

Scirrhus of the glands of the groin.—The glands of the groin are rarely affected with scirrhus, yet some cases of this kind have been recorded by various authors. The nature of the disease is, however, rarely detected in sufficient time to enable the surgeon to interfere with any prospect of success from an operation, as the glands which are more deeply seated in the

Eléments de Médecine Opératoire, tom. ii. p. 333; Paris, 1832. There is a preparation preserved in the Museum of the College in which a small hernial sac adheres to the base of an enlarged inguinal gland, which occupied the centre of an ulcer in the groin.

† Mr. Cooper mentions an instance in which the surgeon, who had been first in attendance, mistook a psoas abscess for a femoral hernia. *Vide* The Dict. of Practical Surgery, 7th edit. p. 944.

‡ Several cases of this kind are detailed in the second volume of M. Velpeau's work upon Operative Surgery, p. 333.

§ During my residence in the hospital of Newcastle-upon-Tyne, a tumour of this nature, which was as large as the head of a young child, was extirpated by Mr. Heath, one of the surgeons to that admirably conducted institution. Similar cases will be found in Sir Astley Cooper on Hernia, part ii. p. 4; 2nd edit.; Recherches sur les Hernies, p. J. Cloquet, 7e Obs. p. 25; 4to. Paris, 1819, and in the Lancet for 1839, p. 39.

iliac fossa are, in most cases, similarly affected. The glands of the groin frequently become diseased secondarily in malignant affections of the lower extremity; and hence it is right to ascertain their condition by a careful examination before any operative procedure, such as amputation, is performed for the removal of the primary disorder.†

Hydatid tumour.—The celebrated Desault relates the case of a girl from whose groin he removed a hydatid tumour, for which she had been advised by several other surgeons to wear a truss.‡ In another instance, which is mentioned by Dr. Monro, a sac of the size of an egg, which contained within it a quantity of hydatids, was removed from the upper and inner part of the thigh, where it might be readily mistaken for a hernia, as the hydatids contain a watery fluid, have thin and elastic coats which communicate to the touch nearly the same kind of sensation as a protruded portion of intestine, and are contained within a covering very similar to a hernial sac.§

† Dr. Warren relates the case of a lady in whom the glands of the groin were affected with scirrhus.—Surg. Obs. on Tumours, by D. Warren, U. S. 8vo. pp. 169-71.

‡ See a case of spurious hernia, occasioned by a hydatid of a considerable size, cured by excision, in Desault's Surg. Jour. trans. by R. Gosling; Lond. 1794; vol. i. p. 238.

§ Observations on Crural Hernia, by Alexander Monro, M.D.; Edin. 8vo. 1830; p. 80.

THE SURGICAL ANATOMY

OF

THE THIGH.

CHAPTER I.

DISSECTION OF THE GREAT VESSELS AND NERVES OF THE THIGH.

As this dissection serves to illustrate the principal points connected with the surgical treatment of femoral and popliteal aneurism, wounds of the great vessels, and amputations of the thigh and leg, &c. especially when these operations are followed by secondary hemorrhage, it is desirable that it should be executed with great care and attention. The dissection which has already been made for the purpose of displaying the anatomy of femoral hernia has, in some measure, anticipated the present; but there will be found no difficulty in continuing it in such a manner as to allow of every desirable object relating to the above-mentioned subjects being obtained, without having recourse to a fresh limb.

The cutaneous nerves of the anterior part of the thigh should be traced to their ultimate distribution previously to the dissection of the fascia lata from the muscles upon the lower part. They are three, and not unfrequently more, in number; and are named external, middle, and internal cutaneous.

1. The *external cutaneous* nerve is a branch from the second and third division of the lumbar plexus, from which it descends obliquely upon the iliacus muscle, in its way to reach the crural arch; underneath which it passes, at a short distance from the

anterior superior spinous process of the ilium. (See Plate IV. fig. *s*.) Below the crural arch the nerve rests upon the upper part of the sartorius muscle, and soon pierces the fascia lata, when it divides into two branches, the larger of which runs almost vertically downwards to the external border of the knee, distributing numerous filaments to the integuments covering the vastus externus muscle; the other branch is much smaller than the preceding, and, inclining backwards, crosses over the tensor vaginæ muscle to ramify in the skin covering the anterior part of the gluteal region.

2. The *middle cutaneous* nerve is a branch of the anterior crural, and pierces the fascia lata about three inches below Poupart's ligament; it may be traced, as it lies upon the fascia enclosing the rectus muscle, as far as to the skin covering the patella. (See Plate VI. fig. *r*.)

3. The *internal cutaneous* nerve is also a branch from the anterior crural, and follows nearly the course of the great saphenous vein, ramifying in the skin covering the vastus internus muscle, as far as the inner border of the knee.

The integuments of the front of the thigh receive, besides the nerves which have just been described, numerous filaments from various other branches of the anterior crural and obturator nerves, as well as from the ilio-inguinal and genito-crural nerves of the lumbar plexus.

The femoral vessels.—The femoral artery and vein may be exposed throughout their course, by merely raising the fascia lata from the muscles which occupy the front and inner surface of the thigh, and carefully removing the loose cellular and adipose substance which fills up the interstices between them, so as to avoid injuring the numerous branches that spring on each side from the main trunks. The deep-seated branches of the anterior crural nerve may also be displayed at the same time. (See Plates IV. and VII.)

EXPLANATION OF PLATE VII.

This plate represents the dissection of the large vessels and nerves on the front of the thigh, after the fascia lata has been removed from the muscles.

a. The anterior superior spinous process of the ilium.

b. The tuberosity and crest of the os pubis.

c. The crural arch.

d. The cut surface of the os pubis, near its symphysis.

e. The tendinous aponeurosis of the external oblique muscle of the abdomen.

f. The external abdominal ring.

g. The sartorius muscle, the lower part of which has been turned slightly aside, in order to display the superficial femoral artery in the middle third of the thigh.

h. The adductor longus muscle.

i. The pectineus muscle.

k. The adductor brevis muscle, which lies behind the preceding muscles.

l. The gracilis muscle.

m. The adductor magnus, which lies hehind the pectineus and two other adductor muscles.

n. The rectus muscle.

o. The vastus externus muscle.

p. The vastus internus muscle; above the letter is seen a branch of the anastomotica magna artery.

q. The tensor vaginæ femoris.

r. The trochanter major of the thigh-bone.

s. The patella.

1. The common femoral artery.
2. The superficial femoral artery. The figure is placed upon the vessel, in the situation where the ligature is carried round it in Scarpa's operation. A small nervous filament frequently passes obliquely over the vessels at this spot.
3. The profunda femoris giving off the external circumflex artery, and then inclining inwards, behind the superficial femoral, and afterwards furnishes the perforating branches.
4. The femoral vein.
5. The superficial femoral artery in the lower part of its course. It was here that Hunter was accustomed to secure the vessel, in his celebrated operation for the cure of the popliteal aneurism. The internal, or long saphena nerve, is seen lying upon the superior and external side of the artery.
6. The lower part of the strong tendinous aponeurosis, which, passing from the vastus internus to the adductor longus and magnus muscles, binds down the vessels in the middle third of the thigh.
7. The trunk of the anterior crural nerve, which, a little distance below Poupart's ligament, divides into a large lash of branches.

* The crural ring.

The *femoral artery* is the continuation of the external iliac, which assumes this name as it passes underneath the crural arch midway between the anterior superior spinous process of the ilium and the symphysis pubis. From this point the

femoral artery descends almost vertically to the junction of the middle with the lower third of the thigh, where it passes through a tendinous aperture in the triceps muscle, to reach the popliteal region. The course of the femoral artery may be indicated by a line extended from the middle of the space between the anterior superior spinous process of the ilium, and the symphysis pubis, to the centre of the popliteal region. Relations.—The femoral artery lies very superficially in the first part of its course, as it is only covered by the common integuments, some lymphatic glands, and the fascia lata; but in the middle third of the thigh it is situated more deeply, and is additionally concealed by the sartorius muscle, and the strong tendinous aponeurosis which is stretched across the vessels from the vastus internus to the adductor longus and magnus muscles. (See Plate VII. fig. 6.) Posteriorly the femoral artery at first rests upon the inner edge of the psoas muscle, which separates it from the horizontal branch of the os pubis, and the fibrous capsule of the hip-joint: as the muscle soon sinks deeper to be inserted into the trochanter minor, the artery is then supported upon some loose cellular tissue, in which are situated the profunda artery and vein; it afterwards rests upon the tendinous insertion of the adductor longus muscle, and near its termination upon the conjoined tendons of that muscle and the adductor magnus. Near the crural arch the femoral vein is placed upon the pubal side of the artery, and lies upon the same plane with it; but, as they descend together, the vein gradually inclines backwards, so as to become placed a little behind the artery, which position it generally retains throughout the remainder of their course to the popliteal region. Externally the femoral artery is successively in relation with the psoas magnus, the inner edge of the sartorius, and the vastus internus muscles. The trunk of the anterior crural nerve is at first separated from the artery by the sheath of the vessels, and the external fibres of the psoas muscle; but, towards the termination of the superior third of the thigh, one of its principal branches (the *internal saphenous nerve*) enters into the sheath of the vessels, and lies upon the outer edge of the artery, as far as to the point where the latter passes through the triceps muscle to reach the cavity of the ham; there the nerve separates from the artery, and soon becoming superficial, pierces the fascia lata, just below the inner side of the knee, and passes

down the leg in close relation with the internal saphena vein. (See Plates IV. and VII.) Several delicate filaments of the anterior crural nerve cross obliquely over the vessels as they descend upon the thigh, and must frequently be included within the ligature when the femoral artery is tied in the usual situation; but their size is much too small to render them of any particular importance. One of these smaller branches may be seen lying upon the artery in the Plates IV. and VII.†

There are three or four small lymphatic glands situated upon the femoral artery; these may become enlarged, and simulate an aneurismal tumour from having a pulsation communicated to them from the subjacent vessel.

Ulceration of the inguinal glands may extend to the coats of the femoral artery, and so give rise to a fatal hemorrhage; an accident which I have seen occur in a case of a phagedenic ulcer following a venereal bubo in the left groin.

Branches of the femoral artery.— The *profunda artery* arises from the external and posterior surface of the common femoral, usually from an inch and a-half to two inches below Poupart's ligament. (See Plate VII. fig. 3.) It is not unfrequently, however, found to arise from the femoral much higher than this point, and, in some instances, opposite the lower border of the crural arch: occasionally, indeed, it is given off from the external iliac artery.

Immediately after its origin, the profunda runs a little backwards and outwards, in front of the psoas and iliacus muscles; but it soon changes its direction, and, inclining inwards, passes behind the superficial femoral artery and vein, and gets under cover of the adductor longus muscle; between which and the adductor magnus, it continues to descend, gradually approaching the linea aspera of the femur, near which it pierces the fibres of the last-named muscle, and is finally lost among the flexor muscles on the posterior aspect of the limb. Near to its origin from the common femoral, the profunda gives off two large branches, which are named the *external* and *internal circumflex* arteries; and, as it runs underneath the abductor longus, it fur-

† The great pain which is occasionally felt by patients in whom the femoral artery is tied, when the knot of the ligature is drawn tight, is, doubtless, caused by one of these delicate nerves having been included within the circle of the thread.

nishes three or four others, which have been denominated the *perforating* arteries.

The *external circumflex artery* runs transversely outwards, passing in front of the neck of the thigh-bone, between the rectus and cruræus muscles: it divides, near the outer edge of the femur, into numerous branches, some of which ascend underneath the rectus, sartorius, and tensor vaginæ femoris muscles, and anastomose with the gluteal and circumflex ilii arteries; others run transversely over the outer surface of the trochanter major near its base, and communicate with the branches of the sciatic and internal circumflex arteries; while a third set, which are also the largest in size, descend obliquely between the rectus and cruræus muscles towards the knee-joint, where they inosculate with the articular branches of the popliteal artery.

The *internal circumflex artery*, after its origin from the profunda, inclines suddenly backwards, and passes between the psoas and pectineus muscles, so as to reach the external obturator muscle, in front of which it gives off several branches, some of which communicate with those of the obturator artery; it also sends a small branch into the hip-joint, which enters through the cotyloid notch, to supply the synovial structures of that articulation. The continuation of the artery then winds round the neck of the femur to gain the interval between the quadratus and adductor magnus muscles, after which it soon divides into branches, which anastomose with those of the sciatic, gluteal, and external circumflex arteries.

The branches of these arteries, and even the trunks themselves, are sometimes injured in dislocations of the hip-joint, and fractures of the neck and superior third of the thigh-bone, giving rise to extensive extravasation of blood among the muscles of the upper part of the limb.

The *perforating arteries* are three or four in number, and are so named from traversing, soon after their origin from the profunda, the fibres of the adductor brevis and magnus muscles; these vessels divide at the posterior surface of the limb into numerous branches, which are distributed to the hamstring muscles, and also communicate with the sciatic and circumflex arteries superiorly, and inferiorly with the articular branches of the popliteal artery.

The *anastomotica magna* is given off from the femoral artery,

while it is concealed in the tendon of the triceps ; it runs along in the substance of the vastus internus muscle to the knee, where it joins with the vascular plexus which is formed around that joint by the articular branches of the popliteal artery. (See Plate VII. fig. *p*.)

The femoral artery gives off, also, several small and irregular branches to the muscles which are situated on either side of its course ; but they have not received any particular names.

Varieties.—The circumflex arteries frequently arise from the common femoral, instead of the profunda ; the epigastric artery has been seen, though rarely, to arise from the inner side of the common femoral artery; and the epigastric itself has been observed, in some instances, to give origin to the internal circumflex artery. The profunda artery rarely arises from the femoral lower down than two inches from Poupart's ligament; but, on the other hand, it is not unfrequently seen to take its origin at various intermediate points between that distance and the lower border of the crural arch : all which are circumstances of great importance in the consideration of the comparative merits of the operations of placing a ligature upon the common, and superficial femoral, and external iliac arteries, with the view of arresting the violent secondary hemorrhages which occasionally ensue after severe injuries and amputations of the inferior extremity. Sir Charles Bell operated upon a negro who was affected with popliteal aneurism, in whom it was afterwards found that the superficial femoral artery was double, and that the two trunks were again united as they entered the popliteal space. In this case the blood in the sac of the aneurism was, nevertheless, coagulated ; although a considerable quantity had continued to circulate through it from the artery which had not been included in the ligature.†

M. Manec, in his work upon the ligature of the arteries, relates an instance in which the superficial femoral artery was absent altogether, and its place supplied by the sciatic artery, which descended upon the back of the thigh to become the popliteal.‡

† See the Lancet, vol. x. 1825-6, p. 629; The Dublin Hospital Reports, vol. iv. p. 313; Anderson's Quarterly Journal for October 1826 ; and Sandifort, Obs. Pathol. iv. 97.

‡ *Vide* A Theoretical and Practical Treatise upon the Ligature of Arteries; translated from the French of M. J. Manec. Lond. 4to. 1832, p. 209.

The *femoral vein.*—The femoral vein is the continuation upwards of the popliteal vein, and extends from the opening in the triceps adductor muscle to the lower edge of Poupart's ligament, where it ends in the external iliac vein. At its commencement inferiorly the femoral vein is situated behind, and a little to the outer side of the artery; but, in proportion as it ascends towards the groin, it winds round the posterior surface of that vessel, to gain its inner or pubal side; immediately below Poupart's ligament the femoral artery and vein lie on the same plane. The femoral vein receives two large branches at the distance of an inch and a-half below Poupart's ligament, viz. the profunda and great saphenous veins. The femoral vein also receives numerous other branches in its progress, all of which correspond very exactly to the branches which are given off from the artery. In the middle third of the thigh, the femoral vein is sometimes double, and then the artery lies between them; very frequently there is a smaller vein, which runs along the outer side of the superficial femoral artery, from which smaller branches of communication pass across that vessel to join at various points with the main trunk.

When the femoral vein pours out much blood in amputations of the thigh, and the hemorrhage cannot be arrested by milder means, it must be tied in the same manner as an artery, which I have seen done on several occasions, without any bad consequences resulting.

The anterior crural nerve.—In addition to the cutaneous branches, described at page 157, the anterior crural nerve divides into several others, which are for the most part distributed to the vastus externus, rectus, cruræus, and sartorius muscles. Two of the largest of its branches, however, are particularly deserving of notice, on account of their relation to the femoral artery in the middle third of the thigh. (See Plate VII. fig. 7.) The larger of these, *nervus saphenus major*, enters the sheath of the vessels near the point where the sartorius crosses over their course, and thence lies close upon the external border of the superficial femoral artery, as far as the opening in the triceps, where it then leaves it, to descend underneath the sartorius muscle, to the inner side of the knee-joint, upon which it distributes some of its branches; the nerve afterwards becomes subcutaneous, and joins the internal saphena

vein, which it accompanies as far as the inner edge of the foot, whence it passes onwards to the great toe. The other branch is rather smaller than the preceding, and lies a little more externally; it does not, therefore, enter into the sheath of the vessels, but inclines towards the vastus internus, the fibres of which it soon pierces in its descent to the knee-joint, upon which it is finally distributed.

The obturator nerve, which also furnishes branches to the articulations of the hip and knee, anastomoses with some of the branches of the internal saphenous nerve.

The severe pain which is so commonly felt on the inner side of the knee by patients suffering from coxalgia is, doubtless, owing to the irritation which the trunks of these nerves suffer in consequence of their proximity to the hip-joint.

OF THE LIGATURE OF THE ARTERIES OF THE THIGH.

The operation of placing a ligature upon the superficial femoral artery is most commonly performed for the cure of popliteal aneurisms, or to arrest the profuse secondary hemorrhages which sometimes follow compound fractures and deep wounds of the leg, where it is frequently impossible to determine with precision the exact source of the bleeding; or when it occurs after amputation below the knee, at a period when the stump is not in a condition to allow of the wound being re-opened, and an endeavour made to secure the open mouth of the vessel.

The superficial femoral artery may be tied in two different parts of its course; in the middle third of the thigh, before it passes through the opening in the triceps muscle to enter into the popliteal region, or where it lies in the upper third before it is crossed by the sartorius muscle.

Mr. Hunter's operation.—Previously to the year 1785, surgeons were in the constant habit of laying open the sac of a popliteal or femoral aneurism, and, after scooping out its contents, placing a ligature upon the artery, above and below the aperture in its coats; but this operation, besides being very difficult and tedious in its performance, was so rarely followed by success, that many excellent operators preferred performing amputation of the thigh. It was at this period that Mr. Hunter introduced the present practice of exposing the artery at a dis-

tance from the disease, by removing the seat of the operation to the inner part of the front of the thigh, where the femoral artery lies under cover of the sartorius muscle.

Mr. Hunter began his operation by making an incision of about three or four inches in length upon the anterior and inner part of the thigh, rather below its middle, which incision was continued obliquely across the inner edge of the sartorius muscle.† The fascia lata having been opened to the same extent as the incision of the integuments, the inner border of the sartorius muscle is exposed to view, and is then lifted to the outer side of the wound, so as to enable the operator to feel with his finger the pulsations of the artery as it lies underneath the tendinous aponeurosis, which is stretched over it from the vastus internus to the adductor muscles, and binds it down in this situation. A slight incision, about an inch long, is, in the next place, to be made through this fascia along the side of the artery, which is now exposed. In this part of its course the vein usually lies behind the artery, and the great saphenous nerve rests upon its external border. (See Plate VII. fig. 5.) The artery being disengaged from its lateral connexions, the aneurism needle should be carried carefully round it, from within outwards, so as to avoid as much as possible doing any injury to the coats of the vein. The artery only having been included in the ligature, it is to be secured by the usual knot, and one end of the thread cut away; after which the edges of the wound are to be brought neatly into apposition with each other by means of a few strips of adhesive plaister, aided, perhaps, by a couple of sutures.

With the view of avoiding any injury to the saphena vein, and the numerous lymphatic vessels which run alongside of it, many surgeons have since recommended that the femoral artery should be exposed by making the incisions on the outer side of the sartorius muscle; but in this mode of performing the operation there is a greater liability to err in the search for the artery, by falling upon the fibres of the vastus internus muscle, which have been mistaken for those of the sartorius.

The objections which have prevailed against Mr. Hunter's operation, in favour of that proposed at a later period by

† *Vide* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge; 8vo. Lond. 1793; vol. i. p. 148.

Scarpa, are, that the femoral artery is less easily found lower down than in the upper third of the thigh, where it lies almost subcutaneous; and that the disturbance of parts, which is necessarily created by the lifting up of the sartorius muscle, and opening into the strong tendinous sheath of the vessels, is frequently followed by extensive and long-continued suppurations in the course of the vessels, which on several occasions have been productive of secondary hemorrhage, from ulceration of the coats of the artery where they are embraced by the ligature: in addition to these objections it may also be reasonably urged, that it is more advisable to go still farther from the seat of the disease, for the cure of which the operation is performed, since the coats of the artery are much less likely to be affected there than lower down.

Scarpa's operation.—Throughout the upper third of the thigh the femoral artery runs very superficially, so that its pulsations may be distinctly felt on pressing with the fingers from the crural arch downwards to the point where it is crossed by the sartorius muscle, which is usually about four inches below the lower edge of Poupart's ligament. (See Plate VII. fig. 2.) A little above this spot the artery is easily reached, and may be tied with great facility, without removing the sartorius from its natural situation. Besides, at this place the ligature may be applied at a sufficient distance below the origin of the profunda artery, without any risk of the current of blood, which circulates through that great and important branch, proving a hinderance to the formation of the clot, or preventing the union of the opposite sides of the tied artery. It may be added, also, that there is every reason for believing that the ligature will be applied where the coats of the artery are healthy.

In this operation the first incision should be begun at about an inch and a half or two inches below Poupart's ligament, and carried vertically downwards for three inches; dividing the skin and the superficial fascia of the thigh. If the anterior saphena vein should present itself, it may be withdrawn to the inner side of the wound. The next incision divides the fascia lata, which may be done, according to the choice of the operator, with the hand unsupported, or upon a director introduced underneath it by a small opening at the centre of the wound. If it be necessary, from its unusual breadth, the inner edge of

the sartorius muscle may be drawn a little to the external side of the wound, after which the sheath of the vessels, covered by a thin layer of fascia, will be exposed to view, when, a small portion of it being lifted up between the blades of the forceps, it may be opened to the extent of about an inch, so as to admit of the needle being safely carried round the artery, without injury to the vein or nerve which lie upon either side of the vessel. After the ligature has been tied, one of its ends should be cut off, to promote the immediate union of the sides of the wound. The edges of the incision should be brought together, with or without the use of sutures, as may be considered most expedient, so as to obtain, if possible, the cure of the greater part of the wound by the first intention.

The operation of placing a ligature upon the common femoral artery.—To place a ligature upon the common femoral artery, between the lower border of the crural arch and the origin of the profunda, a small external incision will suffice, as the vessel lies almost subcutaneous in this part of its course. The patient is to be placed upon his back, and the thigh turned a little outwards, with the knee slightly bent; the surgeon, after having determined the situation of Poupart's ligament, commences his first incision a few lines above it, and continues it downwards over the course of the artery for about two inches, when, taking the forceps in one hand, he dissects down to the vessel, cutting through the subcutaneous cellular tissue, and the iliac portion of the fascia lata, pushing aside any of the lymphatic glands which may present themselves, until the sheath of the vessels is exposed, which is next to be opened to a sufficient extent to enable him to carry the needle safely round the artery, which should be done in the direction of from within outwards. If it were to happen in this operation that any of the superficial arteries were divided, it would be proper, should the hemorrhage from it continue after the ligature had been placed upon the main trunk, between the origin of the vessel and the centre of the circulation, to endeavour to secure it in the ordinary way, by placing a ligature upon the bleeding orifice; but, if this cannot be effected, another ligature must be placed upon the main trunk on the distal side of that part of the artery from which the wounded branch takes its origin.

The ligature of the external iliac artery has been found a

much more successful operation in arresting secondary hemorrhages from branches of the femoral, than that of tying the trunk of the common femoral between the lower edge of Poupart's ligament and the origin of the profunda. Mr. Hadwen mentions eight cases in which a ligature was applied to the common femoral artery, in six of which consecutive hemorrhage ensued, in four the external iliac artery was tied, and two died; leaving only two in which the ligature separated favourably.†

The ligature of the external iliac artery.—There are two methods practised of placing a ligature upon the external iliac artery; the first of these was employed by Mr. Abernethy, and the second was afterwards introduced by Sir Astley Cooper, and is now much more generally employed than the former.

Mr Abernethy's method.—The patient being placed in the recumbent posture upon the table, or a firm bed, an incision of three or four inches in length is made obliquely through the integuments, in the course of the external iliac vessels. The superior extremity of this incision will be situated about two inches from the anterior superior spinous process of the ilium, and it will terminate inferiorly a little above the ligament of Poupart. The edges of the wound being held apart, the aponeurosis of the external oblique muscle is exposed to view, and must be divided to the same extent as the external incision. In the next place, the finger is to be introduced underneath the lower edge of the internal oblique and transversalis muscles, so as to separate them from the fascia transversalis and the peritonæum, and to protect the latter while the muscular fibres are divided with the probe-pointed bistoury. An opening having been carefully made into the fascia transversalis, the finger is then passed into the bottom of the wound, and the pulsations of the artery sought for as it lies upon the inner edge of the psoas muscle. The sheath of the vessels is, in the next place, to be opened, and the ligature passed round the artery, taking care to avoid injuring the vein, which is situated upon its inner edge. This plan of performing the operation is not so generally adopted as that which has been since recommended by Sir Astley Cooper.

Sir Astley Cooper's method.—In this operation the first inci-

† *Vide* a Paper entitled "The History of a Case of Popliteal Aneurism, with Observations," by Samuel Hadwen, House Surgeon to the Lincoln Hospital, in the Med. Chir. Trans. vol. xxi. p. 318.

sion, which should be from three to four inches in length, should extend from a point situated one inch and a half above, and to the inner side of the anterior superior spinous process of the ilium, downwards in a slightly curved direction, (the convexity of the incision regarding Poupart's ligament,) to a little above the situation of the external abdominal ring. (See Plate VI. fig. 6.) By this incision the tendon of the external oblique muscle is laid bare, and must be cut through to the same extent, as likewise the fleshy fibres of the internal oblique and transversalis muscles, which may be done either upon a director introduced underneath them as they lie obliquely across the upper part of the inguinal canal, or with a probe-pointed bistoury guided upon the finger. The fascia transversalis is now to be opened near the upper part of the wound, as the peritonæum is less closely attached to it there than below; this opening is to be enlarged downwards with great care, lest the peritonæum should be in any way injured either by the edge of the knife, or by being torn by the finger. An assistant is directed to retract the superior edge of the wound, and along with it the great bag of the peritonæum and the spermatic cord, so that the surgeon may the more easily see the artery as it lies upon the inner edge of the psoas muscle, external to the vein. In many cases it is necessary to divide with the point of the knife a dense fascia which crosses over the vessels in this situation, and binds them down to the fascia iliaca, before the attempt to pass the needle round the artery can be safely made. The needle should be carried round the artery from within outwards, on account of the position of the vein, which lies upon its inner edge. If the genito-crural nerve be seen in this operation, as it lies upon the sheath of the external iliac vessels, it would be proper to hold it aside, so as to exclude it from the ligature. It should also to be recollected, that the epigastric artery may be wounded if the incision be carried too freely inwards towards the linea semilunaris,—an accident which occurred in one of the operations performed by Dupuytren.†

It is alleged by those who adopt Mr. Abernethy's plan of operating, that they can apply the ligature higher up on the artery than by pursuing the method recommended by Sir Astley

† See Mr. Cooper's Dictionary of Practical Surgery; 7th edit. p. 157.

Cooper; but this advantage, if it do really exist, which is subject to dispute, is counterbalanced by the greater risk of wounding the peritonæum, which is much more extensively disturbed in the former than in the latter operation. As a rule, the ligature should be placed, in either operation, at such a distance above the origin of the epigastric artery, (for example, about an inch,) as will permit of sufficient space for the formation of a coagulum, and thus diminish the possibility of secondary hemorrhage occurring, when the ligature separates from the artery.

After the ligature of the external iliac artery, the collateral circulation of the limb is principally carried on by the anastomosing branches of the gluteal, sciatic, internal pudic, and obturator arteries, with the circumflex and profunda branches of the femoral artery, and with the articular branches of the popliteal.†

† *Vide* An Account of the Anastomosis of the Arteries at the Groin. By Sir Astley Cooper, Bart. Medico-Chirurgical Transactions, vol. iv. p. 425.

THE SURGICAL ANATOMY

OF

THE POPLITEAL REGION.

The Popliteal Region, sometimes denominated the Ham, is a space of considerable extent situated behind the knee-joint, and may be described as including within its limits the lower third of the thigh, and the superior fourth of the leg.

When the muscles of the back part of the leg and thigh have been dissected, the popliteal region presents a lozenge-shaped figure, (see Plate VIII,) which is divided into two unequal portions by a line carried transversely across the space, opposite the flexure of the knee-joint. The superior division of the region is a little larger than the inferior, for it extends as high as the point where the fleshy belly of the biceps flexor separates from the semi-tendinosus and semi-membranosus muscles, (with which it had previously lain in close apposition, from their common point of origin at the tuberosity of the ischium,) to descend obliquely outwards to its insertion into the head of the fibula. (See Plate VIII. fig. *a*.) The inferior portion of the space is, when viewed externally, of rather smaller extent, as it is limited inferiorly by the junction with each other of the two heads of the gastrocnemius muscle. (See Plate VIII. figs. *e*, *f*.) When regarded more deeply, the popliteal region extends from the triangular-shaped opening in the triceps adductor muscle, as far downwards as the inferior edge of the popliteus muscle.

The ham or popliteal region is bounded superiorly, and externally, by the biceps (fig. *a*); and lower down by the external condyle of the femur, the outer head of the gastrocnemius and the plantaris muscle (fig. *f*, +); superiorly and internally by the semi-tendinosus, semi-membranosus, and gracilis muscles (figs. *b*, *c*, *d*); internally and inferiorly by the inner head of the gastrocnemius and the internal condyle (figs. *e* and *g*); posteriorly by the skin and fascia lata; and anteriorly by the posterior flat surface of the lower third of the femur, the back part of the knee-joint, and the popliteus muscle. Occupied by a large quantity of adipose substance, it contains, in addition, the popliteal nerve, vein, and artery, with their branches, which are numerous, and of considerable importance (figs. *h*, *i*, *k*, *l*, and *m*).

Dissection of the popliteal region.—The subject should be laid upon its face, with the lower limbs hanging down over the edge of the table; if it should be required, the trunk of the subject may be additionally elevated by placing a large block of wood underneath the belly.†

The first incision, for the dissection of the popliteal region, may be made in a perpendicular direction, along the inner border of the limb, commencing about five inches above the knee-joint, and terminating about four inches below it; from each extremity of this incision another cut is to be made at right angles to it, and extended across, in a transverse direction, to the opposite border of the limb. When the flap of skin, which has been thus marked out, has been raised, with the subcutaneous layer of adipose tissue (the *superficial fascia* of some writers), and reflected outwards, that portion of the fascia lata of the thigh which covers in the cavity of the ham will be exposed to view. In the popliteal region the fascia lata is extremely strong and resistant, being composed of numerous dense transverse fibres, which are greatly fortified by the aponeurotic expansions of the tendons of the ham-string muscles. The principal set of the fibres of this portion of the fascia lata run in an oblique direction downwards and inwards, and are interwoven with numerous

† Previously to commencing the dissection of the popliteal region, it is recommended that the veins should be injected with some coloured wax or tallow injection, which is easily done from pipes inserted into the posterior saphena vein, and the venæ comites of the posterior tibial artery, as they are passing behind the ancles.

others, leaving between them several small openings, by which some filaments of the middle posterior cutaneous nerve of the thigh (a branch from the smaller sciatic nerve) emerge, to ramify in the integuments of the ham.

When the fascia lata has been examined, it is to be dissected off from the muscles, and reflected in the same manner as the integuments; in doing which the branches of the middle posterior cutaneous nerve may, by a little care, be preserved. This nerve descends in the mesial line close underneath the fascia lata, and may be traced for a considerable distance upon the calf of the leg in company with the posterior saphena vein, which should also be preserved, where it ascends between the fascia of the leg and the belly of the gastrocnemius muscle, to join with the popliteal vein, by dipping deeply down into the ham between the two heads of that muscle. (Plate VIII. fig. *n*.)

The fascia lata having been reflected, the several muscles which bound the popliteal region on each side are exposed to view: on the inner side are seen the semi-tendinosus (fig. *b*), semi-membranosus (fig. *c*), and gracilis (fig. *d*) muscles, together with the internal head of the gastrocnemius (fig. *e*); on the outer side are seen the two portions of the biceps flexor muscle where they unite to join with the common tendon (fig. *a*) by which they are attached to the head of the fibula, and a little lower down, and inclosed by it, is the external head of the gastrocnemius muscle (fig. *f*). The fleshy and tendinous fibres of each of these muscles should, in the next place, be neatly displayed by removing the thin fascia by which they are covered, preserving, at the same time, the small vessels and nerves which supply them.

The large quantity of adipose substance which occupies the interspace between the muscles of the ham, should now be cautiously removed, in order to exhibit the great sciatic nerve, which ordinarily divides, near the superior angle of the popliteal region, into its two principal branches, the posterior tibial and peronæal nerves (figs. *h*, *i*, *k*); from both of which numerous filaments proceed to be distributed to the integuments of the leg and foot, and to the muscles of the calf of the leg. Two of the cutaneous branches have received names, one of them being denominated *nervus communicans tibialis*; this nerve will be found lying alongside of the posterior saphena vein deeply in the

cleft between the heads of the gastrocnemius muscle. (Plate VIII. fig. 3.) The other, *nervus communicans fibularis*, (Plate VIII. fig. 5,) is given off from the peronæal nerve, as it is descending alongside of the inner edge of the tendon of the biceps muscle, between it and the external head of the gastrocnemius. (Plate VIII. fig. 4.) These branches converge in their descent, and unite with each other a little below the middle of the calf of the leg; after which the common trunk so formed may be traced, having pierced the fascia in company with the posterior saphena vein, behind the outer ancle, and along the external border of the foot, to the skin covering which, and the three or four external toes, it distributes numerous branches; one of these is not unfrequently found to join with a branch of the internal saphena, and also with the anterior tibial nerve upon the dorsum of the foot.

A little deeper in the cavity of the ham, and somewhat nearer to the mesial line than the posterior tibial nerve, will be found the popliteal vein (fig. *l*), which is closely connected to the outer cellular coat of the popliteal artery, along the external and posterior edge of which it is placed. Sometimes the popliteal vein is double, and then the artery is situated between the two trunks, and is crossed at various points by smaller veins which connect them together; a circumstance which is worthy of being remembered, as it might otherwise prove a source of embarrassment in the operation of placing a ligature upon the popliteal artery.

The popliteal artery (fig. *m*) lies deeply in the centre of the popliteal space, and much closer to the surface of the bone than either the nerve or vein; in exposing it the knife should not be used too freely on either side, lest the articular branches, which spring from the main trunk at right angles to its course, should be cut across. (See Plate VIII. figs. 1 and 2.) It is also advisable, in this stage of the dissection, that the muscles which bound the popliteal region on each side should be relaxed, so as to admit of being drawn more widely apart, which may be easily done if the lower part of the limb be raised by bending the knee-joint; by so doing, much more room, and greater freedom to use the knife with safety to the smaller branches of the artery, will be gained, than if the limb were to remain extended as before. These directions having been executed, and all the adi-

pose substance removed, the cavity of the ham will be completely exposed to view, and an accurate and just idea of its great depth, and of the exact relation which the several important structures contained within its limits bear to each other, and to the bones which form the knee-joint, obtained. (See Plate VIII.) To complete the dissection of the popliteal region, the internal head of the gastrocnemius must be detached from its connexions to the inner condyle of the femur (fig. *g*), and reflected downwards and outwards; after which the lower part of the artery can be easily dissected, and the inferior muscular and articular branches traced to their respective distribution.

The muscles of the back part of the thigh connected with the popliteal region.—The *biceps flexor cruris* arises by two heads, one of which is much longer than the other, and is attached to the outer surface of the tuberosity of the ischium; the short head is fixed to the linea aspera of the femur, between its inferior extremity and the insertion of the glutæus maximus muscle. The two portions of the muscle unite with each other a little above the knee-joint, and soon end in a tendon, which is inserted into the upper and outer surface of the head of the fibula, covering, at the same time, the external lateral ligament of the knee-joint. The structure of the muscle is fleshy, except at its origin from the tuber ischii, and at its insertion, which are tendinous. Relations—posteriorly with the glutæus maximus muscle, and the fascia lata; anteriorly, with the sciatic nerve, the adductor magnus muscle, the external articular arteries, the gastrocnemius externus, and the outer condyle of the knee-joint; the peronæal nerve is situated along the inner side of its tendon. This muscle forms the outer hamstring.

The *semi-tendinosus* is attached superiorly to the posterior surface of the tuberosity of the ischium, and is also connected with the tendon of the biceps for about two inches below that point; near the commencement of the lower third of the thigh the muscular fibres end in a long round tendon, by which it is inserted into the inner border of the tibia, about two inches below the knee-joint. Superiorly, the structure of the muscle is fleshy; inferiorly, it is tendinous. Relations — posteriorly with the biceps and fascia lata, and anteriorly with the adductor magnus and semi-membranosus, upon the latter of which it rests in the lower part of the thigh, and behind the knee-

joint; the expanded tendon of the sartorius muscle conceals its insertion into the tibia.

The *semi-membranosus* arises from the tuberosity of the ischium, between the preceding muscles and the quadratus femoris, and is inserted into the inner and back part of the head of the tibia, where it gives off a process, which is reflected obliquely upwards and outwards upon the posterior ligament of the knee-joint and is finally attached to the external condyle of the femur. The muscle is fleshy in its middle, but tendinous at its extremities. Relations — anteriorly, with the quadratus femoris and adductor magnus muscles, the popliteal artery and vein, the internal articular arteries, and inner condyles of the knee-joint; posteriorly, with the biceps and semitendinosus muscles and the fascia lata; internally, with the sartorius and gracilis muscles; and, exernally, with the great sciatic nerve. This, with the preceding muscle, forms the inner hamstring.

The first incisions in the operation of tying the popliteal artery, should be made along the external edge of this muscle.

The *gastrocnemius* arises superiorly by two heads, which are attached to the upper and back part of the condyles of the femur, and to the two diverging lines into which the linea aspera is divided inferiorly; the fibres of the muscle converge as they descend, and become blended with each other at the upper part of the leg, where they form a thick fleshy mass resting upon the soleus muscle, with which they are inserted into the tendo Achillis, which connects them with the under and back part of the os calcis. The internal is rather larger than the external head of the muscle. The structure of the gastrocnemius is fleshy and aponeurotic superiorly, fleshy in the centre, and tendinous inferiorly. Relations—posteriorly, with the skin and fascia of the leg, the communicating branches of the posterior tibial and peronæal nerves, and the posterior saphena vein; anteriorly, with the capsular and synovial ligaments of the knee-joint, (a delicate bursa mucosa usually intervening,) the popliteal vessels and nerves, and the plantaris, soleus, and popliteus muscles. The two heads of the gastrocnemius are included superiorly between the hamstring muscles, the peronæal nerve lying in the groove between the tendon of the biceps and the external head.

The *plantaris* is a very small muscle, which lies between the

gastrocnemius and soleus. The fleshy fibres of the muscle are not more than two inches in length; and, taking their origin from the capsular ligament of the knee-joint covering the posterior surface of the external condyle, soon end in a long and delicate tendon, which descends obliquely from without inwards to its insertion into the inner part of the os calcis by the side of the tendo Achillis: the plantaris muscle is not unfrequently absent, or partially deficient.

The popliteal artery.—The superficial femoral artery assumes, as it enters the cavity of the ham after passing through the opening in the triceps adductor, the name of the *popliteal artery;* which appellation it retains until it has reached as far as the lower border of the popliteus muscle, where it terminates by dividing into two large branches,—the anterior, and posterior tibial arteries. The popliteal artery thus extends from the commencement of the inferior third of the thigh to below the superior fourth of the leg, and its length may be estimated in the adult at about seven inches. The direction of the course of the vessel is at first slightly oblique, downwards and outwards, (see Plate VIII. fig. *m*,) until it gains the deep hollow between the condyles of the femur; after which it runs vertically downwards to its termination.

Relations.—The popliteal artery corresponds by its anterior aspect with the flat surface of the lower part of the femur, the posterior ligament of the knee-joint, and the popliteus muscle; from which structures it is only separated by a thin layer of loose adipose substance, which enables the artery to accommodate itself more readily to the various and extensive motions of the articulation behind which it is situated. The popliteal artery is covered, posteriorly, by the large mass of fat which occupies the greater part of the popliteal cavity, and by the skin and fascia lata. The popliteal vein lies along the posterior and external edge of the artery, to the outer coat of which it is very closely connected by the dense cellular tissue which forms here the sheath of the vessels. The sciatic nerve is much more superficial than either the artery or vein; and is, moreover, placed somewhat external to them both, except towards the lower part of the ham, where its internal division, the posterior tibial nerve, is situated directly behind the vessels. (Figs. *h*, *i*, *k*, *l*, *m*.) By its internal border, the popliteal artery is in relation with the semi-membranosus muscle, which slightly overlaps it in the first part of its course; so that it is requisite that

this muscle should be drawn a little aside (towards the inner border of the limb) in the operation of tying this part of the vessel: more inferiorly, it is in relation with the internal condyle of the femur, and the inner head of the gastrocnemius muscle.

The short head of the biceps flexor, the plantaris, and the external division of the gastrocnemius muscles, with the outer condyle of the femur, are in relation with the external border of the artery.

Branches of the popliteal artery.—The popliteal artery furnishes several branches to the structures which lie adjacent to it; some of which have received names, and are deserving of more particular attention, both on account of their size, and, more especially, as they constitute the principal medium by which the collateral circulation of the limb is carried on when the main trunk has been obliterated, as after the operation for the cure of popliteal aneurism, &c. These branches are, 1st, *rami articulares superiores;* 2nd, *rami articulares inferiores;* 3rd, *ramus azygos*, vel *articularis medius;* 4th, *rami surales.*

1. *Ramus articularis superior externus.*—This branch leaves the trunk of the popliteal artery at a right angle, and immediately afterwards inclines outwards to pass between the biceps flexor muscle and the bone, just above the external condyle of the femur. After distributing a few branches to the external head of the gastrocnemius, biceps, and vastus externus muscles, it divides into numerous ramusculi, which spread over the outer and front surfaces of the knee-joint, where they freely anastomose with the branches of the inferior perforating and external circumflex arteries superiorly, and with those of the inferior external articular and anterior tibial recurrent arteries inferiorly. (Plate VIII. fig. 1.)

2. *Ramus articularis superior internus* arises from the inner side of the popliteal artery, and, running towards the internal border of the limb, passes between the bone and the tendons of the semi-tendinosus, semi-membranosus, and adductor magnus muscles, just above the inner condyle of the femur; after which it soon divides into a numerous lash of branches, which form a vascular network upon the inner side and front of the knee-joint, when they anastomose with the branches of the anastomotica magna and inferior articular arteries, as well as with the corresponding vessels of the opposite side. (Plate VIII. fig. 2.)

Besides these branches, the popliteal artery furnishes several

others to the flexor muscles as they are placed on each side of the upper part of its course through the ham. They are sometimes named the *rami musculares superiores.*

3. *Ramus articularis medius* vel *azygos.*—This is a very small branch, which arises from the anterior surface of the popliteal artery near the centre of the back part of the knee-joint; it pierces the fibres of the posterior ligament, and is distributed to the crucial ligaments and synovial membrane of that articulation.

4. *Ramus articularis inferior internus* arises from the popliteal artery low down in the cavity of the ham, and, after passing between the internal head of the gastrocnemius and the popliteus muscle, takes its course inwards and forwards between the internal tuberosity of the tibia and the internal lateral ligament of the knee-joint, where it is also covered by the tendons of the semi-membranosus, semi-tendinosus, and gracilis muscles. Its branches freely anastomose, upon the front and lateral surface of the knee-joint, with the articular arteries of the opposite side, and with the branches of the superior internal articular artery.

5. *Ramus articularis inferior externus* takes its origin from the outer side of the popliteal artery immediately below the flexure of the knee-joint; it then inclines obliquely downwards and outwards, and, passing underneath the plantaris and external head of the gastrocnemius, as also the external lateral ligaments of the knee-joint, divides into numerous small branches, which inosculate freely with the vascular plexus which is formed by the branches of the other articular arteries upon the sides and front of the knee.

6. *Rami surales* vel *musculares inferiores.*—The popliteal artery, after giving off the articular arteries, supplies several large branches, on each side, to the muscles of the calf of the leg; viz. the popliteus, plantaris, soleus, and gastrocnemius, amongst the fibres of which they descend for a considerable distance below the knee.

These arteries usually require to be secured with the ligature after amputations of the leg below the knee, particularly when the circular method is that which has been employed.

Varieties of the popliteal artery.—Few arteries are less liable to variation in their size and course than the popliteal artery: nevertheless, instances are occasionally met with, in which the division of the principal trunk takes place much higher up in the popliteal region than is usual; so that the

anterior and posterior tibial arteries commence their course between the condyles of the femur, instead of opposite the lower border of the popliteus muscle.† Portal states having seen two arteries of equal size in the ham, which resulted from a high division of the femoral artery.†

The popliteal vein.—The popliteal vein is formed by the junction with each other of the venæ comites of the anterior and posterior tibial arteries; it ascends through the ham, lying at first behind the artery, but as it approaches the opening in the triceps it gradually inclines towards its posterior and external edge. The coats of this vein are extremely thick and strong; and it is so closely connected with the artery, to the external border of which it clings by means of the small contributory branches which open into it, and which correspond with the branches of the popliteal artery, that much caution is required to carry an aneurism needle safely round the latter vessel without including the vein, or doing some injury to its coats by the point of the instrument. In the operation of placing a ligature upon the popliteal artery, it is advisable to pass the needle around the vessel from without inwards; as the point of the instrument is much less likely to injure the vein when it is carried round the artery in this direction than in the opposite course.

Very frequently there are two popliteal veins, and then the artery is situated between them, and is crossed at various points by several small branches of communication, which pass from one venous trunk to the other.§

The popliteal vein receives several small branches as it ascends through the popliteal space, the chief number of which correspond with the branches given off from the artery. The posterior saphena vein usually empties itself into the popliteal vein, dipping down between the heads of the gastrocnemius muscle; though occasionally it will be found to take a different course, and, instead of opening into the popliteal vein, to continue to ascend through the ham underneath the fascia lata,

† Dr. Ramsay has given a drawing of a preparation, in which the anterior tibial artery runs between the popliteus muscle and the back part of the knee-joint. In that case the popliteal artery divided between the condyles of the femur. Also, a System of Operative Surgery, by Wm. Hargrave, p. 86.

‡ M. Portal, Anatomie Médicale, tom. iii. p. 326.

§ *Vide* the Lancet for 1837, p. 905.

and then, after piercing the fibres of the adductor magnus muscle, to terminate in one of the contributory branches which unite to form the vena profunda femoris.

Lymphatic vessels and glands. — Numerous lymphatic vessels pass through the popliteal region, some of which come from the superficial lymphatics of the back part of the leg and foot, and reach the ham by taking a similar course to the posterior saphena vein. The deep-seated lymphatics are those which ascend in company with the three sets of deep-seated veins, which, by their junction with each other, form the popliteal vein. The lymphatic vessels in the ham are very numerous, and pass through four or five absorbent glands, which are placed on different sides of the popliteal vessels, to the coats of which they are intimately coherent.

These glands sometimes enlarge, and form solid tumours, which may, by their pressure upon the vessels and nerves, produce painful sensations, with edema of the leg and foot; they may also, from the same circumstance, receive a pulsatile motion from the artery as it lies underneath them, and thus render it difficult to distinguish clearly between a swelling in the popliteal region from this cause, and an aneurismal dilatation of the coats of the artery itself. The lymphatics of the popliteal region, after passing through the glands which lie upon the vessels, ascend along with the femoral artery and vein to the glands of the groin; which circumstance renders it necessary to examine carefully the condition of the glands of the inguinal region and iliac fossa before it is determined to amputate the thigh for diseases in the ham which may be suspected to be of a malignant nature, lest, after the operation has been submitted to, the patient may suffer from a return of the affection nearer to the trunk of the body.

EXPLANATION OF PLATE VIII.

This plate represents the popliteal region when the dissection of the muscle, and vessels which it contains within its limits, has been completed.

a. The biceps flexor cruris muscle, which forms the external boundary of the ham.

b. The semi-tendinosus muscle where it rests upon

c. the semi-membranosus muscle; they form the inner hamstring muscles.

d. The tendon of the gracilis muscle.

e. The internal head of the gastrocnemius.
f. The external head of the same muscle.
g. The internal condyle of the femur.
\+ The posterior flat surface of the lower part of the femur.
h. The great sciatic nerve, before it divides into its two principal branches,
i. the peroneal nerve, and
k. the posterior tibial nerve.
l. The popliteal vein, which receives the posterior saphena vein (*n*), which joins with it by dipping between the heads of the gastrocnemius muscle.
m. The popliteal artery, which here lies upon the posterior flat surface of the inferior third of the femur (+).
n. The posterior saphena vein.
o. The integuments of the back part of the thigh.
p. The integuments of the calf of the leg.
1. The superior external articular artery.
2. The superior internal articular artery.
3. The *nervus communicans tibialis*.
4. The continuation of the posterior tibial nerve.
5. The *nervus communicans fibularis*.

OF SOME OF THE DISEASES WHICH OCCUR IN THE POPLITEAL REGION.

Abscess in the ham.—In the early stages of this disease it is not always possible to determine with certainty what may be the cause of the symptoms; but, when matter has formed, its presence will be indicated by the swollen state of the integuments, which are also more red and hot than is natural. This inflammatory swelling of the integuments and subcutaneous layer is circumscribed, and, at the same time, pits upon pressure. The patient suffers much from pain in the part, which obliges him to keep the knee in the bent position to obtain any relief. The sense of fluctuation is frequently very obscure, on account of the contents of the abscess being so firmly bound down by the fascia lata. The history of the case,—joined with the unnatural increase of heat and redness of the part,—the febrile excitement,—and the absence of the characteristic pulsation, are sufficient to distinguish the case from one of aneurism of the popliteal artery. The abscess should be opened early, and very freely; and the limb must be placed in the straight position as soon as the patient can bear it, in order to prevent the tendency to perman-

ent contraction of the knee-joint, which frequently follows the healing of abscesses in this situation.†

The matter which forms from disease within the pelvis, as in some cases of lumbar abscesses, may find its way down the back part of the thigh in the loose cellular tissue between the flexor muscles, and thus make its appearance externally in the ham.‡

Disease of the bursæ mucosæ.—Sometimes the synovial bursæ which are connected with the tendons of the flexor muscles of the thigh become diseased, and form tumours in the ham of very various magnitude and consistence. I recollect very well a tumour of this nature which was extirpated from the ham of a young woman who was admitted some years ago into the hospital of Newcastle-upon-Tyne: the patient appeared to be doing very well for a short time after the operation, when the knee-joint suddenly became affected; which rendered it afterwards necessary to perform amputation of the thigh, which was soon followed by the death of the patient. M. Velpeau mentions his having successfully removed tumours of this nature from two persons during his attendance at the hospital of La Pitié.§

Sarcomatous tumours.—Firm and hard tumours of a fibrous, or fleshy structure are occasionally developed in the ham, and in

† The following case of abscess of the ham will serve to illustrate the description given above:—William Halliday, aged 57, was admitted into the College Hospital under the care of Mr. Cooper, in November 1835, on account of a painful tumour in the ham. "On examination there is a deep-seated swelling of the soft parts behind the knee-joint, with an edematous state of the integuments covering the swelling, and which are also of a dusky red colour; the redness disappearing under pressure, but returning as soon as it is removed. The surface of swelling also pits upon pressure with the points of the fingers. An unnatural degree of heat is perceptible when the hand is closely applied over the swelling; at the same time, an obscure sense of fluctuation is to be felt on a close examination of the part with both hands. The disease is of a fortnight's duration, and has gradually attained to its present state. The patient experiences much pain, is unable to walk, and is obliged, for the sake of the relief which it affords him, to keep the knee bent." The swelling was laid freely open by a long and deep incision, and about a pint of healthy-looking pus discharged.

For similar cases see Anat. Chirurgicale, par M. Velpeau, tom. ii. 582-3.

‡ *Vide* Traité Complet d'Anatomie Chirurgicale, par M. Velpeau, 3rd edit. tom. ii. p. 553; 8vo. Paris, 1837.

§ *Vide* Op. citat. tom. ii. p. 569, 3rd edit.

some instances appear to originate from disease in some of the lymphatic glands which lie in contact with the sheath of the vessels. Upon other occasions they have been found to have taken their origin from the cancellated structure of the spongy heads of the bones forming the articulation of the knee-joint. Some of these tumours may present the appearance of osteo-sarcoma, inasmuch as there are sometimes numerous spiculæ deposited within their substance. These tumours are at the first deep-seated, being situated between the great vessels and the bones which form the knee-joint, so that they cannot be extirpated, except by amputation of the thigh; which, however, should not be had recourse to if the inguinal glands be diseased.

Sir Charles Bell met with a case in which a large tumour had formed in the substance of the posterior tibial nerve, after a blow upon the back part of the thigh; the patient died, exhausted by the continual sufferings which he had endured for two years.†

Popliteal aneurism.—Aneurism of the popliteal artery is, perhaps, of more frequent occurrence than that of any other artery in the body, the aorta being excepted. In the greater number of instances it would seem most probable that the affection is produced in consequence of the coats of the artery, which have lost their natural appearance and elasticity from disease, giving way under the influence of some violent strain, or sudden motion of the knee-joint, behind which it is so closely applied; and hence it is that we find that the disease in question has been most frequently observed in persons who are in the constant habit of making long-continued and violent exertions of the muscles of the lower extremities, such as grooms, coachmen, porters, troopers, and others.‡ In some few instances, aneurism of the popliteal artery has been produced by wounds of the coats of this vessel from the point of a sword;§ or by injury from a musket-ball, as it crossed the region of the ham.‖ Sir Charles Bell relates a case in which it was caused

† Bell's Oper. Surg. vol. ii. p. 232.

‡ For cases of this kind see the Med. Chir. Trans. vol. viii. p. 492; and vol. ix. p. 411: also Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge; London, 1793; vol. i. p. 142.

§ *Vide* Principles of Surgery. By John Bell, vol. i. p. 328.

‖ First Lines of the Practice of Surgery; 6th edit. p. 155.

by the ulceration of the coats of the artery, which was pressed upon by the sharp edge of the inferior fragment of the thigh-bone, which had been broken in its lower third, a little above the condyles.† From the close connexion with one another of the popliteal vein and artery, a venous aneurism may be produced in the ham, instances of which have been related by several surgeons.‡

The aneurism of the popliteal artery is seldom brought under the notice of the surgeon until it has made considerable progress, since, from the great depth at which the affected vessel lies, and from the yielding nature of the structures which are adjacent to it on either side, the swelling must attain a certain magnitude before it forms any tumour externally and attracts the attention of the patient.

In the commencement of the disease a small swelling is felt, deeply seated in the ham, when the fingers are pressed forcibly into the hollow between the tendons of the flexor muscles of the knee; the tumour, when it is grasped between the fingers, throbs violently, and is felt to dilate at each pulsation of the artery at the bend of the groin: the pulsation in the tumour can be arrested at pleasure, by making pressure upon the femoral artery in a degree sufficient to interrupt the flow of the current of blood through it. The swelling in the ham continues to increase, sometimes very slowly; at the same time that its pulsations become stronger, and more perceptible to the fingers, to which they communicate a thrilling sensation. There is now a feeling of heaviness and numbness in the limb, with frequent cramps and throbbing pains in the part affected, and extending downwards to the leg and foot, in consequence of the pressure which the tumour begins to exercise upon the large branches of the great sciatic nerve. When the tumour is firmly grasped in the hand, its whole bulk seems to be dilated at each impulse of the heart, and, if sufficient pressure be made upon the artery in the bend of the groin, the size of the tumour will be perceived to undergo a very sensible diminution; but it quickly, though gradually, regains it former bulk as soon as the pressure upon the femoral artery has been removed, and

† Engravings of the Arteries, by Charles Bell; royal 8vo. London, 1824; 4th edit. p. 53.

‡ Eléments de Médecine Opérat. par M. Velpeau, tom. i. p. 149.

the current of the blood again allowed to flow on uninterruptedly.

When the ear is applied over the swelling, a loud *bruit de soufflet* is generally heard, and at the same time the head of the auscultator is lifted up at each action of the heart.

Thus far the aneurism may be said to be of moderate size, and to constitute a well-marked example of the *circumscribed false aneurism* of the popliteal artery, and is a favourable case for the interference of the surgeon, who may proceed to ligature the superficial femoral artery with every prospect of success.

As the tumour enlarges, the pain which is experienced by the patient becomes more and more severe, and he is no longer able to extend the limb as before, nor to walk without limping, on account of the bent position in which he is compelled to keep the knee for the sake of relief from the painful sensations which this position is capable of affording. There is great variation in the length of time during which an aneurism of the popliteal artery remains circumscribed: in some instances it has been known to remain, without any change, for many months; while, in others, the whole of the muscles and cellular tissue of the leg and thigh have been infiltrated and gorged with blood in as many weeks from the first appearance of the disease. If from the neglect of the patient, or from any other cause, the disease be permitted to pursue its course unchecked by art, then the swelling commonly becomes larger and much harder than before; its pulsation becomes more feeble, and is perceived with much greater difficulty, nor can the bulk of the tumour be diminished, as before, by pressure upon the artery at the groin.† The temperature of the limb below the knee is lowered, and the skin covering the tumour loses its natural colour, and becomes livid, threatens to slough, which in the end does actually take place, and, as the eschar cracks and loosens,

† There is a very interesting and instructive case recorded by Mr. Lawrence in the 8th vol. of the Med. Chir. Trans. of London, in which a popliteal aneurism was mistaken for a large and rapidly increasing fleshy tumour, and the leg amputated. Previously to the performance of the operation, Mr. Lawrence plunged an abscess lancet into the softest part of the tumour to the whole depth of the blade, without giving issue to any fluid. On examination of the limb after its removal, the tumour was found to have been formed by a popliteal aneurism, containing an immense mass of firm bloody coagulum.—*Vide* the Med. Chir. Trans. Lond. vol. viii. p. 497.

hemorrhage ensues, which is repeated from time to time, until the patient sinks under the continued loss of blood, unless the art of the surgeon, successfully employed, rescues him from the imminent danger which constantly hovers over him when the disease has attained to this advanced stage. In these protracted cases, the bones which form the knee-joint are frequently deprived of their periosteum, and become carious,—the ligaments diseased,—the popliteal vein obliterated, —and the nerves and muscles greatly altered from their natural appearance and structure—by the constant and increasing pressure of the tumour; so that the only remedy which can be proposed for the relief of the sufferer is, the speedy removal of the disease by amputation of the thigh.†

Of the operation for the cure of popliteal aneurism.—In former times (previously to the year 1785), it was the practice to lay freely open by an incision the sac of a popliteal aneurism, and, after scooping out its contents, to place a ligature upon the artery immediately above and below the aperture in its coats. Experience had, however, shown that this method was not only attended with considerable difficulty in its performance, but that it was rarely successful; and it was so frequently followed by the death of the patient from secondary hemorrhage, or from the exhaustion consequent upon the long-continued and profuse discharge from the extensive and unhealthy sore produced by the operation, or from mortification of the limb, in consequence of the destruction of the collateral vessels, that many surgeons of the greatest eminence preferred practising amputation of the limb in all such cases.‡ Indeed, in a great number of those who recovered from the operation, the knee remained permanently bent, so as to render the limb entirely useless, from the cicatrisation of so extensive a wound in the ham. It was from a consideration of these circumstances that the celebrated Hunter was led to examine this subject; an examination which terminated, by a train of the most clear and philosophical reasoning, in the introduction of the modern operation for aneurism, by which the artery is tied with facility where it is readily

† The operation of tying the superficial femoral artery, as is at the present day usually practised, for the cure of the popliteal aneurism, has been described in a preceding part of the work, to which the reader is referred.

‡ Trans. of a Society, vol. i. p. 138.—Potts' Works, by Earle, 3rd edit. vol. iii. p. 220.

got at, and where its coats are sound, leaving the aneurismal tumour to be removed by the absorbents, at the same time that the anastomosing vessels are preserved in the best condition possible for carrying on the circulation during the period which is requisite for the cure of the disease. The great merit of establishing the principles upon which the operation effects the cure of the disease, of confirming its superior advantages by numerous cases, and of procuring for it a universal adoption by the surgical profession, belongs, without the possibility of contradiction, to John Hunter.‡

The operation of tying the popliteal artery.—The patient, having been placed upon the table, should lie upon his face, with the limb extended. The first incision, which must be three or four inches in length, should be made along the external border of the semi-membranosus muscle, and should divide the skin and subcutaneous layer of adipose substance. The direction of this incision may be slightly oblique from within, outwards and downwards, so as nearly to correspond with the course of the artery as it winds round the inner and posterior surface of the lower third of the femur, to gain the interval between the condyles of that bone. The fascia lata, having been thus exposed, may be divided to the same extent as the first incision, either upon a director introduced underneath it, or with the hand unsupported. The external border of the semi-membranosus muscle is now exposed to view, and should be detached from its connexions by a few light touches with the edge of the scalpel, in order that it may be held aside by means of a blunt hook. The adipose substance which fills the popliteal region is, in the next place, to be cut through in the same careful manner, so as to lay bare the sheath of the vessels as they lie deeply underneath the edge of the preceding muscle, which, when it is largely developed, completely overlaps them. It must be recollected that the artery is situated more deeply in the cavity of the ham, and also lies more internally than the vein, with the coats of which, however, it is in very intimate contact. In many cases the great sciatic nerve is not seen in the operation as thus performed, for it is placed rather to the external side of the popliteal vessels; but if, from any cause, it should present itself under the knife, it may be withdrawn to the outer side of

‡ See the description of Hunter's operation for the cure of the popliteal aneurism, in the Transactions of a Society, &c. p. 148.

the wound by means of a retractor, or by the finger of an assistant. The sheath of the vessels having been opened to a sufficient extent (about one inch) to admit of the aneurism needle being passed around the artery, much advantage in the execution of this step of the operation will be gained by causing the knee-joint to be slightly flexed for the purpose of relaxing the hamstring muscles, which position will permit the surgeon to obtain a more distinct view of the important structures that occupy the deeper part of the ham. The aneurism needle, armed with a single ligature, should be passed from without inwards, so as more effectually to exclude the possibility of injuring the coats of the vein. The popliteal artery alone having been included in the ligature, it is to be secured in the ordinary manner.

In some persons the popliteal vein is double, and then the artery may lie between them; a circumstance which would require greater care to be exercised by the operator while carrying the needle round the artery.

The cases in which this operation may be performed are those in which a profuse hemorrhage follows a deep wound in the popliteal region, when it might be considered advisable to enlarge the original wound for the purpose of exposing the wounded vessel, and securing it by a ligature placed above and below the opening in its coats; another case is, where there is an aneurism of some of the deep-seated arteries of the leg, or repeated secondary hemorrhage from a wound of one of these, and in which it is found impossible to secure the mouth of the bleeding vessel.† Some surgeons, however, would prefer, in all such cases, performing the ligature of the superficial femoral artery, to the operation of securing the popliteal artery itself.

When we regard the great number and considerable size of the branches which are furnished from the popliteal vessels and the great sciatic nerve to the heads of the gastrocnemius, soleus, and plantaris muscles, as well as the possibility of the existence of a high division of the trunk of the popliteal artery itself, we have, I think, sufficient reasons for renouncing the operations, which are described by sytematic writers, of placing a ligature upon that vessel in the latter part of its course.

† In the spring of 1835 Mr. Cooper tied the popliteal artery with complete success, in the case of a young man who was suffering under repeated secondary hemorrhage from a deep wound in the calf of the leg.

THE SURGICAL ANATOMY

OF

THE HIP-JOINT.

This articulation is the most perfect specimen of the class of enarthroses, or ball-and-socket joints, which is found in the human body.

The globular head of the thigh-bone is maintained in the cavity of the acetabulum by means of a strong fibrous capsule and an inter-articular ligament, to which may be added the cotyloid and transverse ligaments; all of which are more or less covered by the synovial membrane which lines the interior of the joint.

The *capsular ligament* is extremely strong and thick, excepting at its internal part, where it is rather thinner and looser in its texture than at any other point. It is attached superiorly, around the greater part of the outer margin of the acetabulum, to the periosteum and rough surface of the bone; but over the cotyloid notch its fibres are implanted upon the transverse ligament. Inferiorly it is fixed in front into the anterior inter-trochanteric line, and posteriorly into the neck of the femur, at the distance of two or three lines from the oblique ridge which extends on the back part of the bone between the trochanters.

The capsular ligament of the hip-joint is greatly strengthened in front by a thick band of dense fibres, which pass in a radiated manner from the anterior inferior spinous process of the ilium to the anterior inter-trochanteric line into which they are inserted. These fibres are sometimes called the ilio-femoral ligament.†

The *ligamentum teres* is not perfectly round in the whole of its extent; as, at the extremity where it is attached by two divergent processes to the opposite margins of the cotyloid notch, it is rather flattened and of a triangular figure; towards its centre,

† Ligamentum accessorium anticum.

and other extremity, by which it is fixed into the fossa or pit upon the inner surface of the head of the femur, it is round.

The *cotyloid ligament* is a triangular-shaped band of fibro-cartilaginous fibres, which are arranged in a spiral manner around the osseous margin of the acetabulum, which they serve to deepen; these assist, by embracing closely the head of the femur, in retaining it more firmly within its socket. The external and internal surfaces of the cotyloid ligament are covered by the synovial membrane of the hip-joint. A portion of this ligament may be said to be stretched across the cotyloid notch, and has therefore been named the *transverse ligament.*

The *synovial membrane* of the hip-joint invests the globular head and greater part of the neck of the thigh-bone, from which it is reflected upon the internal surface of the capsular ligament, and thence over the cotyloid ligament into the acetabulum, furnishing at the same time a process which encases the round ligament.

A large mass of fatty substance is situated in the notch at the bottom of the acetabulum, between the synovial membrane and the bone; its probable use is to diminish the friction between the articulating surfaces of the bones forming the hip-joint.†

The ligamentous structures of the hip-joint receive their principal supply of blood from some small branches of the obturator and internal circumflex arteries, which enter into the articulation by passing through the cotyloid notch underneath the transverse ligament. One of these vessels furnishes a delicate twig, which reaches the cancellated structure of the head of the thigh-bone by running along in the centre of the round ligament.

Several small filaments of the obturator nerve are distributed to the ligaments and synovial membrane of the hip-joint.

The external surface of the capsular ligament of the hip-joint is covered in front by the psoas and iliacus internus muscles,—a large bursa mucosa, which sometimes communicates with the interior of the joint, being interposed; an abscess may form in this bursa independently of any disease of the articulation, in front of which it is placed. Superiorly the tendon of the rectus and the fleshy fibres of the gluteus minimus muscle cover the joint. Posteriorly are placed the pyriformis, superior gemellus, the reflected portion of the obturator internus, inferior gemellus, the

† Formerly this fatty mass was regarded as the gland that secreted the synovial fluid which lubricates the joint, and was named the gland of Havers.

tendon of the obturator externus, and the quadratus femoris muscles. On the inner side are situated the fleshy portions of the obturator externus and the pectineus muscles.

The bony margin of the hip-joint is sometimes fractured in consequence of severe falls upon the hip; an accident which may give rise to symptoms resembling, in many respects, those of a fracture of the neck of the thigh-bone, for which injury it might easily be mistaken.

When it is recollected that the three bones which form the os innominatum are united with each other (in the adult) in the acetabulum, an explanation is at once perceived of the stellated appearance which fractures of the pelvis, when they involve the acetabulum, commonly present; this lesion being generally produced by heavy falls upon the trochanter major, by which the head of the femur is driven with great violence against the acetabulum.

Section I.

DISLOCATIONS OF THE HIP-JOINT.

A dislocation of the hip-joint is an accident which is much more rarely met with in practice than fractures of the neck or upper part of the thigh-bone. The head of the femur may be dislocated from the cavity of the acetabulum in four different directions, which may be stated in the following order, which is also that of the relative frequency of their occurrence:† viz. first, The dislocation of the head of the bone upwards and outwards, upon the dorsum of the ilium; secondly, Backwards, into the great ischiatic notch; thirdly, Downwards, forwards, and inwards, into the foramen ovale; and fourthly, Upwards and inwards, upon the horizontal branch of the os pubis.‡ To these some other surgeons have added the dislocation of the head of the femur, downwards and backwards, upon the tuberosity of the ischium;§

† The French writers consider the dislocations of the hip-joint to take place in a different order of frequency to that which is stated in the text; viz, 1. upon the dorsum ilii; 2. on the thyroid foramen: 3. on the pubis; and 4. into the ischiatic notch. *Vide* Dict. de Médecine, Paris, 1825, tom. xiii. art. Luxation, par M. Marjolin.

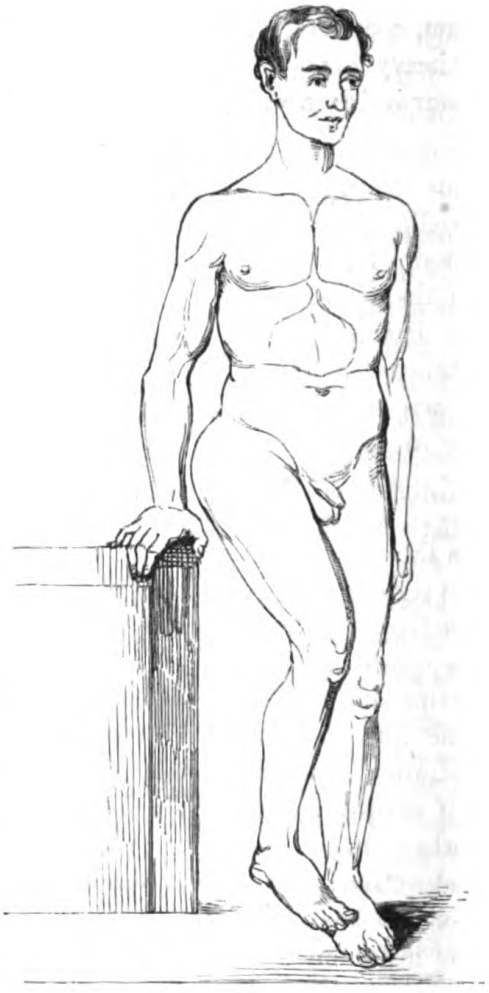
‡ Sir Astley Cooper mentions, that, according to his observations on the subject of dislocations of the hip-joint, the proportion of cases in twenty would be as follows: twelve on the dorsum ilii; five into the ischiatic notch; two in the foramen ovale; and one on the pubes.—See Sir Astley Cooper's work on Dislocations, p. 89.

§ *Vide* the Medico-Chirurgical Transactions of London, vol. xx. p. 117; and the London Medical Gazette, vol. x. p. 19.

which, however, must be of very rare occurrence, since Sir Astley Cooper states that he has never seen an instance of it.

1. *The dislocation upwards and outwards upon the dorsum ilii.*—This dislocation is commonly produced by falls upon the side, while the thigh is bent forwards and inwards; so that the head of the femur is twisted outwards, and violently thrust against the superior and external part of the capsular ligament, which it tears through, and so slips upon the dorsum of the ilium above, and behind the acetabulum.

No. 7.



In this dislocation there is a remarkable diminution in the length of the limb, which is an inch and a half, or two inches, shorter than on the sound side.—The knee is slightly advanced in front of the other, and is inclined towards the lower part of the opposite thigh. The great toe rests upon the instep of the other foot. The thigh is bent upon the pelvis, and the whole limb is inverted, but admits of a still further degree of flexion and adduction, during which motions the head of the

bone may be distinguished, if the patient be thin, or there be not present much swelling from extravasated blood, moving in its new position upon the dorsum ilii; but neither abduction, rotation outwards, nor extension of the limb can be performed; any attempt at which is accompanied with very great pain to the patient. The trochanter major is rather less prominent than natural, since the neck of the bone lies in the same line with the dorsal surface of the ilium; in addition to which it is situated much nearer to the anterior superior spinous process of the ilium. From the same cause, the usual roundness of the hip is also obliterated. To all these symptoms it may be useful to add, that the limb appears immoveably fixed in its new position; from which it cannot be removed without the employment of considerable force, which must also be used in the proper direction.

In this dislocation much injury is sustained by the muscles more immediately surrounding the hip-joint: the pyriformis, quadratus femoris, obturatores externus and internus, with the gemelli, are frequently torn near their insertions into the trochanteric fossa; the fibres of the pectineus, and some of those of the adductor brevis, are also occasionally torn. The capsular ligament of the hip-joint is extensively lacerated towards its external and superior aspect, and the ligamentum teres is torn across. The head of the bone has been found lying, in some cases, between the gluteus maximus and medius, and in other instances between the latter muscle and the gluteus minimus;† a large quantity of blood is also found extravasated between these muscles, and in the subcutaneous cellular tissue over the region of the hip-joint.

Reduction. — If the patient be very strong and muscular, or if a considerable time has been permitted to elapse after the receipt of the injury, the attempt to reduce the head of the bone into its proper position should be preceded by the administration of large nauseating doses of the tartar emetic, aided, if necessary, by copious venæsection and the use of the hot bath. As soon as these remedies have produced their intended effects, the patient should be placed upon a firm table, or in a large bed, lying upon his sound side: the pelvis is to be maintained in a fixed position, by means of a band carried round between the perinæum and the upper part of

† See Sir Astley Cooper on Dislocations, v. p. 90; and the Dublin Hospital Reports, vol. iii. p. 395.

the thigh, while extension is made by means of another band fixed upon the thigh just above the knee, which should be bent; the dislocated limb is then to be slowly and steadily drawn obliquely downwards across the lower third of the opposite thigh, and, when the head of the bone has been in this manner brought down as far as the edge of the acetabulum, it may be raised a little by the surgeon placing his hand underneath the upper part of the thigh, so as to lift it up, as it were, from the ilium, which must at the same time be depressed, and thus facilitate its return into the cotyloid cavity.†

2. *The dislocation backwards and upwards into the great ischiatic notch.* — This accident occurs when a person falls violently upon his side, with the thigh much bent forwards, and at the same time rotated inwards. It may also happen consecutively during attempts to reduce the dislocations upon the dorsum ilii, or upon the thyroid foramen, if sufficient attention be not paid to the direction of the extending force which is employed.‡

The symptoms of this dislocation are, the thigh being very slightly bent, and the knee turned inwards, but not so much so as in the dislocation upon the dorsum ilii. The prominence of the hip is lost, because the trochanter major is more deeply seated; it is, also, placed further backwards than is natural. The groin appears flattened, at the same time that the buttock appears somewhat fuller than usual. The toe rests against the ball of the great toe of the opposite side. When the patient stands erect, the toes, but not the heel, touch the ground, and the whole limb is slightly inverted; nor can rotation outwards be performed, though the thigh may be flexed, and rotated inwards.

In this dislocation the capsular and round ligaments are lacerated, as well as the tendons of the external rotator muscles, which are inserted into the trochanteric fossa; and the fibres of the pectineus and adductor brevis muscles are placed upon the stretch. The head of the femur rests upon the inferior edge of the pyriformis muscle, under cover of the lower edge of the

† For a delineation of the plan to be pursued in the reduction of this dislocation, see plate viii. fig. 1, in Sir Astley Cooper's work on Dislocations.

‡ Op. citat. p. 59.

gluteus medius, surrounded by a quantity of extravasated blood.†

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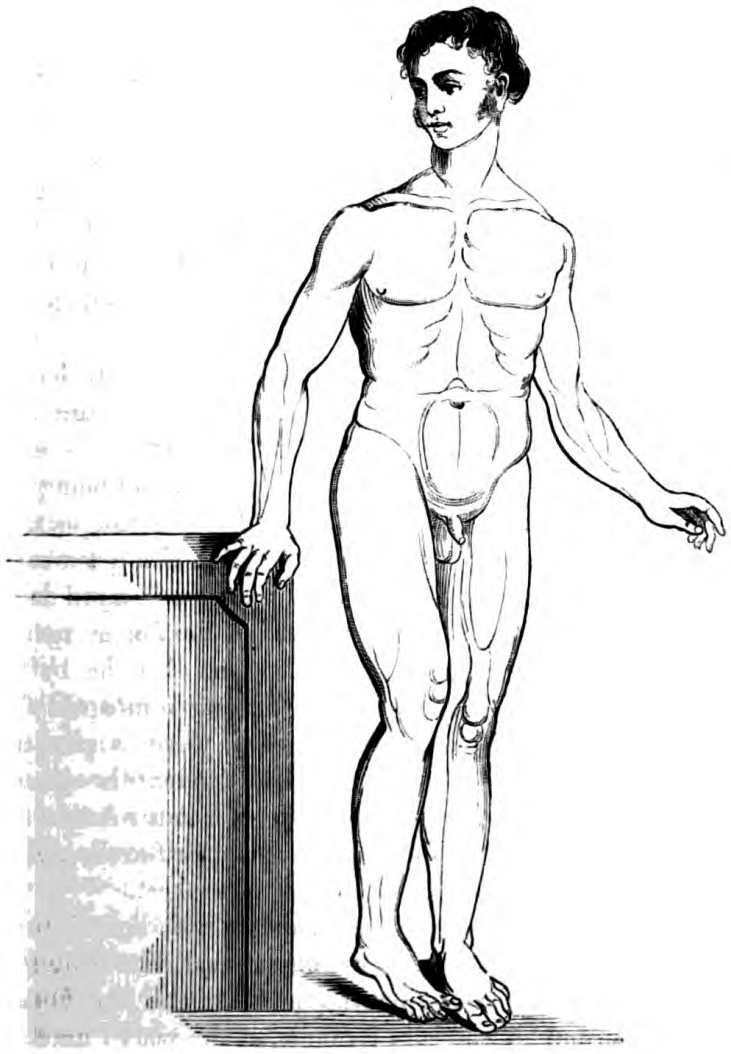

† See a paper on Dislocations of the Hip-joint, by Mr. Scott, in the Dublin Hospital Reports, vol. iii. p. 389.

Reduction.—The reduction of this dislocation is the most difficult to be effected of all those to which the head of the thigh-bone is subject; but it is best effected in the following manner:—The patient must be laid upon his sound side, and the pelvis fixed by a girth passed between the inside of the thigh and the perinæum; a wetted roller is next to be applied round the lower part of the thigh, above the knee, upon which the extending band may be firmly fixed. The knee is to be bent, and the affected thigh brought over the middle of the sound one; in which direction the extension should be made. While the extension is maintained, an assistant should be instructed to lift up the head of the bone out of the ischiatic notch, in which it is lodged, by means of a napkin passed underneath the upper part of the thigh; observing, at the same time, to keep the pelvis pressed firmly down upon the table.†

On two occasions, I have known much injury done by violent attempts to reduce this dislocation, when more than three months had elapsed after the receipt of the injury: in one of these cases, the thigh-bone was broken across in its upper part; and, in the second, the patient lost his life in consequence of extensive abscesses which subsequently formed within the cavity of the pelvis, and were produced by the force employed in the fruitless endeavour to disengage the head of the femur from the ischiatic notch.

2. *The dislocation downwards and forwards into the foramen ovale.* — This accident may happen when a person is thrown violently upon the ground, while the limb is separated widely from the mesial line of the body, so that the head of the femur is rudely driven against the internal part of the circumference of the capsular ligament where it is weakest.

The symptoms of this dislocation are, the increased length of the limb, which is two inches longer than the other; the trochanter major is less prominent than on the sound side; the knee is advanced, and bent forwards, at the same time that it is widely separated from the other, and cannot be brought any nearer the axis of the body without exciting very great pain. The body is inclined forwards, owing to the tense state of the psoas and iliacus internus muscles. The glu-

† See Sir Astley Cooper's work, plate ix. fig. 3.

teal muscles are placed upon the stretch, which gives a flattened appearance to the buttock. In thin persons, the head of the bone may be felt on pressing deeply between the pectineus and adductor longus muscles, forming a firm globular tumour upon the upper and inner part of the thigh. When he stands, the patient stoops forwards, and supports himself in the erect posture upon the toes, while the heel is considerably elevated from the ground. In some instances of this dislocation the foot has been observed to be turned a little outwards; but, in the majority of cases, it is directed straight forwards.

No. 9.

The ligamentum teres and the capsular ligament are torn through; and the head of the bone, having escaped from the cavity of the acetabulum, is lodged upon the fibres of the obturator externus muscle, which separate it from the thyroid ligament. The pectineus and adductor brevis have been found lacerated after this dislocation, as also the fibres of the quadratus femoris, and the tendons of the external rotator muscles, which are inserted into the trochanteric fossa.

Reduction.—This dislocation is in general very easily reduced. The patient should be placed upon his back, with the thighs separated as much as possible, when the band which is intended to fix the pelvis is to be placed between the thigh and the pudendum: the surgeon then lays hold of the ancle of the dislocated limb, and draws it over the sound leg; when this has been done, the head of the bone usually slips into the acetabulum. It is useful, also, to fix the pelvis more securely by passing a band round it, underneath that which passes round the thigh, and to which the pulleys are attached, in order to prevent the pelvis from moving in the same direction as the thigh.† Great care should be observed, in the reduction of this dislocation, not to advance the knee and leg of the affected side too much; as the head of the bone might otherwise slip behind the acetabulum into the great ischiatic notch, from which it would be extremely difficult to remove it.

4. *Dislocation upwards and forwards upon the horizontal branch of the os pubis.*—This dislocation happens when a person, while walking, unexpectedly puts his foot into some hollow in the ground; or by slipping, when making a sudden step forwards, (as in fencing,) the body being at the same time bent backwards; so that the head of the bone bursts through the capsular ligament, and is thrown forwards and upwards upon the ileo-pectineal line of the os pubis.

In this dislocation the limb is about one inch shorter than on the sound side; the knee and foot are turned forcibly outwards; and it is impossible to rotate the thigh inwards, but it may be bent slightly backwards and forwards. The toes touch the ground, but the heel does not reach it. The head of the bone forms a prominent, hard, and globular tumour in front of the horizontal branch of the os pubis, underneath Poupart's ligament, on the external side of the femoral artery and vein, and is easily perceived to obey all the motions of the limb; the natural prominence of the trochanter major is lost, as it is situated forwards and inwards immediately under the anterior superior spinous process of the ilium.

In this, as in all other dislocations of the hip-joint, the capsular and round ligaments are torn, and the head of the bone is

† See plate viii. fig. 2, of Sir Astley Cooper's work on Dislocations.

lodged upon the pubes underneath the psoas and iliacus muscles and the anterior crural nerve, which lies over the neck of the thigh-bone.

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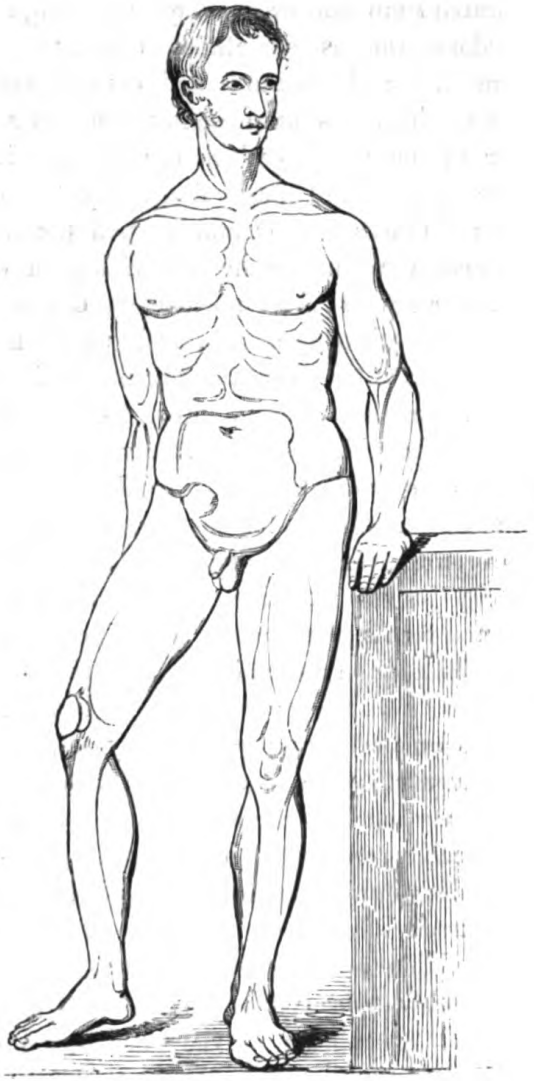

Poupart's ligament has been found torn up, so as to admit more easily the head of the femur between it and the pubes.† The tendons of the external rotators are sometimes torn near their attachments to the trochanteric fossa.

Reduction.—The patient should be placed upon the sound side, and the pelvis fixed by a broad band passed between the upper and inner part of the thigh and the fold of the perinæum; another band is to be placed upon the lower part of the thigh above the knee, and extension of the limb made (the knee being bent at right angles) in an oblique direction, downwards and back-

† Op. citat. p 84.

wards. It will be useful, when the extension has been steadily kept up for a few minutes, to raise the head of the bone from its situation upon the pubes by means of another bandage applied round the upper part of the thigh close to the perinæum.

Spontaneous dislocations of the hip-joint. — The head of the thigh-bone is sometimes dislocated in consequence of disease of the ligamentous and osseous structures which form the hip-joint; this kind of luxation (on account of the great power of the muscles which are inserted into the upper part of the thigh-bone) most frequently takes place in the direction upwards and outwards upon the dorsum of the ilium, or upwards upon the horizontal branch of the pelvis; but in such cases as these no attempt ought to be made to restore the length of the limb, as it would not only prove to be vain and fruitless, but probably productive of so much excitement in the parts surrounding and connected with the joint, as to be greatly injurious to the safety of the patient. In all these cases, as well as in those accidental dislocations where reduction has not been effected for many months, the head of the thigh-bone soon undergoes changes in its figure, which adapt it better to occupy its new situation, at the same time that a new cavity is formed for its reception by an ossific deposit from the surface of the bone upon which it has been thrown, while the original acetabulum becomes gradually diminished in size, and frequently filled up by a soft fungous-looking mass.†

Fractures of the os innominatum involving, as they frequently do, the acetabulum, might be mistaken, from the shortening and inversion of the limb with which they are accompanied, for a dislocation of the head of the bone upwards, or a fracture of the neck of the femur;‡ but, on a closer examination, the great mobility of the parts, and the ease with which the length of the limb can be restored by a moderate degree of extending power, joined with the crepitus which can be felt on handling the cristæ of the ilia, will always suffice to establish a correct diagnosis. In these accidents it is always proper to introduce the catheter, as the urethra may have been torn by the sharp

† Numerous specimens illustrative of the various changes that occur in the acetabulum and head of the thigh-bone under these circumstances, are to be seen in the museum of University College.

‡ Sir Astley Cooper on Fractures and Dislocations, p. 95.

fragments of the rami of the os pubis and ischium should they be broken; an accident which I have witnessed in three instances.

Fracture of the neck of the femur.—A fracture of the neck of the thigh-bone is of very frequent occurrence in elderly persons, and is usually produced by falls upon the side of the hip, by which the neck of the femur is pressed between two resisting surfaces in such a manner that it is suddenly snapt asunder; for it no longer possesses, from the changes which are incident to old age, sufficient elasticity to resist the shock. Since the pelvis is wider, and the trochanter major much more prominent in women than in men, though of the same age, we find that this accident is much more frequent in individuals of the former sex than of the latter. This accident is, moreover, very rarely met with in persons who are under fifty years of age; but I have seen it happen in a young woman of seventeen, and also in a strong healthy man of forty years of age. Sir Astley Cooper states, that, out of two hundred and twenty-five cases of this accident (fracture of the neck of the femur within the capsular ligament) which he has seen, only two occurred in persons who were less than fifty years of age;† the correctness of which statement has been repeatedly confirmed by the observations of numerous other distinguished surgical writers.

Sir Astley Cooper divides the fractures which occur of the neck of the thigh-bone into two classes, in one of which the seat of the fracture is altogether within the capsular ligament, whereas in the other it is external to it, opposite the point where the neck of the femur springs from the trochanters; a distinction which is, however, of comparatively little use in practice, excepting as regards the prognosis, which is somewhat more favourable in the latter than in the former case, provided that the patient be not very far advanced in years.

The symptoms of this accident are a diminution in the length of the limb, which is an inch and a half, or two inches, shorter than the opposite side. There is also usually eversion of the foot and knee, so that they rest upon their outer border as the patient lies upon his back in bed. When the patient is supported in the erect posture, the toes, but not the heel, touch the ground, and he is unable to bear any of the weight of the body upon the limb. The trochanter major is less prominent on the injured side than is natural, and, besides, it

† Op. citat. p. 111.

is drawn by the action of the large muscles of the hip nearer to the crest and anterior superior spinous process of the ilium. By a little force the limb may be easily extended to its proper length, and the proper position of the knee and foot readily restored; but the unnatural appearances are immediately repro-

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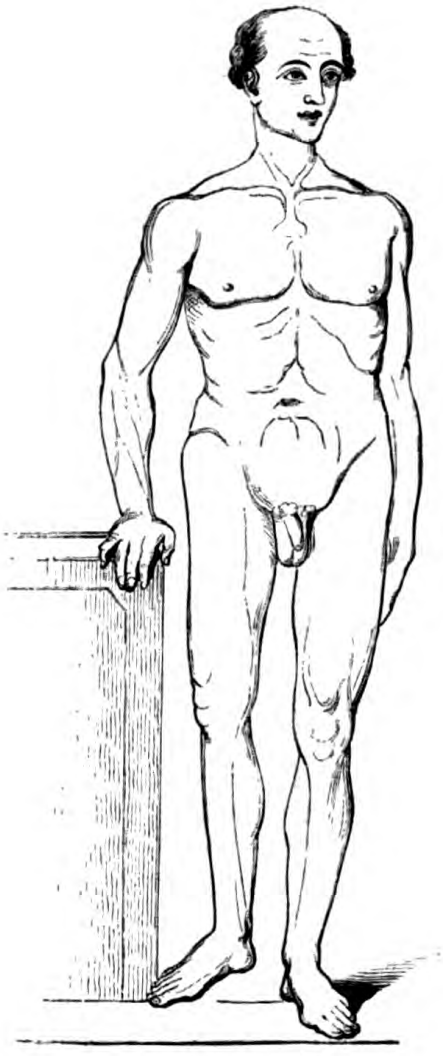

duced when the extension is relaxed. If the limb be drawn down to its original length, and is then rotated, a crepitus will

be felt on firmly grasping the trochanter major with one hand; when, at the same time, it will be observed that the trochanter does not revolve upon the axis of the neck of the thigh-bone, and so describe the arc of a considerable circle, but that it turns shortly upon its own centre, and on the same axis as the shaft of the femur itself.

Persons who have suffered a fracture of the neck of the thigh-bone may, nevertheless, still possess considerable power of flexion and extension of the limb; though these movements are, generally, accompanied with considerable pain. In some instances, where this accident had occurred, no crepitus could be detected on the closest examination; nor was any shortening or eversion of the limb observed until a considerable period of time had elapsed from the occurrence of the injury.† Some persons, indeed, have been known to have walked for some distance after the receipt of this injury; which circumstance must have been owing, in all probability, to some peculiarity in the line of the fracture, by which the broken surfaces of the bone were closely wedged or dovetailed into one another, and had not separated until after a considerable space of time.‡

The knee and foot may be inverted in a fracture of the neck of the thigh-bone; of which unusual circumstance several explanations have been offered by different writers. Sir Astley Cooper considers that this is only likely to occur before the muscles have had sufficient time to contract.§ Mr. Syme states, that it is his opinion that this variation in the appearance of the limb is most likely to be produced when the fracture splits the trochanters, so as to detach the smaller one from the shaft, and also the posterior part of the greater, into which the muscles that perform rotation outwards are inserted, leaving the anterior portion of the process which receives the insertion of the gluteus medius connected with the body of the

† Baron Dupuytren relates several cases of fracture of the neck of the femur, in which the displacement of the broken ends of the bone did not take place until even as many as thirty days had elapsed from the receipt of the injury. See Leçons Orales, tom. ii. p. 47.

‡ A case of this kind is cited in Sir Astley Cooper's work on Dislocations and Fractures, 4th edition, p. 158.

§ Op. citat. p. 106.

bone.† According to Dupuytren, the inversion of the limb must be owing to the peculiar direction of the line of the fracture, which must be oblique, and situated in such a manner that the pointed extremity of the inferior fragment is placed behind that of the superior portion.‡

In all doubtful cases the fracture of the neck of the femur is to be distinguished from the dislocations of the hip-joint by a careful consideration of the distinctive characters of the several displacements to which the head of the thigh-bone is liable, and by contrasting these successively with those which belong to the former accident; thus, it is distinguished from the dislocation downwards and forwards upon the thyroid foramen, by the shortening or equal length of the limb in the former and its positive elongation in the latter accident. It is also distinguished from the dislocation upwards on the horizontal branch of the os pubis, by the forced and steady abduction of the limb,—the great immobility when we endeavour to rotate it inwards,—together with the evident position of the head of the bone underneath Poupart's ligament, where it forms a hard globular tumour, which obeys all the motions of the limb — symptoms which belong to this accident alone. In the luxation backwards into the ischiatic notch the limb is shortened and inverted, (which it may be also in a case of fracture of the neck of the femur,) yet in the case of the luxation there is a great fixity of the upper part of the limb in its new position, with an impossibility of rotating it outwards; neither of which symptoms can co-exist with a fracture of the neck of the femur, in which there is always the greatest latitude and freedom of motion. The same conditions, but in a more marked degree, will amply serve to establish a correct diagnosis between a dislocation of the head of the bone upon the dorsum ilii and a fracture of the neck of the femur.

The best plan of treatment which can be pursued of a fracture of the neck of the femur, consists, I believe, in placing the limb in the straight position, and retaining it there of a proper length by means of the long splint applied along its outer border: the apparatus should be applied for eight or ten weeks;

† See The Principles of Surgery, by James Syme, F.R.S.E.; 8vo. Edin. 1832; p. 232.

‡ Leçons Orales du Baron Dupuytren, tom. ii. p. 53.

except, perhaps, in the case of very old people who are the subject of a fracture of the thigh-bone within the capsular ligament, since in these no prospect of bony union of the broken surfaces can ever be entertained. It is now, however, very generally admitted that osseous reunion of a fracture of the neck of the thigh-bone, although situated within the capsular ligament, may take place under favourable circumstances, but that it is of very rare occurrence.

THE

SURGICAL ANATOMY

OF

INGUINAL HERNIÆ,

THE

TESTIS AND ITS COVERINGS.

BY THOMAS MORTON,

ONE OF THE DEMONSTRATORS OF ANATOMY IN UNIVERSITY COLLEGE, LONDON;
AND FORMERLY HOUSE SURGEON TO THE HOSPITAL
OF THE SAME COLLEGE.

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AND WOOD ENGRAVINGS.

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ADVERTISEMENT.

THE plates illustrating this division of the work on Surgical Anatomy have been carefully engraved from original drawings, made from my own dissections of the parts represented, with the exception of No. V, which is taken from an engraving in Scarpa's Treatise on Herniæ.

I have much pleasure in again acknowledging the kindness of Sir Astley Cooper, who has permitted me to copy the engraving representing the seminiferous ducts of the Testis, from his work on the Anatomy and Diseases of that Organ.

The other wood-engravings are from original drawings, with the exceptions of Nos. 4, 5, 9, 2, and 6, which are taken—the first three from Hesselbach, the others from Cloquet and Camper.

THOMAS MORTON.

UNIVERSITY COLLEGE,
Nov. 30, 1840.

THE SURGICAL ANATOMY

OF

INGUINAL HERNIÆ.

CHAPTER I.

SURGICAL DISSECTION OF THE STRUCTURES CONNECTED WITH THE ANATOMY OF INGUINAL HERNIÆ.

As inguinal herniæ are of much more frequent occurrence in men than in women, it is desirable that a male subject should be procured for this dissection; and, where a choice can be made, a body which is rather thin is to be preferred to one that is corpulent, provided that the muscular system be equally well developed.

Position of the subject. — The subject should be laid upon its back, and a large-sized block of wood placed underneath the loins; and, in order that the abdominal parietes may be rendered as tense as possible, the inferior extremities should be rotated outwards, and the knees bent, so that the legs and feet shall rest upon their external surface. Not unfrequently, however, it happens that the muscular walls of the abdominal cavity are so flaccid that these measures prove inadequate to produce the degree of tension requisite for their easy dissection, and then it will be found very advantageous to distend the peritonæal sac; inflating it by means of a coarse blow-pipe passed through a small puncture made in the upper part of the linea alba. The air which is in this manner introduced, is to be prevented from escaping by closing the aperture with the twisted suture at the same time that

the blowpipe is withdrawn. This method of proceeding will also be found very useful when a hernial sac is present in the subject which has been selected for making the dissection. The penis, together with the scrotum and testicle of the side upon which it is proposed to commence the dissection, should be drawn obliquely downwards and across the upper part of the opposite thigh, in which position they should be fixed by hooks, so that the skin covering them may be held upon the stretch.*

The dissection may now be commenced by an incision which is to be carried across from the crest of the ilium, at a short distance beyond the anterior superior spinous process of that bone, to the linea alba, where it should terminate a little below the umbilicus; from the termination of this cut let another be made downwards, in the course of the linea alba, as far as to the root of the penis. These incisions should divide the skin only. If the last-mentioned incision be prolonged a little way along the dorsum of the penis, and then turned down over the side of the scrotum, the future steps of the dissection will be greatly facilitated. (See Plate I.) The triangular flap of skin which is thus marked out, should, in the next place, be dissected up, commencing at the angle nearest to the umbilicus, and carefully detaching it from the subjacent layer of cellular and adipose tissue (the *superficial fascia*) by successive strokes of the scalpel, until opposite the crural arch; or, if it should be considered desirable, the dissection of the skin may be continued for a little distance upon the upper part of the thigh. While detaching this flap, the dissector should be careful to observe the white appearance of the internal surface of the skin, as he will thus be insured from cutting too deeply, and injuring the next layer, or the external lamella of the superficial fascia of the abdominal parietes.

The skin covering the penis and scrotum, will be found to be much thinner than elsewhere; and, upon the latter, its inner surface is rendered very uneven by the numerous sebaceous glands which abound in this situation, and appear as so many granular bodies, of a whitish colour.

Small superficial abscesses frequently form in this situation,

* It is recommended to those who are commencing their dissections of this region to dissect only on one side at a time, so that the other may be reserved for a repetition of the dissection, which will thus be executed with greater precision and exactness.

deriving their origin from some inflammatory affection of one of these glands. These abscesses, although small, frequently cause, during their formation, considerable pain and uneasiness; but they are quickly cured by making, as soon as suppuration has been fairly established, a simple incision, of sufficient extent to afford a free exit to the contents of the swelling.

The flap of skin which has thus been raised, may be reflected downwards upon the thigh, where, if necessary, it is to be fixed by means of a pin. (See Plate I. fig. *t*, and Wood-cut No. 1, fig. *k*.)

The *superficial fascia* covering the lower part of the abdominal parietes, consists of two distinct layers, between which the superficial vessels and some small lymphatic glands are placed. The external layer (immediately subjacent to the skin) consists chiefly of a loose reticulated cellular tissue, with more or less of adipose substance deposited in its cellules, accordingly as the individual is corpulent or otherwise. The thickest portion of this layer is over the body of the os pubis, where a large mass or cushion of adipose tissue is deposited in it, the granules of which are much smaller than elsewhere; it is this mass of adipose substance which constitutes, in the female, the mons Veneris. The quantity of this fatty substance diminishes near the bend of the thigh, beyond which line the external layer of the superficial fascia is traversed at numerous points by several bands of condensed cellular tissue, which are disposed in a transverse direction.*

The external layer of the superficial fascia may be readily shown to pass over the crest of the ilium and Poupart's ligament, without being adherent to these structures, and afterwards to become continuous with the outer lamella of the superficial fascia of the groin; for, on drawing upon any part of the inguinal portion, we are also able to exercise a certain degree of traction upon the femoral division of the membrane.

The superficial vessels.†—If the subject be much emaciated, some small arteries and veins will be observed to run, in various directions, underneath the external layer of the superficial fascia; those which are situated near the centre of the space between

* *Vide* The Surgical Anatomy of the Groin and Femoral Hernia, p. 95.

† For a description of these vessels, see the Surgical Anatomy of the Groin, &c. p. 99, and also Plates I. and III. of the same work.

the anterior superior spinous process of the ilium, and the symphysis pubis, are named *the superficial epigastric artery and vein;* the first is a branch sent off from the common femoral artery, at a short distance below the crural arch; and, after escaping through a small opening in the iliac portion of the fascia lata, ascends, in an oblique direction, upwards and inwards, towards the umbilicus, giving branches to the integuments on either side of its course, some of which anastomose with the branches of the deep or internal epigastric artery which pierce the muscular and tendinous structures forming this portion of the abdominal parietes; the vein takes the same course as the artery after which it is named, and empties itself into the great saphena vein, as the latter is about to pass through the saphenous aperture of the fascia lata, in its course to reach the common femoral vein.* The other vessels, which are seen crossing over the spermatic cord, where it emerges from the external abdominal ring, are the *external* or *superficial pudic arteries and veins*, also branches of the common femoral artery and the great saphena vein; they issue from the saphenous opening of the fascia lata, and, after passing obliquely inwards and upwards, are distributed to the superficial investments of the cord and testicle, and to the integuments of the hypogastric region. (For a representation of the course and distribution of these vessels, see Plates I. and III. of the Surgical Anatomy of the Groin, &c.)

The external pudic artery is generally divided in the first incisions which are made in the operation for strangulated inguinal hernia, and, sometimes, the vessel will bleed so smartly as to require the application of a ligature for the suppression of the hemorrhage.

If the subject should be very corpulent, the superficial vessels will not at first be apparent; and, then, in such cases, it will be necessary to dissect up the external layer of the superficial fascia, which, lying upon the vessels, conceals them from our view. This is best done by carefully cutting down upon the

* In cases of long-continued distention of the abdomen, as, for example, in some instances of ascites, ovarian tumours, &c., the superficial epigastric vein is frequently greatly enlarged in its size and varicose. In a case of ascites I have seen it as large as the little finger.

vessels at a little distance above the crural arch, and then following them downwards in their course towards the saphenous opening of the fascia lata. As the external pudic vessels are very tortuous in their course, some caution is requisite during this dissection, in order that they may not be cut across unexpectedly; an accident which may be avoided by drawing the superficial fascia upwards and inwards, so as to efface the numerous curves which the vessels make as they are mounting over the spermatic cord. Some branches of the external circumflexa ilii artery and vein will be noticed near the crest of the ilium.

The superficial lymphatic vessels. — Three or four small absorbent glands will be found lying between the two laminæ of the superficial fascia, parallel with, and immediately above Poupart's ligament. Numerous delicate lymphatic vessels may be shown, by a little careful dissection, to enter into these glands in their way from the hip, the hypogastric and umbilical regions, and external organs of generation, to the cavity of the abdomen, and hence it is that they frequently become swollen and inflamed in consequence of any disease in these parts; affections which are, in many instances, wholly unconnected with any venereal taint.

In persons of a strumous habit these glands are sometimes enlarged, without any very obvious cause, to an extraordinary degree, and at length, after suppurating imperfectly at several points, form a succession of troublesome abscesess, which, if neglected by the patient or his surgeon, frequently degenerate into numerous deep and irregular sinuses or fistulæ, which generally prove exceedingly difficult of cure.

When the superficial vessels and glands have been thus exposed, the dissector should next proceed to raise up the deep layer of the superficial fascia, together with the other structures which rest upon it; he may commence at the angle nearest to the umbilicus, and then, holding the fascia tightly up from the tendinous aponeurosis of the external oblique muscle, he must divide, by successive strokes of the scalpel, the delicate cellular tissue which connects its internal surface to the tendon underneath. This cellular tissue should be divided close to the surface of the aponeurosis, the knife being carried in the same direction as the fibres of the external oblique muscle, that is to say, obliquely downwards and inwards. Great care is

required on approaching near to the situation of the external abdominal ring, lest the thin membrane which passes off from the margins of that opening downwards upon the spermatic cord (the *external spermatic fascia*) should be cut, and removed along with the superficial fascia.* To avoid this error an assistant should be instructed to hold the spermatic cord tense, by drawing the testicle obliquely downwards and to the opposite side.

While raising the deep layer of the superficial fascia from the tendinous aponeurosis of the external oblique muscle, it will be observed that it is particularly adherent, in the mesial line, to the linea alba, and, laterally, to the anterior or cutaneous surface of the ligament of Poupart and iliac portion of the fascia lata. The connection of the deep layer of the superficial fascia to Poupart's ligament, is much more intimate along the outer or iliac half of that structure than nearer to the spine or tuberosity of the os pubis, where it is rather attached to the pubic portion of the fascia lata, in front of Gimbernat's ligament.

When the deep layer of the superficial fascia is traced below the crural arch, it will be found to rest upon the fascia lata of the thigh, and to be spread over the saphenous opening, to the margins of which it is closely adherent.

The difference which exists in the structure of the two layers of the superficial fascia of the abdomen, is deserving of particular notice;—the external lamella is formed of a loose cellular tissue, and is always more or less loaded with adipose substance, which is deposited in its cellules, whilst the internal lamella is, on the contrary, very strong and elastic, and presents a smooth, compact, and glistening appearance, especially upon its internal surface, so that it may be said to be always membranous, and, occasionally, even aponeurotic, in its properties.†

The *dartos*.—The superficial fascia of the abdominal parietes changes its appearance in a remarkable manner as it descends over the spermatic cord to reach the scrotum, suddenly losing its adipose, cellular character, and assuming a fibrous structure, of

* The spermatic fascia is represented in Plate III. of the Surgical Anatomy of the Groin, fig. *x*.

† By many the deep lamella of the superficial fascia is known under the name of Scarpa's Fascia. Scarpa himself described it as an aponeurosis derived from the fascia lata of the thigh.— *Traité des Hernies*, p. 22.

a light brown or roseate hue. It is upon the dartos that the vermicular movements and gradual contractions of the scrotum, which occur so frequently when these parts are exposed to the influence of cold, are dependent. From these circumstances it has been regarded by some authorities as being muscular in its structure and properties, although no muscular fibre has ever been satisfactorily shown to exist in its composition.

The dartos is continuous, superiorly, with the superficial fascia of the abdomen; inferiorly, and posteriorly with the superficial fascia of the perinæum: its external surface is closely adherent to the skin of the scrotum; and, by its internal aspect, it is loosely connected by cellular tissue with the fibrous sheath which invests the spermatic cord and testicle. There is prolonged from it an imperfect septum of a fibro-cellular nature (the *septum scroti*), which separates the testicles from one another, and is capable of permitting fluids to pass without much difficulty from one compartment of the scrotum into the other.

It is underneath this structure, and into the lax cellular tissue which connects it to the fibrous sheath of the spermatic cord, that the serous fluid is deposited, in those cases of simple anasarcous swelling of the scrotum and penis, so frequently observed in patients who are affected with general dropsy from diseases of the heart and liver. Blood is frequently largely extravasated underneath the dartos, in consequence of blows and falls upon this part, and upon the perinæum.* Occasionally it happens that the irritating fluids, employed for the cure of hydrocele of the tunica vaginalis, are, owing to the accidental slipping of the trocar from its proper situation, forcibly injected underneath it, producing high irritative fever, and extensive sloughing of the parts, if not speedily evacuated by a free incision. Acute anasarca of the scrotum, as it has been well termed by Mr. Liston, is another disease which, also, has its seat in the loose cellular tissue which is subjacent to the structure of the dartos.† Not unfrequently urine is effused underneath the dartos, as happens in those cases of extravasation of urine following a rupture of the urethra in the situation of the bulb, or

* *Vide* The Surgical Anatomy of the Perinæum, p. 69.

† See Remarks on the acute form of anasarcous tumour of the scrotum, by R. Liston, Esq. in the Med. Chir. Trans. London, 1839, p. 288.

any portion of the canal which may be anterior to the deep perinæal fascia or triangular ligament.*

The *aponeurosis of the external oblique muscle.*—The tendon of the external oblique muscle, which has been exposed by the dissection of the skin and superficial fascia, may next be examined. It will be observed, that, in the hypogastric and iliac regions, the external oblique muscle is altogether tendinous; but it does not present a perfectly continuous and unbroken surface throughout its entire extent, as, at several points, there are formed numerous apertures in it which serve for the transmission of the smaller branches of the deep epigastric artery which anastomose with the ramifications of the superficial vessels; several filaments of the lower dorsal and upper lumbar nerves also issue through these openings, in their course to be distributed to the cutaneous coverings of the lower part of the belly.

The distribution of these nerves sufficiently explains the sensation of being "*tightly girded*" which is so commonly complained of by those patients who labour under disease and curvature of the middle portions of the vertebral column.

The apertures in the tendinous aponeurosis of the external oblique muscle, are sometimes found to be very much enlarged in their dimensions, and to be filled with a small mass of adipose substance which is frequently connected with the outer surface of the peritonæum, which is itself now and then protruded in the form of a small pouch or sacculus.

When any of the contents of the abdominal cavity escape by these openings, the name of *ventral hernia* is given to the disorder.

The *external oblique muscle* arises, on each side, from the outer surface of the eight inferior ribs by as many fleshy processes, which correspond with, and indigitate with some of the costal attachments of the serratus magnus and latissimus dorsi muscles: — the posterior fibres of the muscle, which are fleshy in their structure, descend, in nearly a perpendicular direction, from the false ribs, and are inserted into the anterior half of the outer labium of the crest of the ilium, while the fibres from the superior ribs incline downwards and inwards, towards the mesial line, and terminate at the outer edge of the rectus mus-

* *Vide* The Surgical Anatomy of the Perinæum, p. 12 and p. 69.

cle, in a broad aponeurosis, which, after passing in front of the rectus, unites at the linea alba, with the tendon of the same muscle of the opposite side.

In front of the upper and middle portions of the rectus muscle the tendon of the external oblique is very thin and delicate, and is, moreover, intimately blended with the aponeurosis of the internal oblique, which lies underneath it; but, nearer to the pubes, it becomes much thicker and stronger, and is, also, much more easily separated by the knife from the sheath of the rectus.

On tracing the tendinous fibres of the external oblique muscle, as they pass downwards and inwards from opposite the anterior superior spinous process of the ilium towards their insertion into the inferior third of the linea alba and body of the os pubis, it will be found that, as they approach the crista of the os pubis, they separate from one another, so as to be divided into two distinct fasciculi, of which the innermost and superior is the broadest and weakest, while the external and inferior, though much narrower than the first, is, nevertheless, much thicker and stronger. The first of these fasciculi is inserted into the body and symphysis of the os pubis, where it also decussates with the corresponding portion of the tendon of the opposite muscle. (See the woodcut No. 1, at p. 220, fig. *d*.) The second or stronger fasciculus is fixed into the tuberosity or spinous process of the os pubis, and the adjacent portion of the ileo-pectineal line, where it mainly contributes towards the formation of Gimbernat's ligament, presenting there a free and sharp margin, somewhat concave in its outline, and directed towards the common femoral vein. (See fig. *b*, *c*, of the woodcut, No. 1.*) There is frequently a very great difference in many subjects as to the precise distance from the symphysis pubis at which the above mentioned divergence of the fibres of the tendon of the external oblique muscle commences; — in the greater number of instances it is about one inch and a half from the symphysis pubis, while in some it is much nearer than this; in other cases again it is still farther distant, so that it is situated almost opposite the anterior superior spinous pro-

* *Vide* The Surgical Anatomy of the Groin and Femoral Hernia, page 84, and the wood-engraving at page 85 of the same work, fig. *m*. *n*.

cess of the ilium. Occasionally another split is to be found in the tendon of the external oblique, which is situated above and to the inner side of that which forms the external abdominal ring, and through it the fleshy fibres of the internal oblique muscle may be clearly distinguished, as they are only covered by some of the fibres of the intercolumnar fascia.

EXPLANATION OF PLATE I.

Exhibits the first stage of the dissection of the anatomy of the structures concerned in inguinal herniæ.

The skin and superficial fascia have been reflected downwards upon the thigh, in order to show the tendinous aponeurosis of the external oblique muscle, the external abdominal ring, spermatic cord, and testicle, &c.

a. The anterior superior spinous process of the ilium.

b. The spinous process or tuberosity of the os pubis.

c. Poupart's ligament, which is extended between these two processes of bone.

d. The tendinous aponeurosis of the external oblique muscle.

e. The fleshy fibres of the same muscle.

f. The aponeurosis of the external oblique muscle, where it passes in front of the rectus muscle to be attached to,

g. The linea alba.

h. The linea semilunaris, which is situated at the outer edge of the rectus muscle.

i. The inferior and outer pillar of the external abdominal ring, which is formed by the pubal extremity of Poupart's ligament; it is thicker and stronger, though narrower than

k. The superior and inner pillar of the same opening.

l. The intercolumnar fibres, which serve to bind the two pillars of the external abdominal ring more strongly together.

m. The spermatic cord, after it has emerged through the external abdominal ring;—some of the fibres of the cremaster muscle are seen upon its outer side.

n. The testicle, concealed by the tunica vaginalis reflexa.

o. The iliac portion of the fascia lata of the thigh, which is attached to the lower edge of Poupart's ligament.

p. The pubic portion of the fascia lata, covering the pectineus and adductor longus muscles.

q. The falciform process of the iliac portion of the fascia lata, where it bends inwards, underneath Gimbernat's ligament, and arches over the upper part of the crural canal.

r. The deep layer of the superficial fascia of the abdomen reflected, along with the skin, upon the upper part of the thigh.

PLATE I.

W. Fairland, lithog.

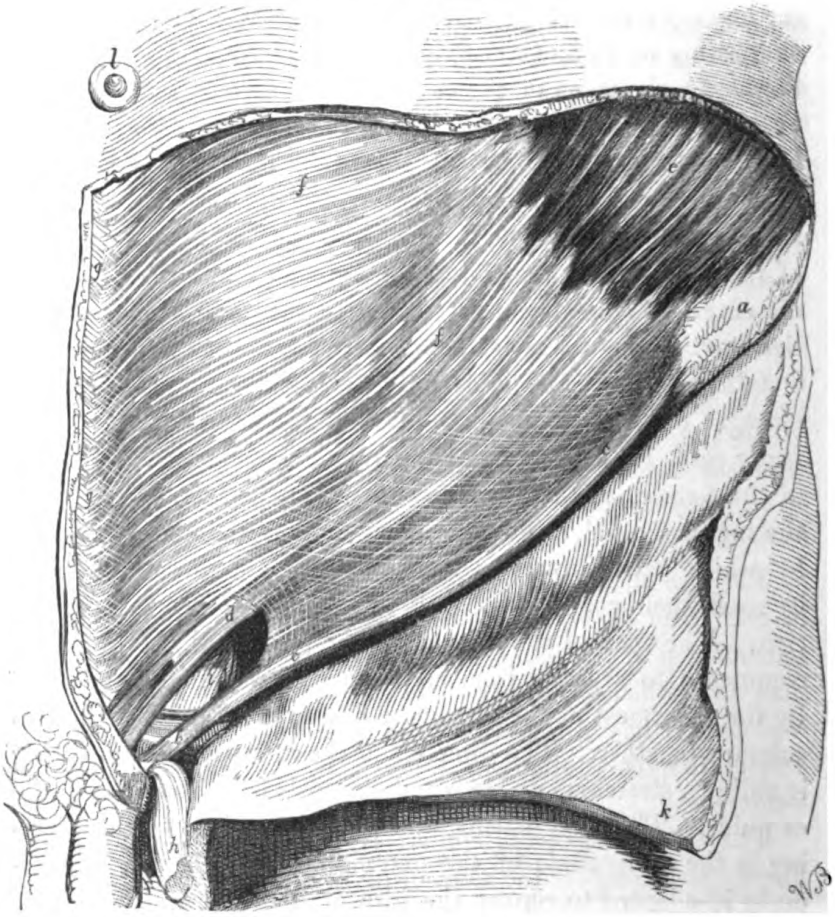
s. The external circumflexa ilii artery.
t. The superficial epigastric artery.
u. The external pudic artery.
v. The umbilicus.
w. The suspensory ligament of the penis.
x. The fascia lata covering the glutæus medius muscle.

The *external abdominal ring*.* — This name has been given to the aperture in the tendinous aponeurosis of the external oblique muscle, which is formed by the divergence of the tendinous fasciculi as they approach the crista of the os pubis. In the healthy condition of the parts, the external abdominal ring is an opening of a triangular figure, the base of the triangle being formed by the crista of the os pubis, and its sides, which are of unequal length, by the two bundles of tendinous fibres, which have been denominated the *columns*, or *pillars*, of the ring; of these, one is *superior* and *internal*, and descends, as has been already stated, to become inserted into the body and symphysis of the pubis; the other forms the *inferior* and *outer pillar of the ring*, and consists chiefly of the pubal extremity of Poupart's ligament, where it is about to be inserted into the spinous process or tuberosity of the os pubis. The external is the narrower but stronger of the two pillars of the ring, and supports the spermatic cord, in the male, and the round ligament of the uterus in the female, as they severally emerge from the lower part of the inguinal canal, or oblique passage in the abdominal parietes, by which these structures issue from the interior of the belly to reach their connections with the external organs of generation. The apex of the triangle is the part at which the pillars commence to separate from each other; here it is rounded off by the lowermost of the transverse fibres, which connect the two columns together. The direction of the external abdominal ring is oblique, stretching upwards and outwards from the crista of the os pubis. The term of ring which has been given to this opening in the aponeurosis of the external oblique muscle, is obviously ill-adapted to convey the idea of its figure in the healthy and natural state of the parts; but it should be recollected that, when a hernial sac has been protruded through it, it assumes a

* Also called the *ring of the external oblique, inguinal ring, lower* or *external aperture of the inguinal canal; anneau inguinal, anneau du grand oblique; annulus inguinalis anterior*.

circular form, and has always been thus described by surgical writers. Thus, then, the external abdominal ring is the opening which is formed by the divergence of the tendinous fasciculi of the aponeurosis of the external oblique muscle, and is situated immediately *above* the spinous process and crista of the os pubis, which circumstance it is of considerable importance to bear in mind when establishing a diagnosis between some obscure forms of inguinal and femoral hernia.*

No. 1.



The wood-engraving represents the figure and situation of the external abdominal ring, as it appears in the male subject. The skin and superficial fascia have been dissected from the aponeurosis of the external oblique

* See the Surgical Anatomy of the Groin and Femoral Hernia, p. 137.

muscle, and turned down upon the thigh; the spermatic cord was cut across as it escaped through the opening, and reflected downwards upon the scrotum.

a. The anterior superior spinous process of the ilium. *b*. The spinous process or tuberosity of the os pubis, into which the ligament of Poupart is inserted. *c. c*. Poupart's ligament, or lower edge of the tendinous aponeurosis of the external oblique muscle, which is extended between these points of bone, and constitutes the principal part of the crural arch. Between the letters *b* and *c* Poupart's ligament forms the outer and inferior pillar of the external abdominal ring. *d*. The superior and internal pillar of the ring; it is broader, but thinner than the inferior pillar. The curved white lines represent the intercolumnar fascia, which consists of a series of tendinous threads, which take their origin from the crural arch, spread upwards, diverging as they proceed, and are lost in the linea alba; they serve to bind more strongly together the oblique fibres of the aponeurosis of the external oblique muscle, and to connect the two columns of the external abdominal ring. *e*. The fleshy fibres of the external oblique muscle opposite the crista of the ilium. *f. f*. The aponeurosis of the external oblique muscle, the fibres of which are intersected nearly at right angles by the filaments of the intercolumnar fascia. *g. g*. The linea alba, where the tendinous fibres of the external oblique muscles decussate with one another. *h*. The spermatic cord which has been cut across as it emerged from the external abdominal ring, and reflected downwards upon the scrotum. *i*. The external abdominal ring; the letter is placed upon that part of the posterior wall of the inguinal canal, situated behind the external abdominal ring, which is formed by the conjoined tendons of the internal oblique and transversalis muscles. *k*. The skin and superficial fascia of the abdominal parietes dissected from the aponeurosis of the external oblique muscle and reflected downwards upon the upper part of the thigh.

The size of the external abdominal ring is considerably larger in men than in women; for a smaller opening suffices for the transmission of the round ligament of the uterus in the female, than that which is required for the passage of the spermatic cord and testicle in the male.* This obviously accounts for the greater frequency of inguinal hernia in the latter than in the former.

The *intercolumnar fascia*. — It will be recollected that the fibres which compose the aponeurosis of the external oblique muscle have been described as being arranged parallel with each other, and descending obliquely, downwards and inwards, to their at-

* The comparative size of the external abdominal ring in the male and female, is well represented in the wood-engravings, No. 4. and 5. p. 102 and 104 of the Surgical Anatomy of the Groin, &c.

tachments to the os pubis — a disposition of parts which alone could afford but a feeble resistance to the protrusion through the external ring, of the loose and floating viscera of the abdomen, when compressed by any unusual contraction of the muscular parietes of that cavity.

On a closer inspection, however, a regular series of strong tendinous fibres will be observed to lie closely upon the outer surface of the aponeurosis of the external oblique muscle, crossing, nearly at right angles, the proper fibres of the tendon, adhering very intimately to each, and thus materially serving to bind them more firmly together. As these fibres extend over from one pillar of the ring to the other, they have been named the *intercolumnar fascia.* The fibres of the *intercolumnar fascia* take their origin, in a great measure, from the anterior edge of Poupart's ligament, in the whole of the space between the anterior superior spinous process of the ilium and the root of the spinous process of the os pubis; near the last-mentioned point of bone some of them appear to spring from the pubic portion of the fascia lata binding down the pectineus muscle, immediately anterior to the ligament of Gimbernat; they thence ascend, in a curvilinear direction, towards the lower part of the linea alba, into which they are finally inserted. The convexity of the curve, which these fibres make in their course, is, for the most part, directed downwards towards the external abdominal ring, but near the apex of that opening they are disposed in the contrary direction. (See the woodcut No. 1. page 220, where the fibres of the intercolumnar fascia are represented by numerous white lines, upon the aponeurosis of the external oblique muscle.) Near the anterior superior spinous process of the ilium, these fibres are weak and scattered; but as they approach the outer extremity of the external abdominal ring they become much more numerous, and, at the same time, greatly increased in thickness and strength, and are thus well calculated to prevent the further divergence from one another of the pillars of the ring.

When the external abdominal ring is distended by the protrusion through it of the sac of an inguinal hernia, the intercolumnar fascia limits the excessive enlargement of the opening, and communicates the circular form to it, whence it has derived its name; and it is owing to the circumstance of the most inferior

fibres of the intercolumnar fascia being more closely aggregated together in such a case, that the constricted appearance usually observed towards the upper part of a large scrotal hernia is produced, an appearance which designs, with precision, the situation of the external abdominal ring.

The fibres of the intercolumnar fascia are commonly found to be more strongly developed in men than in women, and in some rare instances they may exist on both the surfaces of the aponeurosis of the external oblique muscle. They are, on the other hand, in some subjects so thin and delicate as to be demonstrated with great difficulty; and occasionally may even be absent altogether.

The arrangement of the fibres of the intercolumnar fascia is well deserving of particular attention; since their principal function must be the prevention of the farther separation from each other of the pillars of the external abdominal ring, and thus to oppose the formation of inguinal herniæ, since the tendency of the viscera to protrude through the inguinal canal will be in a great degree proportionate to the imperfect or weakly developement of this structure. (The intercolumnar fascia is also represented in Plate I. fig. *l*.)

The *spermatic fascia*. — The margins of the external abdominal ring are not naturally so clearly defined as they have been represented in the first plate of this work, since they are somewhat obscured by the existence of a thin and delicate fascia, through which the fibres of the cremaster muscle may be distinguished. This membrane is the *spermatic fascia*, and descends from the circumference of the external abdominal ring upon the spermatic cord in the male, and the round ligament of the uterus in the female, as they emerge from the inguinal canal.* In the male subject the fascia descends upon the outer surface of the cremaster muscle, to which it is connected by loose cellular membrane; and externally it is in relation with the sub-dartoic cellular tissue. The spermatic fascia descends to the lower part of the testicle, completely surrounding both it and the cord. Some anatomists

* The spermatic fascia is well represented in Plate III. of the Surgical Anatomy of the Groin, fig. *x*. It has received various names from different authors:—tunica aponeurotica, fascia cremasterica; by Scarpa it is called the aponeurotic web of the fascia lata; tunica vaginalis communis, tunique fibreuse du cordon spermatique, &c. &c.

have regarded this membrane as derived from the intercolumnar fascia, which has already been described as lying upon the aponeurosis of the external oblique muscle, while others,—more correctly, I believe, — consider it as a separate and distinct structure, having its origin from the margins of the external abdominal ring.

By drawing the cord and testicle in various directions, it is easily shown that the spermatic fascia adheres very firmly to the circumference of the external abdominal ring, and that it descends thence upon the spermatic cord, gradually becoming narrower until it approaches the testicle, when it expands so as to cover the whole of that gland.

In some subjects the spermatic fascia is sufficiently thick and strong to admit of being easily dissected throughout its entire extent; but, in the greater number of instances, it becomes so extremely thin and delicate in its structure, as it descends upon the cord, as to render the proceeding very difficult and frequently unsatisfactory.

In the female subject the spermatic fascia is neither so strong nor so extensive as in the male; for it is soon blended with the cellular and adipose substance which covers the crista of the os pubis, and in which the round ligament of the uterus is inserted.

The use of this fascia is, according to Sir Astley Cooper, to furnish additional support to the testicle and its coverings; and, by its loose connections with it and the cord, to allow of the free motion of the gland, enabling it more easily to elude the consequences of pressure and violence.*

In cases of old and large scrotal hernia the spermatic fascia is commonly found to be much increased in its thickness and density.

General and surgical remarks. — It may prove useful, before proceeding any further in the dissection of this region, to replace the structures which have already been exposed, and to review them as they now appear.

Underneath the skin is placed the superficial fascia, which, as has been shown, consists of two lamellæ; of which the deeper one is the stronger and more membraniform in its structure,

* See Sir Astley Cooper's work on the Anatomy and Diseases of the Testis, 4to. p. 83.

and adheres closely to the anterior and inferior edge of Poupart's ligament, and to the iliac portion of the fascia lata, in the interspace between the anterior superior spinous process of the ilium and the spinous process or tuberosity of the os pubis; the superficial lamella is, on the other hand, of a much more loose and cellular texture, at the same time that its thickness is liable to frequent variations, which are dependent upon the quantity of adipose substance that may be deposited in its tissue. The superficial pudic and epigastric vessels, with three or four small absorbent glands, have also been seen as they lie betwixt the two lamellæ of the fascia, opposite the crural arch. The superficial fascia is more closely connected to the tendon of the external oblique muscle in the course of the linea alba than elsewhere, while opposite the crista of the os pubis it descends into the scrotum, covering the spermatic cord after its emergence from the external abdominal ring, and finally becomes continuous with the membrane of the dartos.

The delicate cellular tissue which connects the internal surface of the superficial fascia to the tendinous aponeurosis of the external oblique muscle should not be overlooked, as it is by the destruction of it that those dangerous extravasations of urine into the perinæal region, which occasionally supervene upon a rupture of the urethra from inveterate strictures situated in front of the triangular ligament, &c. are enabled to make their way with such alarming and frightful rapidity upwards upon the hypogastric region; a course which is the very opposite of that which would be indicated by the common law of gravitation of fluids, but which is satisfactorily explained by reference to the connexions and relations of the superficial fascia of the perinæum, the dartos, and superficial fascia of the abdominal parietes.* It is, also, in this structure that the diffused inflammation and extensive suppuration which not unfrequently follow injuries inflicted, and surgical operations performed upon this region, are commonly found to have their seat.

The mode of formation of the external abdominal ring, by the divergence from each other of the fibres of the aponeurosis of the external oblique muscle as they approach the crista of the os pubis, is deserving of particular attention; as are, like-

* *Vide* the Surgical Anatomy of the Perinæum, pp. 11 and 12, and Surgical Observations by Sir Charles Bell, p. 90. 8vo. Lond. 1816.

wise, the fibres of the intercolumnar fascia, which, resting on the outer surface of the aponeurosis, cross its fibres at right angles, and by adhering to each as they pass over them, tend to prevent their unnatural separation, and so diminish the frequency of hernial protrusions in this region.

The exact situation of the external abdominal ring must not be forgotten, since it forms a principal point in establishing a correct diagnosis in all difficult and obscure cases of inguinal and femoral herniæ: the ring is situated immediately *above* the crista and spinous process of the os pubis; its longest diameter is directed upwards and outwards, towards the anterior superior spinous process of the ilium; the size of the opening being limited by the inferior fibres of the intercolumnar fascia.* Through the opening projects the spermatic cord in the male, and the round ligament of the uterus in the female; both of which structures receive, as they emerge, a perfect tubular investment from the thin membrane or fascia which springs from the margin of the ring, and is called the spermatic fascia.

The influence which is exercised by the position of the inferior limbs upon the condition of the lower portion of the abdominal parietes, but principally upon the tendon of the external oblique muscle, should also be examined. The iliac portion of the fascia lata of the thigh is firmly attached, in the interval between the anterior superior spinous process of the ilium and the root of the tuberosity of the os pubis, to the inferior edge of Poupart's ligament and its reflected portion, denominated the ligament of Gimbernat; and consequently, when the lower extremity is extended and rotated outwards, the tendon of the external oblique muscle is rendered quite tense and unyielding, and the pillars of the external abdominal ring are brought more tightly together, so that it is with some difficulty that the extremity of the finger can be insinuated into the opening; but if the thigh should be raised and bent upon the pelvis, at the same time that the knee is rotated inwards and towards the opposite side, all the tenseness of the aponeurosis of the external oblique muscle will be removed, and the columns of the external abdominal ring so much relaxed as to admit of the introduction of the finger with the greatest facility.

* The Surgical Anatomy of the Groin, &c. p. 137.

It is with the view of producing a similar relaxation of the pillars of the external abdominal ring, and of the several structures which enter into the composition of the parietes of the inguinal canal, that surgeons are in the constant habit, previously to endeavouring to reduce the contents of a strangulated inguinal hernia by the taxis, of first taking the precaution of placing the lower limbs in such a position as shall most completely relax this portion of the abdominal walls.

The dissection of the inguinal canal.—The lower part of the tendinous aponeurosis of the external oblique muscle may now be raised, in order that the external abdominal ring may be examined from its inner surface, as well as the subjacent structures which are connected with the anatomy of the inguinal canal. For this purpose let an incision be made through the fleshy fibres of the external oblique muscle, about one inch beyond the anterior superior spinous process of the ilium, so as to expose the cellular interspace which separates its fibres from those of the internal oblique muscle; this incision should be prolonged in an oblique direction as far as the linea alba, and thence downwards to the symphysis of the pubes; observing, at the same time, to render the subjacent muscles tense, by drawing the linea alba towards the opposite side, and the cord and testicle downwards and across the right thigh. (See Plate II.) The tendinous and fleshy flap, thus marked out, is to be carefully dissected from the fleshy fibres of the internal oblique and cremaster muscles, and the sheath of the rectus. Near the umbilicus it will be found rather difficult to separate the tendon of the external oblique from the sheath of the rectus muscle; but, as we approach the crista of the os pubis, the connexion between these structures becomes much less intimate, in consequence of the presence of some loose cellular tissue which is interposed between them. The internal and superior pillar of the external abdominal ring should not yet be cut across, but may be allowed to remain entire in its attachments to the body and symphysis of the ossa pubis.

On raising the tendinous aponeurosis of the external oblique muscle, two nerves will be noticed lying between it and the fleshy fibres of the internal oblique (the *musculo-cutaneous* and *ilio-scrotal* branches of the lumbar plexus); they descend, after having successively traversed the transversalis and internal

oblique muscles, to the external abdominal ring, through which they emerge to be finally distributed to the superficial coverings of the spermatic cord and testicle. These nerves frequently adhere pretty closely to the inner surface of the tendinous aponeurosis of the external oblique muscle, and are therefore liable to be cut across when it is raised up to expose the internal oblique and cremaster muscles.

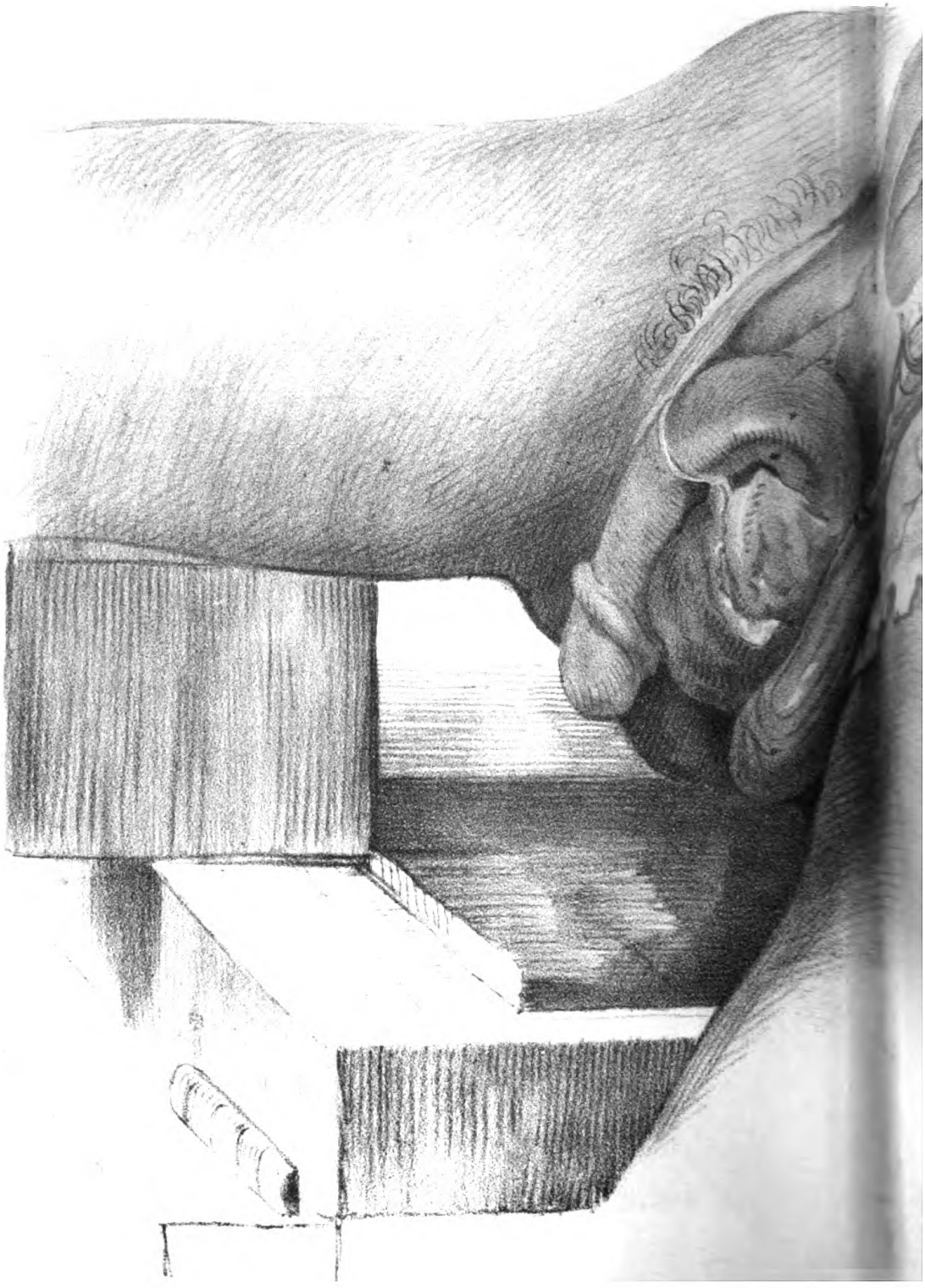
If the tendinous aponeurosis of the external oblique muscle be now taken up in one hand, and the forefinger of the other introduced through the external abdominal ring from its inner aspect, it will be clearly shown how the spermatic fascia passes off from the margins of the opening, and, descending upon the cord, invests both it and the testicle in a perfect tubular sheath. By the same proceeding it will also be readily understood that when the sac of an inguinal hernia protrudes through the external abdominal ring, it will necessarily receive a covering from this membrane.

While it is thus distended by the finger, the external abdominal ring will be observed to lose its natural triangular form, and to assume a circular appearance, which it constantly presents after a hernial sac has descended through it; and hence is derived the appellation of *ring*, which has been given to the opening. (See woodcut, No. 5, figs. *e*, *f*.)

If the dissector should choose to do so, he may now define the margins of the external abdominal ring by cutting with his scalpel lightly round the spermatic cord, as it emerges from the lower opening of the inguinal canal. The spermatic cord, after passing through the external abdominal ring, descends in a vertical direction to the testicle; so that the portion of the cord which lies within the inguinal canal is placed almost at a right angle with that part of it which is included between the ring and the testicle. It may also be here observed, that the spermatic cord, where it passes through the lower opening of the inguinal canal, is partly supported by the inferior pillar of the ring, as it is inserted into the spinous process or tuberosity of the os pubis, and partly by that process of bone itself.

The internal and superior pillar of the external abdominal ring may now be cut away from its insertion, and the aponeurosis of the external oblique muscle reflected downwards upon the thigh as before, so that the dissection of the lower portion

PLATE II.



of the internal oblique and cremaster muscles may be proceeded with, as represented in Plate II.

EXPLANATION OF PLATE II.

This plate represents the second stage of the dissection of the inguinal region, in which the tendon of the external oblique muscle has been raised and reflected downwards upon the thigh, in order to display the lower part of the internal oblique muscle, with the fibres of the cremaster covering the front and sides of the spermatic cord and testicle.

a. The anterior superior spinous process of the ilium.

b. The situation of the spinous process, or tuberosity of the os pubis.

c. The curved line of Poupart's ligament, which is extended between these points of bone.

d. The lower part of the tendinous aponeurosis of the external oblique muscle, raised from its connexions and reflected upon the upper part of the thigh.

e. The fleshy portion of the external oblique muscle above the crista of the ilium.

f. A part of the tendinous aponeurosis of the external oblique muscle, where it covers the sheath of the rectus abdominis muscle.

g. The linea alba.

h. The situation of the linea semilunaris, where the fleshy fibres of the internal oblique muscle cease and become tendinous.

i. The superior and internal pillar of the external abdominal ring reflected upon the thigh.

k. k. The fleshy fibres of the internal oblique muscle as they arise from the anterior superior spinous process of the ilium and the iliac half of Poupart's ligament.

l. A part of the tendon of the internal oblique muscle, where it strengthens and supports the lower portion of the posterior wall of the inguinal canal, behind the external abdominal ring.

m. The tendon of the internal oblique muscle, where it forms the sheath of the rectus abdominis muscle.

n. The external head of the cremaster muscle, arising from the middle of Poupart's ligament.

o. The loops or inverted arches which the fibres of the cremaster muscle form in front of the cord and testicle.

p. The internal or pubic portion of the cremaster inserted into the lower part of the sheath of the rectus.

r. The posterior wall of the inguinal canal, where it is formed by the inner or pubic portion of the fascia transversalis.

s. The skin and superficial fascia of the inguinal region reflected upon the upper part of the thigh. The external epigastric and pudic arteries are seen as they ramify in the deep lamella of the superficial fascia.
t. The symphysis of the ossa pubis.
u. The suspensory ligament of the penis.
v. The corpus cavernosum penis of the left side.
w. The corpus spongiosum penis.
x. The umbilicus.

The internal oblique muscle. — This muscle is attached, superiorly, to the lower margin of the four inferior or false ribs; inferiorly, it is inserted into the anterior two-thirds of the crista ilii, and into the iliac two-thirds of Poupart's ligament; posteriorly, it is prolonged, by a tendinous aponeurosis (part of the fascia lumborum), to the spinous processes of the lumbar vertebræ; and anteriorly, it is inserted into the linea alba, the crista of the os pubis, and the inner part of the ilio-pectineal line. The direction of the superior fibres of the muscle is obliquely upwards and forwards; the central portion is directed transversely inwards to the mesial line; whilst the inferior set incline very obliquely downwards and inwards. At the linea semilunaris the tendon of the internal oblique muscle splits into two layers, one of which passes in front of, and the other behind the rectus muscle, reuniting at its internal edge, where it enters into the composition of the linea alba. In this manner is constituted the sheath of the rectus muscle. This division into two lamellæ of the tendon of the internal oblique muscle exists, however, only from the ensiform cartilage to about midway between the umbilicus and the symphysis pubis; below which point the whole of the tendon passes in front of the rectus, leaving that muscle only separated from the peritonæum by the fascia transversalis and subserous cellular tissue. The structure of the muscle is fleshy, except anteriorly and posteriorly, where it is aponeurotic and tendinous. Relations—superficially, with the external oblique muscle; by its internal surface, with the transversalis, rectus, and pyramidalis muscles; at its posterior part it is in relation with the latissimus dorsi and long muscles of the back. Its lowermost fibres contribute, in the greater number of instances, to the formation of the cremaster muscle.

The most inferior of the fleshy fasciculi of the internal

oblique muscle arise from the iliac two-thirds of Poupart's ligament; and, after arching over the spermatic cord as it lies in the upper part of the inguinal canal (see Plate II. fig. *k*, *l*), end in tendinous fibres opposite the lower part of the outer edge of the rectus muscle, in front of which they pass to reach the linea alba and crista of the os pubis, into which they are implanted. The tendinous aponeuroses of the muscles of each side are united with one another throughout the entire extent of the linea alba.

The portion of the internal oblique muscle which has its origin from the iliac portion of Poupart's ligament should, in the next place, be examined with particular care and attention. In this situation the fleshy fibres of the muscle pass obliquely downwards and inwards, almost parallel with Poupart's ligament, from which they spring; and opposite the outer border of the lower part of the rectus muscle end in a tendinous aponeurosis, which passes in front of it and the pyramidalis towards the linea alba, where it is joined with the tendon of the muscle of the opposite side. Some of the most inferior of the fibres pursue, however, a rather different course from those which are situated just above them; for they become very much curved as they pass over the spermatic cord in the upper part of the inguinal canal, and, becoming tendinous, descend behind the cord where it is contained in the lower part of the canal, and the external abdominal ring, to be finally inserted, along with similar fibres of the transversalis muscle, into that portion of the pectinated line of the os pubis which is situated behind the ligament of Gimbernat.

The cremaster muscle.—The principal fibres of the cremaster muscle spring from the middle portion of Poupart's ligament, between the internal oblique and transversalis muscles, and from this point nearly to the external abdominal ring. (See Plate II. fig. *n*.) Some of these fibres, thinner and paler than the rest, pass directly inwards in front of the upper part of the spermatic cord, and are implanted upon the tendinous aponeuroses of the internal oblique and transversalis muscles, forming the sheath of the rectus muscle (see Plate II. fig. *p*); but by far the greater number of the fibres of the cremaster descend along with the spermatic cord through the external abdominal ring, being at first closely aggregated together on the outer surface of the cord, soon

afterwards, however, separating from each other, and being spread out over the front and lateral aspects of it and the tunica vaginalis reflexa; after which, having ascended along the inner side of the cord, they terminate by being inserted into the crista of the os pubis and lower part of the sheath of the rectus muscle. (See Plate II. figs. *n*, *o*, and *p*.) In this manner the fibres of the cremaster muscle form a successive series of curves, the convexity of which is directed downwards towards the testis: the shortest of these curves consist of the superior fibres of the muscle, simply passing across the upper part of the spermatic cord as it lies beneath the external abdominal ring; whilst the inferior set are much longer, extending over the testis and lower part of the cord.

In this country the cremaster muscle is generally regarded as being derived from the internal oblique, since the disposition and appearance of many of its fibres greatly resemble those of the last-named muscle. The upper edge of the cremaster is, however, frequently separated from the inferior border of the internal oblique muscle by a considerable interval, which is occupied by common cellular tissue, in which sometimes a large mass of adipose substance is deposited. (*Vide* Plate II.)

In some cases, which are however very rare, the fibres of the cremaster are also found upon the posterior aspect of the spermatic cord; a disposition which, it would appear, depends upon the cord piercing the fibres of the internal oblique muscle, instead of merely emerging from beneath its lower edge.* This condition of these structures I have never seen.

M. Jules Cloquet, a distinguished anatomist and surgeon, has devoted considerable attention to the mode of formation of the cremaster muscle in the male subject, and has been led, in consequence of his researches, to the consideration that the cremaster does not exist in the fœtus previously to the descent of the testicle into the scrotum; but that it is produced by the gubernaculum testis, and testis itself, contracting adhesions, as they descend through the inguinal canal into the scrotum, to the middle portion of the muscular fibres forming the lower edge of the internal oblique muscle; and that, by thus dragging these fibres along with them in their descent, (their origin and insertions remaining fixed,) a series of inverted loops or

* See Recherches Anatomiques sur les Hernies, p. 14—18.

arches are produced by the gradual displacement and elongation of their intermediate and more moveable portion.*

The cremaster muscle is supplied with blood by the cremasteric branch of the epigastric artery, and the principal division of the external spermatic nerve is distributed to its fibres.

In the female subject the cremaster muscle cannot generally be said to exist; yet, in some instances, the most inferior of the fibres of the internal oblique muscle are observed suddenly to become much paler than the rest, and also to be loosely scattered, as it were, over the round ligament of the uterus where it lies in the lower part of the inguinal canal.

When an oblique inguinal hernia is formed in the female subject, the front surface of the hernial sac derives a partial muscular investment from the lowermost fibres of the internal oblique, which are displaced and dragged downwards by the sac as the hernia is gradually protruded through the inguinal canal —very closely imitating, in fact, the mode of formation of the cremaster muscle by the descent of the testis in the male.†

Some individuals are possessed of a considerable voluntary power over the contractions of the cremaster muscle, and are enabled to retract the testes as high as the external abdominal ring, and in some instances even to withdraw them into the lower part of the inguinal canal. Persons endowed with the faculty of thus controlling at will the action of the cremaster muscles have been known to deceive medical officers appointed to examine the recruits of the army; pretending that they were affected with inguinal hernia, and, in consequence, unfitted for military service.‡

Dissection of the lower edge of the transversalis muscle.—The lower portion of the internal oblique muscle may now be detached from its connexions to the crista of the ilium and Poupart's ligament, and reflected upwards on the sheath of the rectus, as is represented in Plate III. fig. *h*. This proceeding will be most easily effected if the fibres of the muscle be first divided opposite the anterior superior spinous process of the ilium, as in this situation the muscle is separated from the

* *Vide* Recherches Anatomiques sur les Hernies de l'Abdomen; par Jules Cloquet: 4to. Paris, 1817, p. 15.

† Cloquet, p. 21 (1).

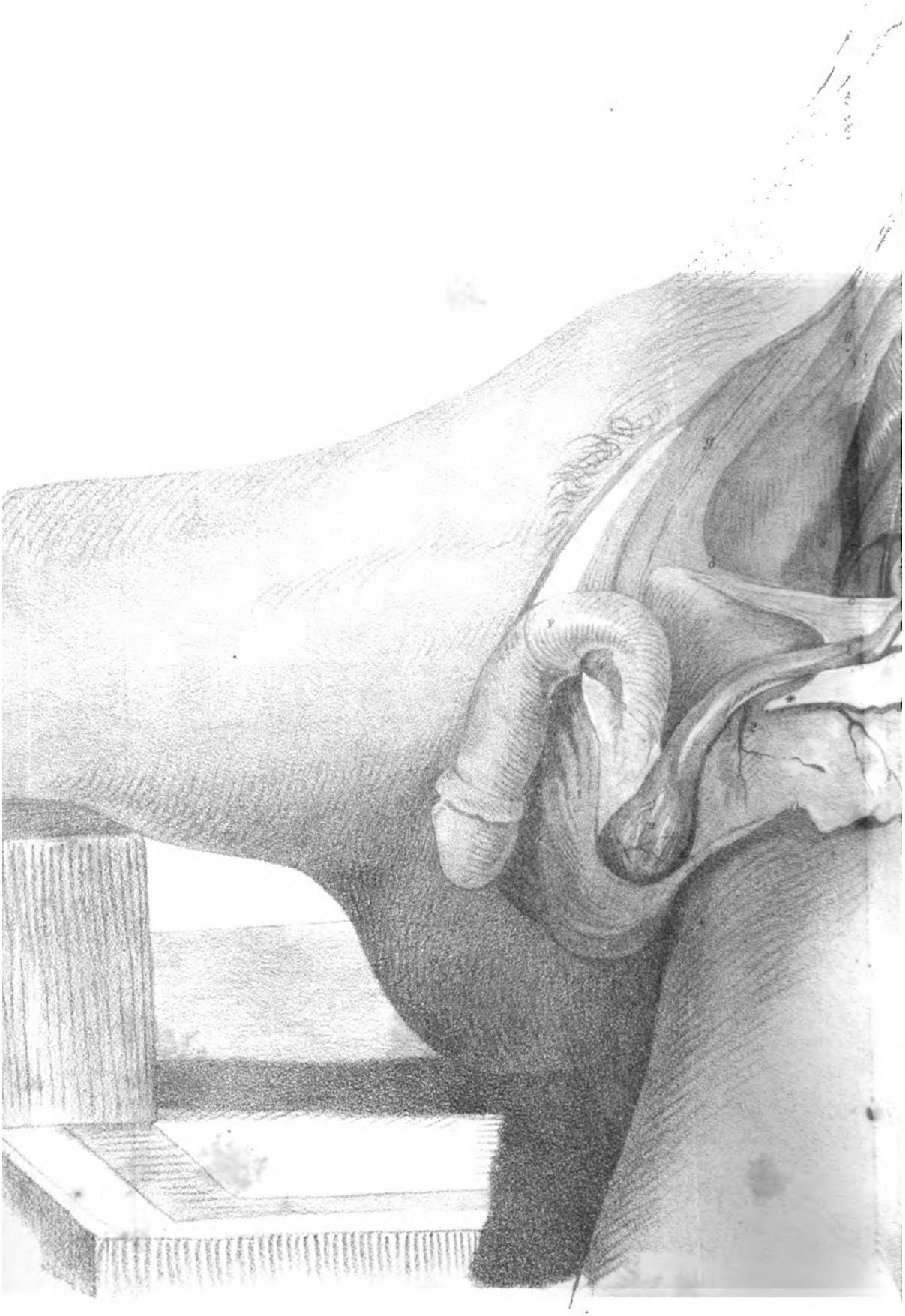
‡ The Cyclopedia of Pract. Medicine, vol. ii. p. 144, art. Feigned Diseases.

transversalis by some cellular tissue and branches of the internal circumflexa ilii artery. In this stage of the dissection it will be found very useful to render the fibres of the transversalis as tense as possible, by drawing the linea alba towards the opposite side, and removing, at the same time that the internal oblique is raised up, the layer of condensed cellular tissue which invests the outer surface of the muscle. When the separation of the internal oblique from the transversalis has been correctly made,—which in many subjects is by no means of easy execution, as these muscles are frequently blended with each other towards their inferior margin,—the fleshy fibres of the latter will, in general, be found to cease to arise from the iliac portion of the ligament of Poupart at the distance of about an inch and a half from the anterior superior spinous process of the ilium. In this situation the muscle terminates by a very clear and distinct edge, which is much curved in its outline, and is partly fleshy and partly tendinous in its structure. (See Plate III. figs. *m*, *n*, *r*.)

Since the fleshy fibres of the internal oblique muscle continue their attachment to Poupart's ligament for an inch, or an inch and a half, nearer to the spinous process of the os pubis than the point where the lower margin of the transversalis muscle is situated, it follows, as a neeessary consequence, that the internal abdominal ring or upper aperture of the inguinal canal, by which the spermatic cord issues from the cavity of the abdomen in its oblique descent to the scrotum and testicle, is supported by it; which circumstance must frequently prove an additional source of prevention against the formation of an oblique or external inguinal hernia.

The *transversalis muscle* arises from the iliac half of Poupart's ligament, and from the inner margin of the crest of the ilium for three-fourths of its extent: it is inserted posteriorly, by a tendinous aponeurosis, which incloses the quadratus lumborum muscle between its laminæ, to the base and apex of the transverse processes of the lumbar vertebræ; anteriorly, the fleshy fibres end, at the outer edge of the rectus muscle, in a tendon, which, after passing conjointly with the posterior division of the aponeurosis of the internal oblique behind that muscle in the space included between the ensiform cartilage and a point situated about midway between the umbilicus and symphysis pubis,

PLATE III.



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is inserted into the linea alba; below this point, however, the tendon of the muscle passes altogether in front of the rectus muscle in its way to reach the lower part of the linea alba. Relations — externally, with the internal oblique muscle; internally, with the fascia transversalis, which is interposed between it and the peritonæum. Structure — muscular at the sides, and aponeurotic anteriorly and posteriorly.

In addition to the attachments of the transversalis muscle which have just been described, it should be particularly noticed that the lowermost fibres of the muscle, after arching over the internal abdominal ring and spermatic cord, are implanted into the crista of the os pubis, and for some distance into the sharp pectinated line of the horizontal branch of the same bone, behind the external abdominal ring and Gimbernat's ligament.

EXPLANATION OF PLATE III. FIG. 1.

The first figure of this plate represents the lower portion of the transversalis muscle and the posterior wall of the inguinal canal, as they appear when the cremaster muscle has been removed from the spermatic cord, and the internal oblique detached from its connexions with the spinous process and crista of the ilium. The spermatic cord is held slightly aside by the hook, in order that the structures which form the posterior wall of the inguinal canal may be more clearly seen.

a. Marks the situation of the anterior superior spinous process of the ilium.

b. The situation of the spinous process or tuberosity of the os pubis, into which the inferior pillar of the external abdominal ring (*c*) is inserted.

c. c. The ligament of Poupart, or lower edge of the tendinous aponeurosis of the external oblique muscle.

d. The internal surface of the tendinous aponeurosis of the external oblique muscle, which has been raised from its connexions, and reflected downwards upon the upper part of the thigh. The superior and internal pillar of the external abdominal ring is marked thus +.

e. Part of the fleshy fibres of the external oblique muscle, cut away from the rest and reflected with the aponeurosis.

f. The fleshy fibres of the external oblique muscle in their natural position, on the side of the belly.

g. g The tendinous aponeurosis of the external oblique muscle, where it covers in the tendinous sheath of the rectus muscle.

h. The lowermost fibres of the internal oblique muscle, cut away from their origins from the iliac half of Poupart's ligament and the anterior superior spinous process and part of the crest of the ilium; they have been reflected upwards upon the sheath of the rectus muscle, for the purpose of exposing the lower margin of the transversalis muscle, and also the internal abdominal ring and posterior wall of the inguinal canal.

i. A part of the internal oblique muscle, where it forms a portion of the lateral parietes of the abdomen.

k. The fibres of the lower portion of the internal oblique muscle, where they spring from the iliac portion of Poupart's ligament.

l. The lower part of the sheath of the rectus muscle, formed by the united tendons of the internal oblique and transversalis muscles.

m. The fleshy fibres of the transversalis muscle, which are not attached so far downwards to Poupart's ligament as the fibres of the internal oblique.

n. n. A part of the tendinous aponeurosis of the transversalis muscle.

o. A large branch of the internal circumflexa ilii artery, which runs in the cellular substance separating the fibres of the internal oblique and transversalis muscles.

p. The internal abdominal ring, or superior aperture of the inguinal canal, by which the spermatic cord issues from the cavity of the abdomen.

The letter is placed upon the fascia transversalis where it parts from the circumference of the ring to furnish the funnel-shaped sheath of the spermatic cord.

The boundaries of the internal abdominal ring are, superiorly, the lower fleshy and tendinous margin of the transversalis muscle; internally, the epigastric artery; and inferiorly, the ligament of Poupart.

q. The pubic portion of the fascia transversalis, where it forms the upper part of the posterior wall of the inguinal canal.

r. s. The conjoined tendons of the internal oblique and transversalis muscles, forming the lower part of the posterior wall of the inguinal canal, and which they greatly strengthen where it otherwise would be weakest, viz. behind the external abdominal ring.

The letter *r* is placed on the tendon of the transversalis, which extends a little farther outwards towards the epigastric artery than the tendon of the internal oblique muscle, which is marked by the letter *s*.

t. The spermatic cord, invested by the funnel-shaped sheath of the fascia transversalis. The cord is held aside by a hook at the point where it emerges from the internal abdominal ring, for the purpose of more clearly exposing to view the structures which form the posterior wall of the inguinal canal.

u. The testicle of the left side, withdrawn from the lower part of the scrotum.

v. The corpus cavernosum penis on the left side.

w. The corpus spongiosum penis.

x. The umbilicus. *y*. The linea alba.

z. The skin and superficial fascia of the inguinal region, reflected downwards upon the upper part of the thigh.

1. The trunk of the epigastric artery, where it runs along the inner margin of the internal abdominal ring. The fascia transversalis has been cut open in the direction of the course of the vessel so as to expose it fully to view. Towards the umbilicus the artery is obscurely seen, as it lies underneath the tendon of the transversalis muscle.

2. The external pudic artery.

3 and 4. Branches of the external epigastric artery.

The posterior wall of the inguinal canal is formed by the fascia transversalis (*q*), and the conjoined tendons of the transversalis (*r*) and internal oblique (*s*) muscles: behind the first of these structures runs the epigastric artery (1), and more posteriorly are found the subserous cellular tissue and the peritonæum, with the ligamentous remains of the umbilical artery.

For the explanation of Fig. 2, the reader is referred to that part of this work which treats of the anatomy of the testicle.

The *conjoined tendons of the internal oblique and transversalis muscles*.—When the inferior fleshy fibres of the internal oblique muscle have been raised and reflected inwards towards the mesial line, as is represented in Plate III, they will be found to terminate, in front of the outer portion of the rectus muscle, in a thin but strong aponeurosis which soon becomes intimately blended with the tendon of the transversalis; a connexion which is so close, that it is absolutely impossible to separate them satisfactorily from one another with the knife. On this account it is usual to describe them together, under the name of the conjoined tendons of the internal oblique and transversalis muscles.

The *conjoined tendons* are partly situated in front of the pyramidalis and lower portion of the rectus muscle, being in-

serted into the linea alba and crista of the os pubis. But, in addition to these attachments, the most inferior fibres of the conjoined tendons are reflected, somewhat in a spiral manner, downwards and outwards, to be inserted, behind the ligament of Gimbernat, into the inner part of the ilio-pectineal line of the os pubis, passing behind the spermatic cord as it lies in the lower part of the inguinal canal. (See Plate III. figs. *r*, *s*.) It is in this manner that the conjoined tendinous fibres of the internal oblique and transversalis muscles close up a considerable portion of the space which is included between the epigastric artery and the outer edge of the rectus muscle; thus constituting a principal part of the posterior wall of the inguinal canal. (See Plate III. fig. *r*, *s*.)

The mode in which the conjoined tendons of the internal oblique and transversalis muscles form the lower part of the posterior wall of the inguinal canal may be very clearly demonstrated in the following manner: — Let the tendinous aponeurosis of the external oblique muscle be reflected, together with the spermatic cord, upon the upper part of the thigh, so that the entire of the triangular space which is included between the epigastric artery and the lower portion of the rectus muscle shall lie fairly exposed to view. (See Plate III.) The index finger of the left hand may now be placed upon this space a little above and parallel with Poupart's ligament, whilst with the other hand traction is made alternately upon the lower fleshy fibres of the internal oblique and transversalis muscles, which, for this purpose, should be separately detached from their respective connexions to the crista of the ilium and ligament of Poupart. When these instructions are observed, the finger which rests upon the posterior wall of the inguinal canal will be elevated, at every movement of the muscular fibres held in the right hand, by the tension of tendinous fibres belonging to each. It will be perceived, at the same time, that the tendinous fibres belonging to the transversalis muscle are more curved in their direction, and extend further outwards from the border of the rectus, than those appertaining to the internal oblique muscle. (See Plate III. fig. *r*.) By a tedious dissection we may, in some subjects, succeed in separating the tendinous fibres which are proper to each muscle from one another, and both of these from the fascia transversalis, which lies behind them: in many instances, however,

this is rendered impracticable, from the intricate manner in which the whole of these structures are interwoven with each other.

In some subjects the conjoined tendons of the internal oblique and transversalis muscles are by no means so clearly developed or so extensive as they have been described in the preceding pages; and in some instances, indeed, they would appear to be altogether absent from that portion of the posterior wall of the inguinal canal which they ordinarily strengthen and support. Under such circumstances, however, the fascia transversalis is generally much stronger in its texture than usual.

The conjoined tendons, being situated behind the external abdominal ring, form the principal obstacle to the direct protrusion of the viscera of the abdomen through this portion of the posterior wall of the inguinal canal; or, in other words, tend greatly to prevent the frequent formation of a direct or internal inguinal hernia.

The *internal abdominal ring*.*— The circumscribed space underneath the lower margin of the transversalis muscle (see Plate III. fig. *p*) has been named by Sir Astley Cooper the *internal abdominal ring*, to distinguish it from the opening in the tendinous aponeurosis of the external oblique muscle, which has already been described as the external abdominal ring, or lower opening of the inguinal canal. In the healthy condition of the parts, no aperture with clearly defined margins, such as the name which has been given to it might lead us to expect, will be found to exist in the situation of the internal abdominal ring; since the term by which it is customarily denominated has been applied to it, not so much from a consideration of the natural figure of the part, as on account of the form which it presents when a hernial protrusion has taken place through it. (See the wood engraving No. 4, fig. *o*.) The internal abdominal ring is situated in the fibrous membrane which lines the inner surface of the transversalis muscle, and named by Sir Astley Cooper the fascia transversalis.

The exact position of the internal abdominal ring is midway between the symphysis pubis and the anterior superior spinous

* Also called the *annulus inguinalis posterior* (Hesselbach); *upper inguinal* or *abdominal aperture* (Monro); *inner opening* or *end of the inguinal canal* (Langenbeck and Scarpa); *l'ouverture supérieure et externe du canal inguinal* (J. Cloquet); *l'orifice postérieur du canal inguinal* (Velpeau).

process of the ilium, being there placed about a finger's breadth above the ligament of Poupart. Its distance from the external abdominal ring is not always the same in different subjects; as it varies between an inch and a half to two inches in extent, according to the length of the inguinal canal, and the magnitude of its openings. (See the woodcut No. 3, fig. *o*.)

At the internal abdominal ring the fascia transversalis is not covered by the fibres of the transversalis muscle, as it is here that the spermatic cord in the male subject, and the round ligament of the uterus in the female, commence their oblique descent through the parietes of the inguinal region; receiving, as they emerge, a funnel-shaped investment from the fascia. (See the wood engraving No. 2, at p. 243, figs. *i*, *k*.)

The internal abdominal ring is bounded superiorly by the fleshy and tendinous margin of the transversalis muscle; inferiorly, by the grooved surface of Poupart's ligament; and internally, by the epigastric artery and its accompanying veins. (See Plate III. fig. *p*.)

As the epigastric artery, in this part of its course, runs along underneath the fascia transversalis, the dissector must either uncover it by an incision with the point of his scalpel, — as was done in the dissection from which the drawing was taken—or,—what is more advisable,—he may satisfy himself of its position and course by lightly pressing his fore-finger upon the inner edge of the ring, when, if the vessel has been injected, it will be clearly distinguished as it rolls underneath the tip of the finger.

It is through the internal abdominal ring that oblique or external inguinal herniæ, in all their various forms, commence to be protruded; and it is from the relation which the several structures here situated bear to the neck of the sac, and consequently to the surgical treatment of these diseases, that so much care and attention are demanded from the student in his dissections of this region. (See the woodcut No. 3, at p. 246, fig. *o*.)

The *fascia transversalis*.—The cellulo-fibrous membrane which lines the internal surface of the abdominal parietes has been thus named in that portion of its extent where it covers the interior of the transversalis muscle. This membrane has received different names in separate parts of its extent; thus, for example, it is called the *fascia iliaca*, where it covers the psoas and iliacus muscles, and the *fascia pelvica* where it

descends into the cavity of the pelvis, upon the inner surface of the levator ani muscles to reach the sides of the bladder and rectum and base of the prostate gland.*

A small portion of the fascia transversalis is now exposed to view (See Plate III. fig. *p*) between the lower margin of the transversalis muscle and Poupart's ligament, which will be observed, on a closer inspection, to furnish a funnel-shaped sheath or investment to the spermatic cord and round ligament of the uterus as they are passing through the internal abdominal ring. (See the woodcut No. 2, p. 243, fig. *i*, *k*.)

The testis and spermatic cord receive, as they descend from the abdomen into the scrotum, a complete covering from the fascia transversalis; and, although it may not always be possible for the dissector to exhibit this prolongation of the membrane upon the lower part of the cord as a distinct fascia, in consequence of its degeneration into a loose cellular tissue, it can, nevertheless, be always distinctly seen to invest the upper part of the cord and the round ligament of the uterus while they are as yet within the inguinal canal. The sheath which is thus furnished by the fascia transversalis to the spermatic cord, is rather wider and more loose above, where it parts from the circumference of the internal abdominal ring, than lower down, where it gradually contracts to the dimensions of the structures which it invests. From this arrangement, the tubular sheath which the spermatic cord and testis receive from the fascia transversalis, has been denominated the *infundibuliform*, or *funnel-shaped process* of the membrane.

Underneath the funnel-shaped process of the fascia transversalis, and in more immediate contact with the vessels which enter into the composition of the spermatic cord, is placed a similarly shaped process from the subserous cellular tissue of the abdominal parietes, but which is much more loose in its texture, and generally contains more of adipose substance than it.

These structures, comprised under one term, constitute what has been called the *fascia propria* of oblique inguinal herniæ.

It is sometimes recommended to carry the scalpel lightly round the spermatic cord as it is held upon the stretch by drawing downwards the testis, and in this manner to divide, close to the inferior border of the transversalis muscle, the funnel-

* *Vide* The Surgical Anatomy of the Perinæum, p. 29—30.

shaped sheath which it derives from the fascia transversalis, and thus to define what have been termed the margins of the internal abdominal ring. When this has been done, the circular form of the superior aperture of the inguinal canal becomes, on relaxing the traction upon the spermatic cord, more distinctly apparent.

There is, however, another plan of proceeding which is much more preferable, in several respects, than that which has just been mentioned, which consists in making a small cut in the fascia transversalis opposite the anterior superior spinous process of the ilium, — the lowermost fleshy fibres of the transversalis muscle having previously been detached from their attachments to Poupart's ligament and the crista of the ilium, and reflected inwards, as has been already directed to be done with the corresponding portion of the internal oblique muscle, — and then, gently to insinuate the handle of the scalpel between the membrane and the subserous cellular tissue. In this manner the handle of the scalpel may be passed downwards for a considerable distance upon the front of the spermatic cord.

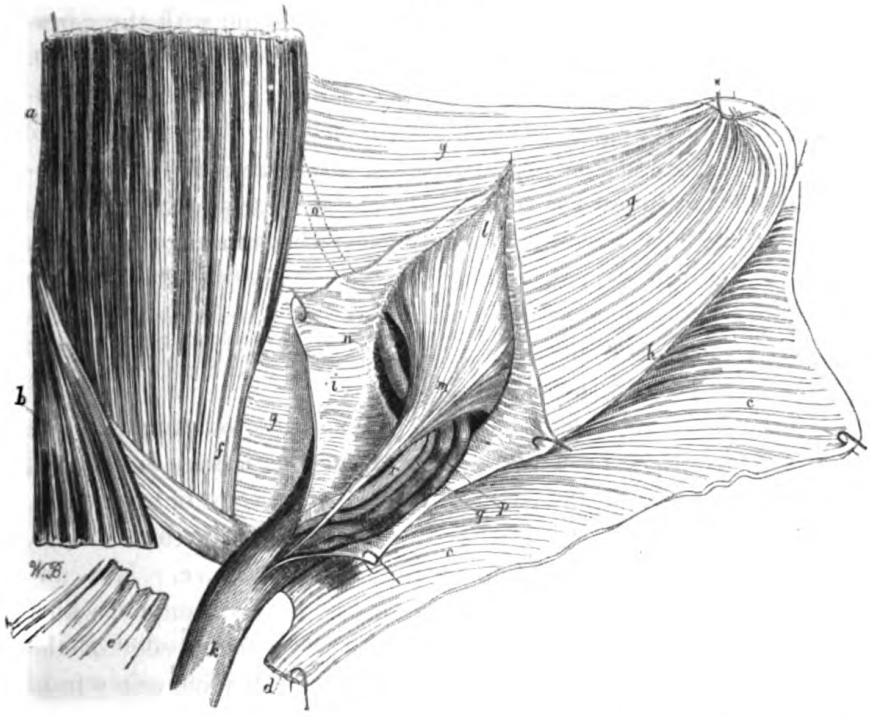
At the first view the fascia transversalis appears of a yellow tint; but this depends only upon its translucent nature, which permits the proper colour of the subserous cellular tissue, a structure which is always more or less loaded with adipose substance, to be seen through it.

The fibres of which the fascia transversalis is composed are arranged, for the most part, in an oblique direction, downwards and outwards from the edge of the rectus muscle; but these are, however, crossed in various directions by numerous others, which give to the membrane a reticular appearance. Not unfrequently the fascia transversalis consists of two laminæ, which are united with each other opposite the posterior edge of the ligament of Poupart. The anterior of these laminæ arises from the ligament itself, while the posterior is but the continuation of the fascia iliaca, which quits the iliacus internus muscle to be reflected upon the lateral and anterior parietes of the abdomen. On the outer side of the internal abdominal ring it is not difficult to separate these laminæ from one another, but, around the margins of that opening, and between it and the edge of the rectus muscle, they are so closely blended together that it is almost impossible to disunite them. When this division of the

fascia transversalis exists, the posterior lamina will be found to extend, behind the rectus muscle, to the linea alba, whilst the anterior is implanted into the outer edge of the same muscle. The epigastric artery sometimes runs behind, and sometimes in front of these laminæ, but not unfrequently it is found betwixt them.

The sheath which is furnished from the fascia transversalis to the spermatic cord in the male, and round ligament of the uterus in the female, is rather wider and looser above where it parts from the margin of the internal abdominal ring, than lower down, where it gradually contracts to the dimensions of the structures which it serves to enclose. (See the following woodcut, fig. *i*, *k*.)

No. 2.



The wood-cut represents the funnel-shaped sheath of the fascia transversalis laid open upon its front aspect, so as to show the manner in which it encloses the structures which constitute by their union the spermatic cord.

a. The rectus abdominis muscle of the left side dissected.

b. The pyramidalis muscle.

c. c. The tendinous aponeurosis of the external oblique muscle, dissected from its attachments, and reflected downwards upon the upper part of the thigh.

d. The internal and superior pillar of the external abdominal ring, cut from its connections with the body of the os pubis, and reflected downwards with the rest of the aponeurosis of the external oblique muscle, of which it forms a part.

e. The corresponding portion of the internal and superior pillar of the external abdominal ring, occupying its natural position in front of the body of the os pubis.

f. The outer border of the tendon of the rectus muscle, where it is continuous with the inner or pubic portion of the fascia transversalis (*g*).

g, *g*, *g*. The fascia transversalis where it lines the inguinal region.

h. The fascia transversalis blended with the posterior edge of Poupart's ligament, so as to form with it the floor of the inguinal canal. The fibres of the internal oblique and transversalis muscles have been dissected from their attachments to the iliac portion of the crural arch and wholly removed.

i. The funnel-shaped sheath of the fascia transversalis, laid open in front to display the component structures of the spermatic cord, which it encloses.

k. The funnel-shaped sheath of the fascia transversalis, where it invests the spermatic cord, between the external abdominal ring and the testis; behind this portion of the cord are observed some oblique fibres, which constitute the triangular ligament of the inguinal canal.

l. A portion of the great sac of the peritonæum.

m. A tubular process of the peritonæum, which is frequently to be found as a fibro-cellular band in front of the rest of the structures composing the spermatic cord; it consists of the obliterated portion of the original processus vaginalis peritonæi.

n. The epigastric artery, as it passes deeply in the subserous cellular tissue, betwixt the fascia transversalis and the peritonæum, and along the pubal side of the internal abdominal ring.

o. Dotted lines, which serve to indicate the course of the epigastric artery, as it ascends in an oblique direction behind the fascia transversalis in its way towards the umbilicus.

p. The spermatic veins. *q*. The spermatic artery.

r. The vas deferens.

s. The triangular ligament of the inguinal canal.

The fascia transversalis is stronger and more fibrous in its structure around the circumference of the internal abdominal ring than elsewhere, and it is more especially so on the inner edge of that opening, between it and the epigastric vessels: in this situation, indeed, the fascia transversalis frequently presents the appearance of terminating by a well-defined edge, over which the spermatic cord turns, to descend from the interior of the belly into the inguinal canal. This sharp margin only exists, however, in consequence of the angular reflexion of this portion of the fascia transversalis, as it doubles upon itself in order to contri-

bute towards the formation of the funnel-shaped sheath of the cord. When the membrane is extended upon the handle of the scalpel, this angular appearance of it is effaced, and the whole is thus shown to constitute one continuous and uniform surface.*

It is principally owing to the presence of the fascia transversalis at the superior aperture of the inguinal canal, supported as it is there by the lower fleshy fibres of the internal oblique muscle, that the oblique form of inguinal hernia is not of more frequent occurrence; for, as we have already seen, neither the spermatic cord, nor the round ligament of the uterus, completely fill up the space included within the circumference of the internal abdominal ring.

In persons of an originally weak and sickly habit of body, and even in individuals of a contrary disposition, but in whom the muscular system has been temporarily enfeebled by acute and wasting diseases, such as fevers, &c. it will be frequently observed, on making an examination of the inguinal regions, that the abdominal parietes yield in a very perceptible manner, and become prominent opposite the situation of the internal abdominal ring, whenever they cough violently, or make any other similar exertion tending to excite a forcible contraction of the muscles bounding the abdominal cavity; and if, under these circumstances, the hand should be applied against this region, the impulse which is communicated to the viscera within will be very sensibly distinguished. In this manner inguinal herniæ may be frequently detected in the earliest stages of their formation, long before the patient is himself aware of the existence of the disease.

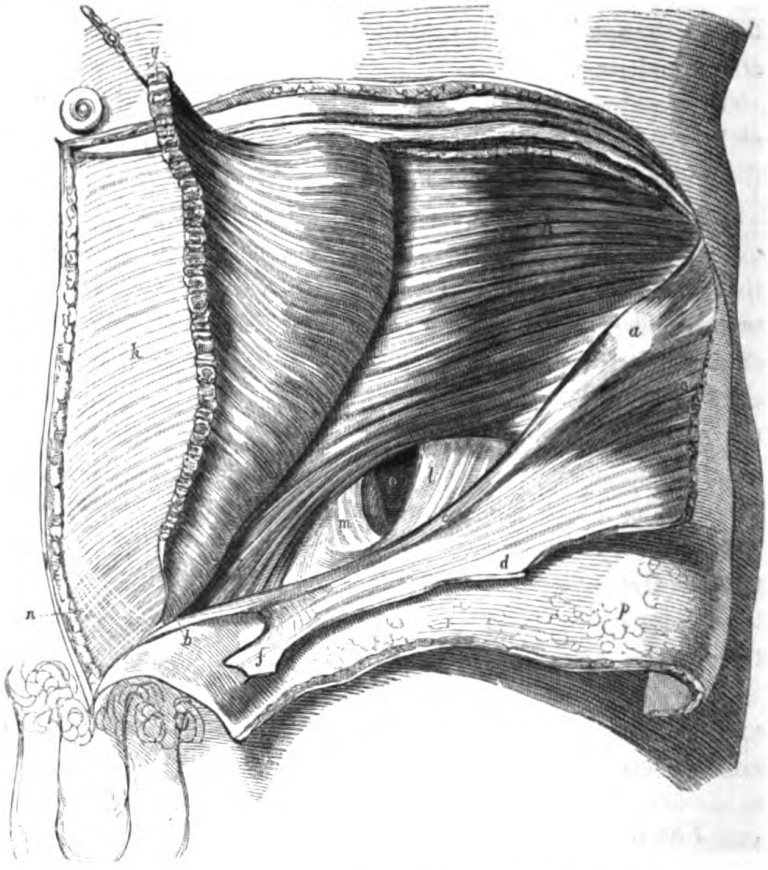
The fascia transversalis is not always of the same strength and thickness in different individuals; in some persons it is scarcely stronger than a layer of simple cellular tissue, while in some others, generally men, it is perfectly aponeurotic in its structure and properties.

Around the circumference of the internal abdominal ring, the

* As the fascia transversalis is very thin and delicate in its structure opposite the internal abdominal ring, it is not always acknowledged that the spermatic cord receives an investing sheath from it, as the latter passes through the opening: on the contrary, the spermatic cord has been described as emerging from the cavity of the abdomen betwixt two portions of the fascia, the free margins of which are described as the external and internal pillars of the internal abdominal ring.—*See Lawrence on Ruptures*, 5th edit. p. 189.

fascia transversalis adheres very closely to the inferior margin of the transversalis muscle, and is so intimately blended with the posterior surface of its tendon, that it is with much difficulty they can be separated from each other with the scalpel. The fascia transversalis is connected to the outer margin of the rectus muscle, and is regarded by some anatomists as ceasing here; but, with a little care, it may be traced behind it as far as the linea alba, where it is continuous with the membrane of the opposite side.

No. 3.



The wood-engraving represents the posterior wall of the inguinal canal. The superficial fascia and the aponeurosis of the external oblique muscle have been reflected downwards upon the upper part of the thigh; the lower portion of the internal oblique muscle has also been detached from its connections to the ligament of Poupart, and thrown upon the sheath of the rectus abdominis muscle. The spermatic cord and funnel-shaped sheath of the fascia transversalis have also been removed from the inguinal canal.

a. The anterior superior spinous process of the ilium. *b*. The insertion of Poupart's ligament, or inferior pillar of the external abdominal ring, into the spinous process or tuberosity of the os pubis. *c*. The ligament of Poupart, stretched between the spinous process of the os pubis and the anterior superior spinous process of the ilium. *d*. The tendinous aponeurosis of the external oblique muscle, dissected up from its connections, and thrown down upon the upper part of the thigh. *e*. A portion of the fleshy fibres of the same muscle, detached from the rest. *f*. The superior or internal pillar of the external abdominal ring reflected with the rest of the aponeurosis. *g*. The lower portion of the internal oblique muscle, cut away from its connections to Poupart's ligament and the crista of the ilium, and thrown upwards upon the sheath of the rectus muscle. *h*. The fleshy fibres of the transversalis muscle, in their natural situation. *i*. The tendon of the same muscle, as it is about to become blended with the tendon of the internal oblique muscle, and so form part of the conjoined tendons, where they constitute a portion of the posterior wall of the inguinal canal, strengthening it behind the external abdominal ring. *k*. The sheath of the rectus abdominis muscle, formed by the tendons of the internal oblique and transversalis muscles. *l*. The outer or iliac portion of the fascia transversalis, forming what has been termed the external pillar of the internal abdominal ring. *m*. The inner or pubic portion of the same membrane, the outer edge of which constitutes the internal pillar of the ring; it contributes also to the formation of the posterior wall of the inguinal canal. *n*. The triangular ligament, or diagonal brace of the inguinal canal, formed by some of the fibres of the tendon of the external oblique muscle of the opposite side. *o*. The internal abdominal ring, or superior aperture of the inguinal canal. The epigastric artery is seen as it runs deeply along the internal or pubic margin of the ring. It is by the dilatation of this opening that the various forms of external or oblique inguinal herniæ commence their descent from the abdomen. *p*. The skin and superficial fascia dissected, and thrown down upon the upper part of the thigh.

The posterior wall of the inguinal canal is formed, in its upper part, by the peritonæum, the subserous cellular tissue, and the fascia transversalis; and, in the lower part of its extent, by these structures additionally strengthened and supported by the conjoined tendons of the internal oblique and transversalis muscles, and the triangular ligament of the inguinal canal.

The inguinal canal. — This name has been given to the oblique passage through the iliac region of the abdominal parietes, by which the spermatic cord in the male, and the round ligament of the uterus in the female, descend from the interior of the belly to reach the structures with which they are connected externally.

The length of the inguinal canal varies between one inch and a-half to two inches in extent; being usually a little longer

and narrower in women than in men. The greater width of the inguinal canal in the male subject,—joined with the larger size of its apertures, the internal and external abdominal rings, — are circumstances fully adequate to account for the more frequent occurrence of inguinal herniæ in the male sex.

The direction of the inguinal canal is very oblique, passing downwards, inwards, and forwards; a disposition which, as it fortunately permits of the opposite walls of the passage becoming more closely approximated together under the ordinary pressure of the visceral contents of the abdomen, must tend greatly to prevent the formation of oblique inguinal herniæ during every unusual muscular exertion.

The inlet, or superior orifice of the inguinal canal, is the internal abdominal ring, the situation of which, opposite the centre of the space between the anterior superior spinous process of the ilium and the spinous process of the os pubis, and just above the ligament of Poupart, has been already described (see the woodcut No. 3, at page 246, fig. *o*). The external abdominal ring, placed immediately above the spinous process of the os pubis, constitutes the inferior aperture or outlet of the canal. (See the wood-engraving No. 1, at page 220, fig. *i*.)

The anterior wall of the inguinal canal is formed by the tendinous aponeurosis of the external oblique muscle, which is strengthened by the fibres of the intercolumnar fascia, and is covered by the skin and superficial fascia. (See Plate I. figs. *b*, *d*, and *r*.) The posterior wall—or that which is next the cavity of the abdomen—is formed, in the upper third of its extent, by the fascia transversalis, the subserous cellular tissue, and the peritonæum; but, in the lower or pubal two-thirds, by these several structures greatly fortified by the fibres of the conjoined tendons of the internal oblique and transversalis muscles, and the triangular ligament, as they descend towards their insertions into the inner part of the ilio-pectineal line of the os pubis, behind the ligament of Gimbernat. (See Plate III. fig. *q*, *r*, and *s*.)

The triangular ligament of the inguinal canal.—When the inner and superior pillar of the external abdominal ring is raised and reflected, as in Plates II and III. a thin layer of oblique tendinous fibres may be observed to fill up the angular space which is included between the outer edge of the tendon of the rectus

muscle and the pubal extremity of Poupart's ligament. These fibres belong to the aponeurosis of the external oblique muscle of the opposite side; and, after decussating with the corresponding fibres of the opposite muscle, are inserted into the crista and spinous process of the os pubis, and, also, into the inner third of the ilio-pectineal line of the same bone, behind the ligament of Gimbernat. By some anatomists this triangular fascia has been supposed to exert a considerable influence in preventing the formation of a direct inguinal hernia; but after a close inspection of its situation and extent, this opinion, I believe, can hardly be maintained.* These fibres are sometimes so very thin and indistinct, that it is with great difficulty that their existence can be demonstrated.

The inferior wall, or flooring of the inguinal canal, is constituted by the grooved surface which results from the union of the posterior border of Poupart's ligament with the fascia transversalis.

The inguinal canal contains, besides the lower edge of the obliquus internus in the male subject, the spermatic cord and upper portion of the cremaster muscle; and, in the female, the round ligament of the uterus.

The subserous cellular tissue.—Betwixt the inner surface of the fascia transversalis and the peritonæum exists a layer of loose cellular substance, which is frequently of considerable thickness, especially in corpulent persons, in whom it is so much loaded with adipose matter as to resemble, in a remarkable degree, the omentum, for which it has been not unfrequently mistaken during operations for strangulated inguinal and femoral herniæ.† Opposite the posterior wall of the inguinal canal, the subserous cellular tissue is frequently found to be nearly half an inch in thickness.

In cases of phlebitis originating in the veins of the lower ex-

* Dr. Quain considers that these fibres not only tend to support the conjoined tendons of the internal oblique and transversalis muscles, upon which they are laid; but that they also serve to connect the lower part of the linea alba and Poupart's ligament, on the principle of a diagonal brace, and by means of their elasticity tend to weaken the force of any pressure made upon the part, by diffusing it over a greater extent of surface. — *Elements of Anatomy*, 4th edit. p. 467.

† On this subject, see Sir Astley Cooper on Hernia, 2d edit. Part I, note at bottom of p. 14; and also Part II. p. 11 and 12. Also Scarpa on Hernia, translated by Wishart, 8vo. p. 269.

tremity and of the cavity of the pelvis, the subserous cellular tissue, lining the iliac fossa, is sometimes affected with diffuse inflammation, ending in extensive suppuration.

Previous to their entrance into the inguinal canal, the spermatic cord and round ligament of the uterus receive each an investment from the subserous cellular tissue, which accompanies them as far as their opposite extremities.

It is into the sheath which the subserous cellular tissue furnishes to the spermatic cord, that the sac of an oblique inguinal hernia descends, and it is to the great laxity and distensibility of this membrane that the disgregation of the component structures of the spermatic cord—so commonly observed in cases of large scrotal herniæ of long standing—is mainly attributable. Steatomatous tumours, which are liable to be mistaken for examples of incomplete inguinal herniæ, are occasionally developed in that part of this structure which serves to invest the spermatic cord. Considerable collections of serous fluid are sometimes met with, which are either contained in one cavity or cyst, as in some forms of the encysted hydrocele of the cord, or diffused throughout the whole extent of the membrane, as in that form of the disease (of rare occurrence) which has been denominated by Mr. Pott hydrocele of the cells of the tunica communis.*

The spermatic cord. — The spermatic artery and accompanying veins descend from the lumbar region, where they are placed in front of the psoas and iliacus muscles, to reach the internal abdominal ring, or superior opening of the inguinal canal (see Plate IV. figs. 5 and 6). At this point they join at an acute angle with the vas deferens, which here dips down into the cavity of the pelvis in its way from the testicle to reach the side and base of the bladder, to which it is closely applied, as it runs along to its termination in the prostatic portion of the urethra, where it opens upon the anterior and lateral surface of the veru-montanum. (See the Surgical Anatomy of the Perinæum, Plate IV. fig. *p*, and page 34.) In the inguinal canal, and between the external abdominal ring and the testicle, the

* For an excellent and interesting account of the various forms of Hydrocele, the student is referred to Mr. Pott's Treatise on that disease.

Mr. Pott operated upon one case of diffused hydrocele of the spermatic cord, and drew off eleven pints of water.—See *Pott's Works*, 2d edit. vol. ii. p. 270.

vas deferens is situated to the inner and posterior side of the rest of the vessels composing the spermatic cord.

The *spermatic arteries* spring from the sides of the aorta, at a little distance below the origin of the renal arteries. The artery of the left side passes in front of the vena cava, and both pass obliquely in front of the ureters, lying betwixt them and the peritonæum. In their course from their origin to the superior aperture of the inguinal canal, the spermatic arteries furnish several delicate branches to the cellular tissue, investing the ureters and outer surface of the peritonæum. For the manner of their distribution to the glandular structure of the testicle, the reader is referred to the description of the anatomy of that organ, as given in a future part of this work. In the female the spermatic arteries are distributed to the ovaries and fallopian tubes.

The *spermatic vein*, on the right side, ordinarily opens into the vena cava, a little below the junction of the renal vein with that vessel: on the left side, the spermatic vein usually empties its contents into the great trunk of the renal vein of the same side. The vascular plexuses which are formed upon the lower part of the spermatic cord, by the subdivision of these veins into several branches, which freely communicate with one another by frequent anastomoses, have been named by anatomists the *corpus pampiniforme*. These veins are, particularly on the left side, frequently greatly dilated and varicose; a condition which constitutes the complaint well-known under the denomination of varicocele or cirsocele.

The *lymphatics* of the testicle and spermatic cord are very numerous, and form, by their junction with each other, several trunks of considerable size, which ascend upon the spermatic veins, and terminate in the absorbent glands, which lie on each side of the aorta, in front of the lumbar vertebræ.

The disposition of the absorbent vessels of the testicle, renders necessary the precaution of previously examining with great care into the state of the lymphatic glands of the iliac and lumbar regions, before deciding upon the extirpation of the organ when affected by malignant and cancerous diseases, as, for example, fungus hæmatodes and schirrus.

The *nerves* which are situated among the structures composing the spermatic cord, are very numerous, consisting,—besides

the musculo-cutaneous and genito-crural branches of the lumbar plexus,—of numerous filaments from the mesenteric, renal and hypogastric plexuses of the grand sympathetic, and are sufficient to explain the sympathies which are well-known to exist under many circumstances between the stomach and testicle; as in orchitis, blows upon the testicle, &c.

At its entrance into the inguinal canal, the spermatic cord forms an acute angle with those portions of it which are situated within the cavity of the abdomen, and, after bending over the epigastric artery, follows the oblique direction downwards and forwards of the canal, passing successively underneath the lower margins of the obliquus internus and transversalis muscles. In the lower part of the inguinal canal the spermatic cord is covered anteriorly and upon the sides by the cremaster muscle, and then — continuing its descent towards the testicle — after emerging through the external abdominal ring, it again changes its direction, by making a second curve, the concavity of which is turned towards the outer pillar of the ring and spinous process of the os pubis.

The vessels and nerves which compose the spermatic cord, are enclosed, as has been already described, in sheaths derived from the subserous cellular tissue and the fascia transversalis; they are partially covered also by the cremaster muscle, and again completely by the external spermatic fascia, which is derived from the margins of the external abdominal ring.

Where the vessels of the spermatic cord enter the superior aperture of the inguinal canal, the peritonæum always presents a well-marked depression on its inner surface, the depth of which varies, however, in different subjects. This fossula, or depression of the peritonæum, is frequently prolonged externally, in front of the cord, under the form of a shallow funnel-like tube, which soon terminates in a delicate white fibro-cellular cord, that may be traced downwards until it expands into the tunica vaginalis of the testicle. (See the wood-engraving No. 2, at p. 243, fig. *m*.) This fibro-cellular band consists of the ligamentous remains of the processus vaginalis peritonæi, which is generally obliterated at, or soon after, the period of birth.

The *epigastric artery*.—This vessel usually arises from the inner side of the external iliac artery, about three or four lines above the inner margin of the crural arch. The epigastric artery

inclines at first a little downwards and inwards, so as to get under cover of the posterior surface of Poupart's ligament, after which it suddenly changes the direction of its course, and mounts obliquely upwards towards the umbilicus, passing, at the same time, underneath the commencement of the spermatic cord and along the inferior and inner margin of the internal abdominal ring. In the first part of its course the artery lies embedded in the subserous cellular tissue, between the fascia transversalis and the peritonæum; but about midway between the umbilicus and the symphysis pubis, it pierces the tendinous sheath of the rectus muscle (to which it is finally distributed), frequently anastomosing in the remainder of its passage with the terminal branches of the internal mammary, lumbar, and superficial epigastric arteries. (See Plate IV. fig. 3.)

The epigastric vein follows the same course as the artery, upon the inner side of which it runs. Occasionally two veins accompany the epigastric artery. (See Plate V. fig. 1, 2.)

Near its origin the epigastric artery furnishes three branches, of which the largest turns into the inguinal canal along with the spermatic cord, and, being distributed to the cremaster muscle, has been named the *cremasteric artery;* its branches anastomose with those of the spermatic and external pudic arteries. The second branch is much smaller than the preceding, and runs along the posterior surface of Poupart's ligament, to reach the symphysis pubis, behind which it inosculates with the corresponding vessel of the opposite side. The third branch descends behind the horizontal branch of the os pubis, and joins with some of the branches of the obturatrix artery. As it ascends towards the umbilicus, the epigastric artery gives off, on each side of its course, several other small branches, which are distributed to the inner surface of the transversalis and rectus muscles.

Varieties.—The epigastric artery sometimes arises high up from the external iliac, in some instances at least an inch and a half distant from the crural arch. It sometimes arises from the internal circumflex of the thigh, as well as from the femoral artery below the crural arch; it has also been found arising from the profunda femoris. Hesselbach states having seen it deriving its origin from the obturatrix artery; and in that instance it ran along the inner edge of the neck of the sac of an

internal inguinal hernia.* The epigastric artery frequently gives off the obturatrix artery, the relations borne by which, under various circumstances, to the neck of the sac of a femoral hernia have been already fully noticed in a former part of this work.†

It is important to bear in mind that the epigastric artery lies along the inner or pubic edge of the internal abdominal ring; for, as will be afterwards described, the two principal varieties of inguinal hernia that are of most frequent occurrence commence, either upon the outer, or the inner side of this vessel; circumstances which require that a certain direction should be given to the edge of the knife, while removing the stricture at the neck of the sac in the operation for strangulated inguinal herniæ, otherwise the artery may be wounded, and so give rise to a very troublesome and even fatal hemorrhage.‡

The great laxity of the subserous cellular tissue which connects the epigastric artery, in the first part of its course, to the adjacent structures, renders it very easy to alter the position of the vessel by any considerable pressure exerted on either side; and thus it is that we so frequently find the artery displaced inwards as far as the outer edge of the rectus muscle, in cases of large and long standing external inguinal herniæ.

The epigastric artery and its branches have been frequently wounded in the old operation of tapping for ascites, in which it was the custom to enter the trocar at a point midway between the umbilicus and the anterior superior spinous process of the ilium.§

The epigastric artery may also be wounded in the operation of placing a ligature upon the external iliac artery, if the internal extremity of the incision, which is requisite for exposing

* Dictionary of Practical Surgery, by S. Cooper, 7th edit. p. 718.

† *Vide* Surgical Anatomy of the Groin, &c. p. 114; and the wood engraving, No. 6. at p. 115; also, Plate V. fig. 4, 5, 6.

‡ For cases where this accident occurred, see Sir Astley Cooper on Hernia, 2d edit. p. 54, and Mr. Cooper's Dictionary of Surgery, 7th edit. p. 741; also the works of Scarpa, Bertrandi, Lawrence, &c.

§ *Vide* Medical Communications, vol. ii. p. 482; a Paper by Dr. Carmichael Smith; also, Mr. Cooper's Dictionary of Practical Surgery, 7th edit. p. 1081.

that vessel, should be prolonged too much inwards, towards the edge of the rectus muscle.*

The *internal circumflexa ilii* takes its origin from the outer side of the external iliac artery, at first lying in the subserous cellular tissue (see Plate IV. fig. 4): it soon, however, pierces the fascia iliaca; and taking the same direction as Poupart's ligament, runs along its posterior aspect as far as the anterior superior spinous process of the ilium, near which point it traverses the fibres of the transversalis muscle, and so gets between it and the internal oblique. Its branches are distributed to the muscles which form the lateral parietes of the abdomen, and anastomose with the branches of the lumbar and epigastric arteries.

The epigastric and internal circumflexa ilii arteries are of considerable importance in carrying on the collateral circulation, after the ligature of the common femoral and external iliac arteries.†

* *Vide* the Surgical Anatomy of the Groin, &c. p. 170.

† Ibid. p. 171.

CHAPTER II.

DISSECTION TO EXPOSE, BY AN INTERNAL VIEW, THE STRUCTURE AND RELATIONS OF THE POSTERIOR WALL OF THE INGUINAL CANAL.

THE cavity of the abdomen should now be exposed, by making an incision through its parietes from the crest of the ilium, a little distance beyond the anterior superior spinous process, to the linea alba, near the umbilicus; and thence in a vertical direction to the symphysis pubis, as is represented in Plate IV. The small intestines should likewise be removed from the cavity of the pelvis. When these directions have been executed, on holding upwards and forwards the triangular-shaped flap that has been marked out, the peritonæum which lines the interior of the abdominal parietes of the inguinal regions, will be found to present, on each side of the mesial line, three remarkable and distinct depressions, which may be denominated the *inguinal pouches* or *fossæ of the peritonæum*. The deepest of these fossæ is the most external of the three, and is situated on the outer or iliac side of the epigastric artery, and corresponds with the upper aperture or inlet of the inguinal canal. It is underneath this point that the spermatic vessels and the vas deferens join with each other, as they bend over the trunk of the epigastric artery, previously to their entrance into the inguinal canal, where they constitute the spermatic cord. If the finger be pressed pretty firmly upon the peritonæum at this situation, the membrane will readily yield under the influence of the pressure thus exerted, and may easily be protruded, in the form of a small pouch or sacculus, for some little distance upon the anterior surface of the spermatic cord, as it is resting in the upper part of the inguinal canal. In some subjects a probe or other blunt-pointed instrument will be found, if introduced into the bottom of this depression of the peritonæum, to pass, without the slightest impediment, for a consi-

derable distance downwards and forwards in front of the spermatic cord, or round ligament of the uterus; which circumstance is owing to the imperfect obliteration, in this situation, of the original processus vaginalis of the peritonæum. In the adult female subject a long process of a similar nature is occasionally found to exist, in front of the round ligament of the uterus, and is very well known to anatomists under the name of the *canal of Nuck*. In some few instances, the probe may be passed, in front of the spermatic cord, through a very narrow canal, or passage, as far as the testicle; and, in such cases, the sac of the tunica vaginalis testis still retains its primitive connection with the cavity of the great bag of the peritonæum; the processus vaginalis peritonæi not having been obliterated as usual, but only contracted in its original dimensions.†

Situated opposite the internal abdominal ring, the external inguinal fossa of the peritonæum is — in men at least — undoubtedly the weakest point of the abdominal parietes; and thus it happens, that cases of the common and congenital forms of inguinal herniæ are almost universally observed in individuals of the male sex.

If the processus vaginalis peritonæi should remain pervious during life, the intestines may, at any time, be forced down into its cavity, so as to constitute that form of external or oblique inguinal hernia, which has been named *congenital*, from the general belief which was formerly entertained, that it could only happen at or immediately after birth, before the obliteration of this process from the serous membrane lining the abdomen, which was presumed always to take place, had been effected.

When, under such circumstances, any considerable quantity of serous fluid is collected within its cavity, a *congenital hydrocele* is then said to be formed.

Sometimes the processus vaginalis peritonæi is not wholly obliterated, but only at several points of its extent between the testicle and the internal abdominal ring; and, then, — serous fluid collecting in the sacculi which intervene between each point where the obliteration has been effected, — a series of small *encysted hydroceles of the spermatic cord* may be produced.

† In many of the lower animals, as, for example, the dog, the processus vaginalis peritonæi remains permanently open.

The *second*, or *middle fossa of the peritonæum*, is not so deep as the preceding; it is situated on the inner or pubal side of the epigastric vessels, betwixt them and the ligamentous cord, which is formed by the obliteration of the umbilical artery of the fœtus.

If a hernial sac should commence to be protruded into the inguinal canal in this situation, it would at first be only covered by the subserous cellular tissue and fascia transversalis; since, at this point, these structures alone form the posterior wall of the inguinal canal. The hernia would also belong to that division of inguinal herniæ usually denominated *direct* or *internal*.

The *third*, or *most internal of the inguinal fossæ of the peritonæum*, is situated on the pubal side of the ligamentous cord, which results from the obliteration of the umbilical artery, between it and the outer edge of the rectus muscle. It is placed directly behind the external abdominal ring, and corresponds with the strongest portion of the posterior wall of the inguinal canal, where it is formed by — besides the subserous cellular tissue and fascia transversalis — the conjoined tendons of the internal oblique and transversalis muscles.†

A direct or internal inguinal hernia may also be formed by the protrusion of a hernial sac through this portion of the posterior wall of the inguinal canal; which would then be covered not only by the subserous cellular tissue and the fascia transversalis, as in the preceding instance, but also, in all probability, more or less completely, by the conjoined tendons of the internal oblique and transversalis muscles.‡

The peritonæum, and subserous cellular tissue, should now be detached from the inner surface of the inguinal region and iliac fossa, so as to expose to view the vas deferens and sper-

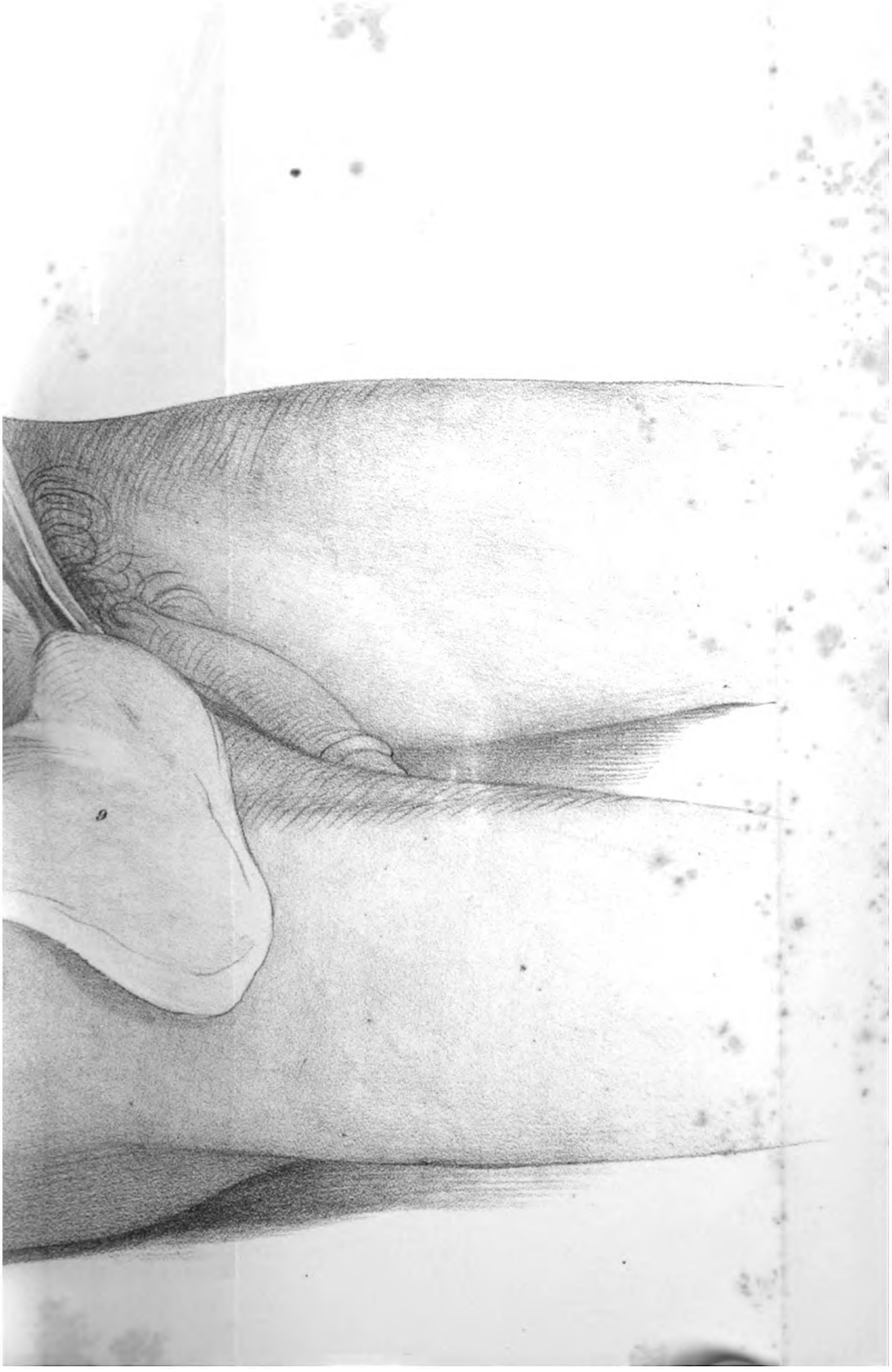
† The three inguinal pouches of the peritonæum have been distinguished by M. Velpeau under the names of *fossette inguinale externe, fossette inguinale interne*, and *fossette vésico-inguinale*. *Vide* Traité complet d'Anatomie chirurgicale. 3d edit. vol. ii. p. 72.

‡ *Vide* Sir Astley Cooper's work on Hernia, 2d edit. Plate X. in which six hernial sacs are shown. Two of the sacs on each side were protruded through that portion of the posterior wall of the inguinal canal which is comprised between the epigastric and umbilical arteries (figs. *h*, *i*, *l*, and *k*); and one on each side, between the remains of the umbilical artery and the outer edge of the rectus muscle (figs. *j*, *m*).

m Fairland litho.

lor & Walton, Upper Gower St

PLATE IV.



matic vessels, as they converge towards each other, in their course to the internal abdominal ring: — the same dissection will suffice, also, for the examination of the internal and external iliac arteries, and the origins of their principal branches. (See Plate IV.)

EXPLANATION OF PLATE IV.

This plate represents a view of the internal surface of the abdominal parietes, in the left inguinal region of the male subject; the peritonæum and subserous cellular tissue having been removed, so as to expose the other structures which are immediately external to them.

a. The crista of the ilium. The letter is placed about the distance of an inch outwards from the anterior superior spinous process of the bone.

b. The situation of the symphysis pubis.

c. The spinous process, or tuberosity of the os pubis.

d. d. The ligament of Poupart obscurely seen through the fasciæ iliaca and transversalis, which join with one another along its posterior margin.

e. Gimbernat's ligament; it is partially concealed from view by the fascia transversalis, and, also, by the conjoined tendons of the transversalis and internal oblique muscles, which here curve downwards to reach their insertions into the inner part of the horizontal branch of the os pubis.

f. The horizontal branch of the os pubis, forming a part of the ileo-pectineal line.

g. The inner surface of the rectus muscle, where its tendinous sheath is defective posteriorly.

h. The inner surface of the transversalis muscle, from which the fascia transversalis has been dissected, so that its muscular structure might be more clearly displayed.

i. The iliacus internus muscle, partially stripped of its covering from the fascia iliaca.

k. The fascia iliaca, which binds down the iliacus internus and psoas muscles.

l. The fascia transversalis, lining the inner surface of the transversalis muscle.

m. The cut edges of the muscles forming the lateral walls of the abdomen.

n. The lower part of the tendinous sheath of the rectus muscle, which ceases about midway between the umbilicus and symphysis pubis.

o. o. The linea alba.

p. A hook, inserted a little below the situation of the umbilicus, to suspend the triangular-shaped flap of the parietes of the inguinal region.

q. The internal wall of the inguinal canal, where it is formed by the fascia transversalis.

r. The internal abdominal ring, or funnel-shaped aperture in the fascia transversalis, by which the vas deferens and spermatic vessels in the male, and the round ligament of the uterus in the female, issue from the abdominal cavity, in their descent to reach the external organs of generation. The opening is situated just *above* Poupart's ligament. The spermatic vessels are seen to unite with the vas deferens, as they bend over the first portion of the epigastric artery, just before their entrance into the inguinal canal.

s. The crural ring, or aperture by the inner side of the femoral vein, by which a femoral hernia commences to descend from the cavity of the abdomen. It is *below* Poupart's ligament.

t. The external cutaneous nerve — a branch from the lumbar plexus — lying behind the fascia iliaca.

1. The trunk of the external iliac artery, as it runs along the inner edge of the psoas muscle, resting upon the fascia iliaca.
2. The external iliac vein, which runs along the internal border of the artery.
3. The epigastric artery, as it ascends from its origin behind Poupart's ligament, to pass along the inner edge of the internal abdominal ring.
4. The internal circumflexa ilii artery, after its origin from the external iliac artery, and before it pierces the fascia iliaca.
5. The spermatic artery; on each side of the artery runs an accompanying vein.
6. The vas deferens.
7. The internal circumflexa ilii vein, which crosses over the external iliac artery, in its way to open into the external iliac vein.

8. 8. 8. The convolutions of the small intestines, which have been removed from the cavity of the pelvis, and thrown over to the right side.

9. The parietes of the inguinal region of the right side, reflected upon the upper part of the corresponding limb.

CHAPTER III.

Section I.

OF INGUINAL HERNIÆ.

After having made ourselves familiar with the natural form and relative position of the several structures which compose the inguinal portion of the abdominal parietes, it should be our next object to determine what are the changes from their healthy condition which are liable to be produced in them by the formation of inguinal herniæ.

There are two principal and leading varieties of this disorder, the distinguishing characteristics of which are derived from a consideration of the course which the hernial tumour pursues, as it is protruded forth from the cavity of the abdomen, and of the position which the neck or internal orifice of the sac bears relatively to the epigastric artery; points which are of considerable practical importance, since they are essentially different in each of the varieties alluded to.

1. *External or oblique inguinal hernia.*—The kind of inguinal hernia which is the most frequent in its occurrence, is that form of the complaint which has been named, in consequence of the hernial tumour pursuing the same course through the inguinal canal as the spermatic cord or the round ligament of the uterus, the *oblique inguinal hernia;* by some surgeons it is, also, named *external*, because the neck of the sac is situated upon the *outer* or *iliac* side of the epigastric artery. (See the woodcut No. 4, at page 263, figs. *o*, *m*.)

Of this form of inguinal hernia there are three different kinds, viz. the *common scrotal hernia*, the *congenital hernia*, and the *encysted* or *infantile hernia*.

2. *Internal or direct inguinal hernia.*—The second principal variety is that in which the hernial sac, instead of descending through the oblique course of the inguinal canal, is pro-

truded through some part of the posterior wall of that passage, on the *inner* or *pubal* side of the epigastric artery. (See the woodcut No. 9, figs. *r*, *p*.) This is named the *Direct* or *Internal inguinal hernia*.

Section II.

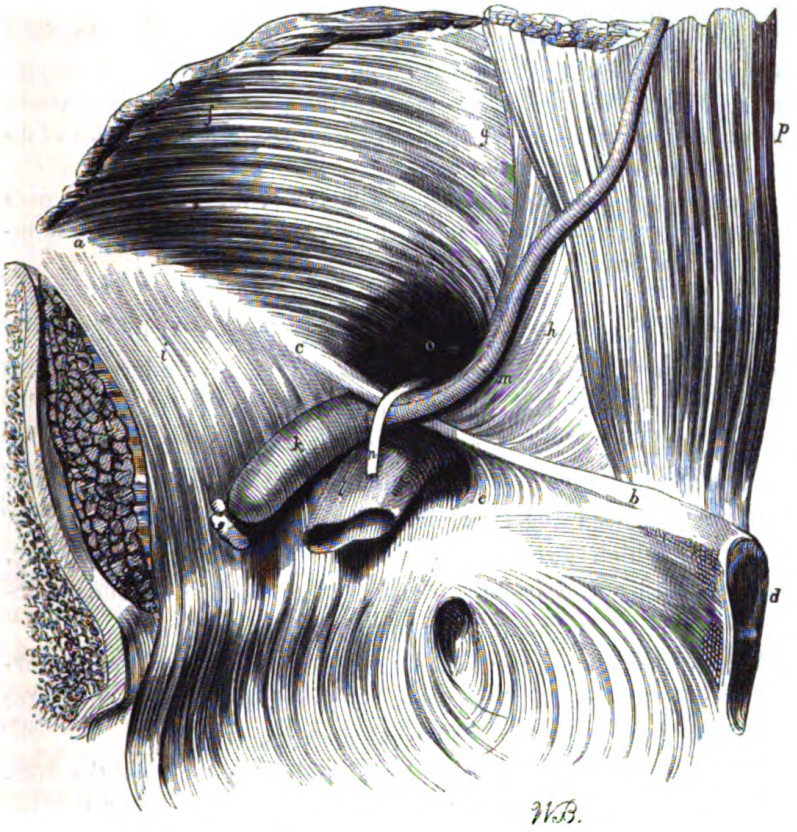
OF EXTERNAL OR OBLIQUE INGUINAL HERNIA.

It has already been observed, whilst making the dissection necessary to expose, by an internal view, the structure and relations of the posterior wall of the inguinal canal, that the external inguinal pouch, or fossa of the peritonæum, is situated directly opposite the internal abdominal ring, or superior aperture of the inguinal canal, and that, consequently, it is (at least in the male sex) the weakest point of the fasciæ which line the interior of this portion of the abdominal parietes, and, therefore, not unfrequently gives way under the pressure which is exerted against it by the viscera, when they are forcibly compressed by the contraction of the muscles which bound the abdominal cavity, as constantly happens during any violent or active exertion, such as, for example, leaping, running, &c. The intestines, on being thus propelled, as it were, into the external inguinal pouch of the peritonæum, carry that membrane before them, enlarging the little cul-de-sac, which it usually forms upon the front of the cord or round ligament of the uterus, where they occupy the upper part of the inguinal canal. (See the woodcut No. 2, at page 243, figs. *l*, *m*.)

As the hernial tumour descends into the inguinal canal, it derives investments from the subserous cellular tissue and the fascia transversalis, which, taken together, constitute that covering of the sac which has been termed the *fascia propria* of inguinal herniæ.

The lowermost fleshy and tendinous fibres of the transversalis muscle are, at the same time, displaced a little upwards, and moulded more completely into the form of a semi-circular border, which arches over the neck of the sac, and is thus capable, under certain conditions, of forming the seat of the stricture in some cases of strangulated oblique inguinal herniæ.

No. 4.



This woodcut represents, by an internal view, the circular dilatation of the internal abdominal ring, which is caused by the protrusion through it of the sac of an external or oblique inguinal hernia. The peritonæum and the subserous cellular tissue have been removed from the iliac fossa, so as to expose more clearly the relation which the epigastric artery bears to the neck of the sac of an external inguinal hernia.

a. The crest of the ilium, near the anterior superior spinous process of the same bone. *b*. The spinous process, or tuberosity of the os pubis. *c*. The inner surface of Poupart's ligament, or the crural arch. *d*. The symphysis pubis. *e*. The posterior surface of Gimbernat's ligament, a part of the crural arch. *f*. The inner surface of the transversalis muscle, where it springs from the iliac portion of Poupart's ligament. *g*. The tendinous portion of the transversalis muscle. *h*. The inner or pubic portion of the fascia transversalis, where it forms the principal part of the posterior wall of the inguinal canal. *i*. The fascia iliaca covering the iliacus internus and psoas muscles, and which descends over the brim of the pelvis, to become continuous with the pelvic fascia. *k*. The trunk of the external iliac artery. *l*. The trunk

of the external iliac vein. *m*. The epigastric artery, as it runs along the under and inner margin of the neck of the sac of an external inguinal hernia. *n*. The vas deferens, where it descends, after its exit from the inguinal canal, in its course to the side of the bladder. *o*. The internal abdominal ring dilated by the protrusion through it of the sac of an external or oblique inguinal hernia. The aperture so produced generally limits what is termed the neck of the hernial sac. *p*. The internal surface of the lower part of the rectus abdominis muscle.

By contrasting this wood-engraving with No. 9, the reader will at once clearly understand the distinction which is made between external and internal inguinal herniæ.

In proportion as the hernial tumour increases, it descends farther into the inguinal canal, and soon passes underneath the inferior margin of the internal oblique muscle, the muscular fibres of which are displaced in a similar manner to those of the transversalis muscle already mentioned; and, becoming more closely aggregated together, form a thick and strong muscular fasciculus, which sweeps over the front and sides of the sac, nearly opposite the middle of the space which is included between the superior and inferior apertures of the canal.

When the hernial sac has descended beyond the lower margin of the internal oblique muscle, the fibres of the cremaster are spread over its front and lateral surfaces.

Incomplete external inguinal hernia.†—So long as the hernial sac does not emerge from the lower aperture of the inguinal canal, it is denominated an *incomplete external bubonocele*, which, it should be remembered, is a very common form of the complaint, and is extremely likely to prove much more dangerous to those who are the subjects of it than the complete form of the disorder, inasmuch as its existence is frequently overlooked both by the patient and his medical attendant; so that it not unfrequently happens that much valuable time is lost, and the means which would be most suited to effect its cure, or, at all events, to prevent its further increase, permitted to remain unemployed, when—were the nature of the affection recognised—they might be had recourse to with the happiest results. The works of medical and surgical writers teem

† Boyer calls this form of inguinal hernia *intra-parietale*, and other French writers name it "*hernie inguino-interstitielle*." By Sir Astley Cooper it is described under the head of *small inguinal hernia*.

with the histories of cases in which the unfortunate sufferers have lost their lives, from the strangulation of a very small knuckle of intestine in the neck of the sac of an incomplete external inguinal hernia having been allowed to continue unnoticed, until it had become too late to attempt to interfere with the most remote chance of success by any operative proceeding.† In these, and many similar instances,‡ the rational symptoms of the disorder are only taken into account, whilst the physical signs of it are neglected (a tumour in the region of the inguinal canal, painful, tender under pressure, and resisting the taxis§), and are regarded only as indications of an attack of peritonitis, or some obscure form of inflammation of the bowels; and the patients are treated during many days in the same manner as persons who actually labour under such complaints; —how ineffectually it must be easy for any one, who is capable of considering the subject, to conceive.‖

Whilst it remains within the inguinal canal, the hernial sac is supported — accordingly as it happens to occur in a male or female subject — by the upper part of the spermatic cord, or the round ligament of the uterus, which intervene betwixt it and the floor of the canal; — anteriorly, it is covered by the skin, the superficial fascia, the intercolumnar fibres, and the tendinous aponeurosis of the external oblique muscle, the lower fibres of the internal oblique, and upper part of the cremaster, underneath which are placed the several investments which it receives from

† *Vide* Sir Astley Cooper on Hernia, 2d edit. Part I. p. 65 and p. 83. Liston's Elements of Surgery, 2d edit. p. 586. Lawrence on Ruptures, 5th edit. p. 223; also, Nouveaux Elémens de Médecine Opératoire, par M. Velpeau, 2d edit. vol. iv. p. 177.

‡ *Vide* the Surgical Anatomy of the Groin, p. 130.

§ *Vide* a Paper, by the Author, in the Medical Gazette of 23d Dec. 1837, p. 506, "On the Symptoms of strangulated Intestine."

‖ See also Sir Astley Cooper on Hernia, 2d edit. chap. xiv. p. 65. Of small inguinal hernia, Sir Astley Cooper says, "that this tumour occurs much more commonly than is usually supposed, for I have frequently found it in the dissection of the bodies of persons who have never been suspected of labouring under the disease, nor have ever worn a truss when strangulated. These cases more commonly fall under the care of the physician than the surgeon; for, as the patient himself is not conscious of having a tumour at the groin, the symptoms of strangulation are ascribed to inflammation of the bowels, and the patient dies, as is supposed, of idiopathic peritonitis."

the funnel-shaped sheath of the fascia transversalis and the cellular substance of the cord (the subserous cellular tissue); —posteriorly, it is separated from the great bag of the peritonæum by the several structures that compose the posterior wall of the inguinal canal. (See the wood-engraving No. 3, at p. 246, figs. *i* and *m*.)

Complete external inguinal hernia.—When the hernial tumour emerges through the external abdominal ring, or lower aperture of the inguinal canal, it is denominated a *complete inguinal hernia* or *oscheocele*. Under these circumstances, the outlet of the canal is more or less enlarged, and loses its natural triangular appearance. (See Plate V. figs. *b* and *c*, and also the wood-engraving No. 6, fig. *e*.) After passing through the external abdominal ring, the hernial sac descends in front of the spermatic cord until it rests just above the testis, and is now additionally covered by the spermatic fascia, the dartos, and the common integuments of the scrotum. (See the woodcut No. 6, figs. *f*, *g*, *h*, and *i*.)

EXPLANATION OF PLATE V.

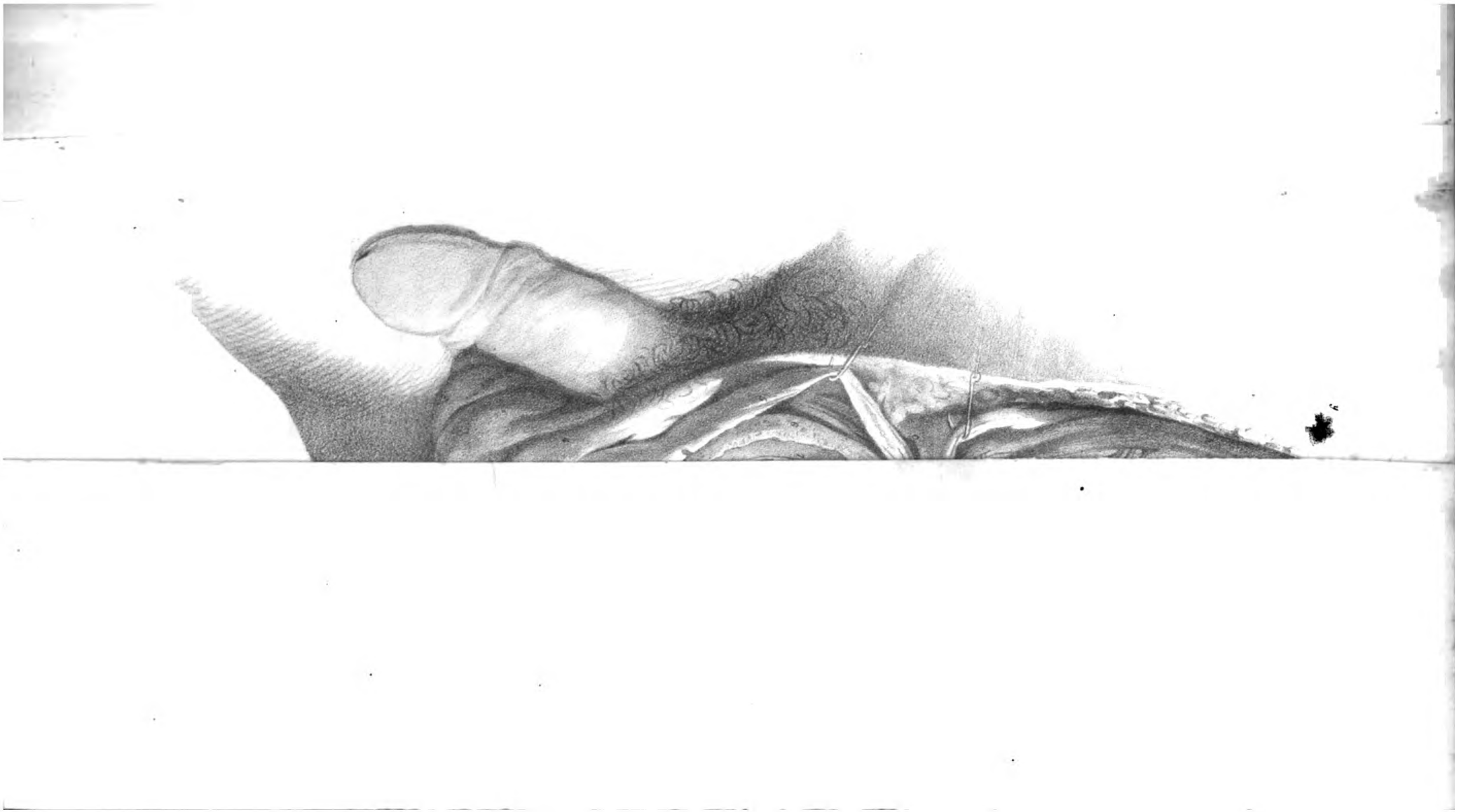
This plate represents the coverings of the sac of an oblique or external inguinal hernia on the left side. It also shows that the obliquity of the inguinal canal is destroyed by the yielding of its posterior wall, under the long-continued pressure of the protruded viscera. It will likewise be observed, that the epigastric artery has, from the influence of the same causes, been removed from its natural course, and driven inwards as far as the outer edge of the rectus muscle, where it must almost inevitably be wounded, should the surgeon, while operating upon an individual affected with a strangulated inguinal hernia, in which those changes have taken place (a case by no means of unfrequent occurrence), direct the edge of his knife inwards, towards the linea alba, when enlarging the constricted neck of the sac.

a. The anterior superior spinous process of the ilium.

b. The inferior pillar of the external abdominal ring, somewhat displaced from its natural position, by the protrusion of the hernial sac through the inferior aperture of the inguinal canal.

c. The superior pillar of the external abdominal ring.

Between the letters *b* and *c* the lowermost of the inter-



columnar fibres are seen aggregated together, so as to form a strong and dense fasciculus, which constricts the hernial sac opposite this point, and gives the circular form to the external abdominal ring, which is so much insisted upon by surgical writers.

d. The ligament of Poupart.

e. e. The aponeurosis of the external oblique muscle, divided and turned back, so as to expose

f. the fleshy fibres of the lower part of the obliquus internus muscle.

g. The tendinous sheath of the rectus muscle of the left side, opened and turned back.

h. The rectus muscle of the left side, lifted up from its natural position and turned over, towards the mesial line of the body.

i. The fascia transversalis, where it lines the posterior surface of the rectus muscle, above the pubes.

k. The great trunk of the femoral artery.

l. The femoral vein.

m. A portion of the great bag of the peritonæum, which, after removing the iliac portion of the fascia lata, and raising Poupart's ligament, appeared externally, under the left crural arch.

n. The great crural nerve.

o. The saphena major vein, near its termination in the common femoral vein.

p. The sartorius muscle.

q. The iliacus internus muscle.

r. The adductor longus muscle.

s. The gracilis muscle.

t. The rectus femoris muscle.

u. The tensor vaginæ femoris muscle.

v. Part of the glutæus medius muscle.

w. The vastus externus muscle.

y. The umbilicus.

1. The epigastric artery, near to its origin from the external iliac artery.

2. The epigastric artery, behind the outer border of the rectus muscle, into which situation it has been brought by the long-continued pressure of a large and old-standing oblique inguinal hernia. The artery would most certainly be cut were the surgeon, when enlarging the neck of the sac in the operation for the removal of the stricture, to turn the edge of his bistoury inwards, in the direction of the linea alba. The epigastric veins are observed as they accompany the artery, the course of which they follow.

3. The internal circumflexa ilii artery; it springs from the external iliac artery opposite the origin of the epigastric.
4. The scrotum of the left side.
5. 5. The external spermatic fascia, cremaster muscle, and funnel-shaped sheath of the fascia transversalis, blended together by the pressure of the hernia, and constituting one of the principal investments of the hernial sac.
6. 6. The subserous cellular tissue, which is interposed between the sheath of the cremaster muscle and the proper hernial sac.
7. 7. The hernial sac, formed by the peritonæum.
8. A portion of the omentum contained in the sac, and lying in front of
9. A knuckle of the small intestine.

The fascia transversalis is, in the majority of cases of inguinal herniæ, but little altered from its usual healthy condition, excepting that the internal abdominal ring (see the woodcut No. 4, at page 263, fig. *o*) is greatly enlarged — principally towards the mesial line — by the protrusion through it of the hernial sac. Occasionally it presents, over the situation of the neck of the sac, the appearance of a narrow, circumscribed, and unyielding band of condensed cellulo-fibrous tissue, of the thickness of fine packing-twine.

In the operation for strangulated inguinal herniæ, this covering is not unfrequently mistaken for the peritoneal sac, in consequence of its uniform and delicate appearance and texture.

The subserous cellular tissue has been found, in several instances, to be a little increased in thickness, but unequally so, from the presence of a number of very small bundles of adipose substance that are deposited here and there in its texture. It frequently appears very vascular where it covers the neck of the sac. This investment of the hernial sac has been frequently mistaken in the operation for the omentum—an error which has, in some instances, caused the death of the patients, from the hernial sac being reduced, along with its contents, into the cavity of the abdomen, the strangulation of the bowel still remaining unrelieved.

The transversalis muscle undergoes little or no alteration in its form and appearance, by the protrusion of the hernial sac through the internal abdominal ring. In some instances, however, of large and old oblique inguinal herniæ, it is en-

croached upon by the hernial tumour, and its lower edge becomes in consequence rather more arched than ordinary, and the conjoined tendons of the two muscles (the internal oblique and transversalis),—where they descend together to be inserted into the inner extremity of the ileo-pectineal line of the os pubis, and form the inner part of the posterior wall of the inguinal canal,†—are displaced more or less inwards, nearer to the outer edge of the rectus muscle; so that instead of extending an inch, and even more than this, from the edge of that muscle, they do not reach more than a quarter of an inch, and frequently even a less distance from it than this. In the healthy condition of these parts, the conjoined tendons constitute a thin and flat band of fibres; but, when an oblique inguinal hernia has existed for a considerable period, and, at the same time, forms a large protrusion, they are no longer able to resist the tendency which the weight of the contents of the hernial sac has to drag inwards that portion of the posterior wall of the inguinal canal, which is composed of the fascia transversalis and the conjoined tendons, and hence they give way, and are pushed aside in the direction of the mesial line of the body, and so change their extended form for that of a thick, narrow, and strong band. (See Plate V. figs. 1 and 2, and woodcut No. 5, figs. *i*, *m*.)

Such of the fibres of the internal oblique muscle as take their origin from the middle portion of Poupart's ligament are more or less displaced by the hernial sac as it descends through the inguinal canal; so that they no longer run, in an oblique direction, downwards and inwards to their attachment to the os pubis, but are forced upwards by the rounded anterior surface of the sac, as it protrudes between the lower edge of the muscle and the spermatic cord, and are so made to form a thick muscular arch, the concavity of which embraces about two-thirds of the circumference of the tumour as it lies within the inguinal canal.

The cremaster muscle is frequently found very much altered from its natural and healthy condition, particularly if the hernia should be large and of long duration. The fibres of this muscle may be enlarged to three or four times their ordinary thickness, losing, at the same time, much of their muscular character, and

† *Vide* Plate III. fig. *r*, and woodcut No. 3, at page 246, figs. *i*, *g*.

becoming pale and semi-transparent. Towards the fundus or inferior extremity of the hernial sac, the fibres of the cremaster are so much displaced as to present the appearance of an irregular network, the meshes of which are of very unequal size and figure. (See Plate V. fig. 5, 5.)

The spermatic fascia, springing from the circumference of the external abdominal ring, is, in many cases of scrotal herniæ, considerably increased in its thickness and density. In some cases I have seen it twice and even three times thicker than it is naturally; nevertheless, in some cases of large scrotal herniæ, this investment of the sac undergoes very little alteration, and remains very thin and delicate.

The external abdominal ring is frequently distended to the magnitude of half-a-crown, but it rarely exceeds this size. At the same time the aperture loses the triangular figure which it naturally possesses. (See Plate V. figs. *b*, *c*, and the wood-engraving No. 6, fig. *e*.)

The intercolumnar fibres, or bands, which serve to connect together the pillars of the external abdominal ring, are pushed upwards and outwards by the hernial sac as it protrudes from the inguinal canal, and are thrust together in such a manner as to form, by their close approximation to each other, a broad and very strong fillet, which limits the farther distension of the ring, and thus communicates a circular form to the aperture when distended by the protrusion through it of an hernial tumour. The intercolumnar fibres become, at the same time that they are displaced upwards and outwards, very much increased in thickness and strength; and to this circumstance is owing that sudden constriction in the bulk of the hernial tumour, which, in every case of large scrotal hernia, serves to define with precision the situation of the external abdominal ring. (See Plate V. figs. *b*, *c*, and the woodcut No. 6, fig. *e*.)

The superficial fascia presents, in the majority of instances of oblique inguinal herniæ, its ordinary appearance; being separable only into two lamellæ, between which are situated the cutaneous vessels which supply the superficial coverings of the inguinal region. In other instances, again, it is very much thickened and greatly increased in density, admitting of being readily divided into three or four laminæ. The external pudic artery lies over the middle of the tumour formed by the hernia,

immediately after it has emerged from the external abdominal ring, or lower aperture of the inguinal canal, and hence must always be divided by the first incisions in exposing the sac of a complete bubonocele. The superficial epigastric artery usually runs a little farther towards the anterior superior spinous process of the ilium than the commencement of the neck of the sac, and, therefore, it is very rarely injured by the knife in an operation for strangulated inguinal hernia, excepting when performed in cases of recent incomplete bubonocele.

The peritonæum, which forms the proper sac of an inguinal hernia, is seldom found altered from its healthy structure and appearance, excepting at the neck or internal aperture of the sac. In this situation the peritonæum frequently forms a sharp angular fold, the free border of which projects towards the central axis of the sac. The increased action which is induced in the vessels which nourish this portion of the peritonæum, and the adjacent subserous cellular tissue, and that part of the fascia transversalis which is immediately external to it, by the excitement kept up by the presence of the hernial descent, and frequently, also, by the means employed to maintain it reduced, is followed, after the lapse of a longer or shorter period, by the deposition of new matter around the neck of the sac, which, probably, in the first instance, is closely allied in its nature and properties to coagulable lymph, but which eventually assumes the character of condensed cellulo-fibrous tissue. The neck of the peritoneal sac is also liable to become greatly thickened, from the changes which occur in it when a hernia has been maintained reduced for a considerable period, as, for example, by the application of a well-adjusted bandage or truss; for, in such cases, the peritonæum, where it passes through the narrow aperture of the internal ring, being no longer distended by the descent of the intestine forming the hernia, falls into loose folds, which present the appearance of the mouth of a purse, the strings of which have been drawn rather closely together. These folds of the peritonæum soon cohere to each other by their opposing surfaces, and in this manner the neck of the sac is increased in its thickness and density, in the same ratio as the diameter of the aperture is diminished.

It is by the co-operation of these several causes, that, in carefully dissecting herniæ of old standing, we so regularly meet

with a remarkable thickened and contracted condition of the neck of the sac; which, so far from presenting its ordinary delicate structure, forms an unyielding band of a dense cellulo-fibrous or even a semi-cartilaginous nature, that very frequently becomes, independently of the surrounding muscles, the seat of the stricture in numerous cases of strangulated herniæ. This deposition of new matter around the neck of the hernial sac is always followed by a diminution of the calibre of the mouth of the sac; and this circumstance may be satisfactorily explained by reference to the strong and firm structures which are situated around the circumference of the internal abdominal ring, and prevent its developement eccentrically, and, also, to the fact that there seems to exist in tissues of a similar nature and origin, an inherent tendency to contract the diameter of the circle, the limits of which they bound.

That this morbid alteration of the peritonæum forming the neck of the sac is of very frequent occurrence, my own observation permits me to state; and it is this condition of the parts which must ever prevent the attempt to relieve the stricture without opening the sac, in operations for strangulated inguinal and femoral herniæ, from being very generally practicable or successful.

The thickened and constricted condition of the hernial sac, just now described, will occasionally be found to exist at various other points of its extent, besides that portion of it which is included within the embrace of the internal abdominal ring, and, sometimes, they are situated even exterior to the lower apertures of the inguinal canal. These changes in the structure and appearance of the peritoneal sac are chiefly dependent upon the farther protrusion of an old hernial sac, consequent upon the descent of an additional quantity of the visceral contents of the abdominal cavity.†

Of the changes which are produced in the course of the epigastric artery, and in the extent of the posterior wall of the inguinal canal, by large old-standing external inguinal herniæ.—The epigastric artery is frequently observed to be very much displaced from its customary course, by large and old-standing oblique, or external inguinal herniæ. In such cases, this vessel no longer runs in an oblique course from

† *Vide* Sir Astley Cooper on Hernia, 2d edit. Plate V. figs. 1 and 3.

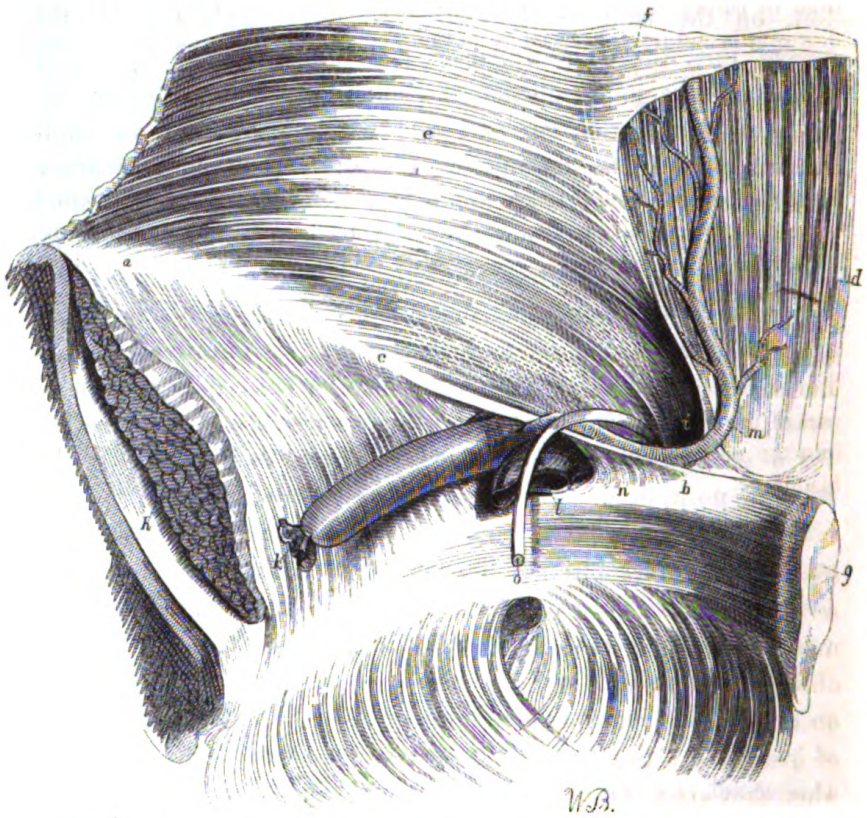
about the centre of the crural arch, up towards the umbilicus; but, on the contrary, is carried so far inwards towards the mesial line, that it ascends, after running along the posterior surface of the pubic portion of Poupart's ligament, behind the outer edge of the lower part of the rectus muscle; and thus the obliquity of the inguinal canal is destroyed, and an instance is afforded of the external or oblique inguinal hernia becoming apparently direct (but not internal) by the obliteration of its posterior wall; a circumstance which, if overlooked, might lead a surgeon into considerable difficulty, were he,—mistaking the true nature of the case, and regarding it as one in which the hernia is protruded through the posterior wall of the inguinal canal, on the inner side of the epigastric artery—in an operation for a strangulated inguinal hernia, where this change in the relative position of the external and internal rings had been effected, to direct (as is taught to be done by some authorities in cases of direct internal hernia), while enlarging the stricture existing at the neck or internal orifice of the sac, the cutting edge of the knife towards the linea alba.†

By referring to Plate IV. fig. 3, or to the woodcut No. 4, at page 263, fig. *m*, and comparing them with the wood-engraving at page 274, the alteration which is produced in the course of this vessel, by the continued pressure against it of an old and large external inguinal hernia, will be at once easily comprehended.

The transposition of the epigastric artery from its natural course, and the corresponding alteration in the situation of the internal abdominal ring, are subjects of considerable interest to the practical surgeon, since it greatly tends to render the establishment of an accurate diagnosis between external oblique inguinal herniæ of long standing and direct or internal inguinal herniæ, previous to the operation, extremely difficult, and, indeed, in very many cases, totally impossible.

† For a case in which this accident occurred, and where the patient very narrowly escaped losing his life from the hemorrhage which ensued upon the division of the stricture inwards towards the linea alba, See Sir Astley Cooper's work on Hernia, 2d edit. Part i. pages 69 and 79. *Vide* also Scarpa on Hernia, translated by Wishart, p. 125.

No. 5.



The wood-engraving represents the change of position to which the epigastric artery is subject, in the greater number of instances of large and old-standing external or oblique inguinal hernia. The posterior wall of the inguinal canal is almost completely obliterated by the constant pressure which is exercised upon the several structures, of which it is composed, by the contents of the hernial sac; from the same cause the internal abdominal ring has been dragged inwards, until at length it is situated immediately behind the external aperture, or outlet of the canal.

a. The inner surface of the crest of the ilium, a little distance beyond the anterior superior spinous process of the same bone. *b*. The spinous process or tuberosity of the os pubis. *c*. The posterior surface of Poupart's ligament. *d*. The inner surface of the lower portion of the rectus muscle of the left side, where its tendinous sheath is deficient. *e*. The inner surface of the transversalis muscle; the letter is placed where the fleshy fibres of the muscle terminate in its tendon. *f*. A part of the posterior division of the tendinous sheath of the rectus muscle, which terminates by a free border about midway between the umbilicus and the symphysis pubis. *g*. The symphysis pubis. *h*. The cut surface of the iliacus and psoas muscles, which

are covered by the fascia iliaca. *i.* The internal abdominal ring displaced from its natural situation by the continual weight of the hernia, and dragged downwards and inwards, as far as the outer edge of the rectus muscle, in such a manner as to destroy the obliquity of the inguinal canal, by the gradual obliteration of its posterior wall. *k.* The trunk of the external iliac artery. *l.* The external iliac vein. These vessels lie upon the fascia iliaca, which separates them from the fibres of the psoas muscle. *m.* The epigastric artery displaced inwards from its usual course by the continual pressure exercised against it by an old and large external inguinal hernia. This vessel is observed to make a considerable bend in its course instead of at once mounting, in an oblique direction, towards the umbilicus; and, after running along the posterior surface of the pubic division of Poupart's ligament, to ascend along the outer edge of the rectus muscle, in order to reach its ultimate destination. *n.* The posterior surface of Gimbernat's ligament, a part of the crural arch. *o.* The vas deferens, cut across as it is descending into the pelvis, in its course from the inguinal canal to the side of the bladder.

Of the changes which are sometimes observed in the situation of the vessels of the spermatic cord, in large and old scrotal herniæ.—It has been already mentioned that the spermatic cord commonly lies behind the hernial sac, in cases of oblique or external inguinal herniæ ;† a statement which will, on examination, be found to apply strictly only to the majority of instances of this form of the disorder, and more especially so, when they are as yet small, and of recent formation ; but it should be known, also, that some important deviations from this general rule are not unfrequently met with in the dissection of large and old scrotal herniæ. In such cases, the component structures of the spermatic cord are oftentimes much loosened from the intimate connections which they naturally have with each other ; and, instead of lying, as is usual, in close apposition with each other, at the back part of the hernial sac, are found widely separated from one another for a considerable distance, and in such a manner as to be situated rather upon the sides, or even in front of the swelling. The displacement and separation from each other of the vessels of the spermatic cord now described, are commonly most marked towards the lower part or fundus of the hernial sac, and diminish in the vicinity of the external abdominal ring, while within the inguinal canal the

† *Vide* the description of complete external inguinal hernia, at p. 266.

whole of the cord is almost invariably found lying behind the sac.†

This decomposition and separation of the vessels which compose the spermatic cord have been particularly investigated by Scarpa, who has shown in a very clear and satisfactory manner, that they are dependent upon the forcible distension of the common cellular sheath of the cord produced by the increased size of the hernial tumour.‡

Mr. Hey, of Leeds, has related the history of a case, in which he unexpectedly divided the vas deferens, while laying bare the sac of a large strangulated scrotal hernia; and it is well known that the same accident has several times happened in the practice of other surgeons.§

For this reason, among others, it is always advisable in the operation for strangulated scrotal hernia, more especially when the rupture is large and of long standing, not to extend the incisions quite to the lower part of the tumour; since, if any variety in the course of the spermatic vessels should exist, it is

† That even a small hernial sac may, however, sometimes insinuate itself between the component parts of the spermatic cord, and cause their separation from one another, is shown by the history of the following case which occurred in the practice of Sir Astley Cooper:—"I was desired to see a boy, a patient of Mr. Clarke, surgeon in the Borough, who had a tumour which extended from the upper part of the scrotum, through the abdominal ring along the cord to the abdomen. The lad's father was anxious for the removal of the disease, but on examination it did not project sufficiently to enable me to judge whether there was either fluctuation or transparency. However, as it interfered with the boy's usual occupation, I resolved to cut down upon it with extreme caution. When I had reached by incision the surface of the cyst I found the spermatic vessels running upon it, and was obliged to open the cyst by its side to avoid these vessels. The cyst contained a portion of the small intestine, everywhere adhering to its inner surface, which had prevented the return of the bowel into the abdomen. The vas deferens could be discovered behind the sac, so that there was a hernia, the sac of which had insinuated itself between the spermatic blood-vessels and the vas deferens."—*Vide* Sir Astley Cooper on Hernia; 2d edit. Part i. p. 16.

‡ *Vide* Scarpa on Hernia, translated by Wishart, p. 70.

§ *Vide* Practical Observations in Surgery by Mr. Hey, 2d edit. p. 140. Sir Astley Cooper on Hernia, 2d edit. Part 1, p. 15. Nouveaux Elémens de Médecine Opératoire, par M. A. L. M. Velpeau, 2d edit. tom. iv. p. 209. Lawrence on Ruptures, 5th edit. p. 214.

most likely to be met with, as has been already explained, towards the fundus of the sac.

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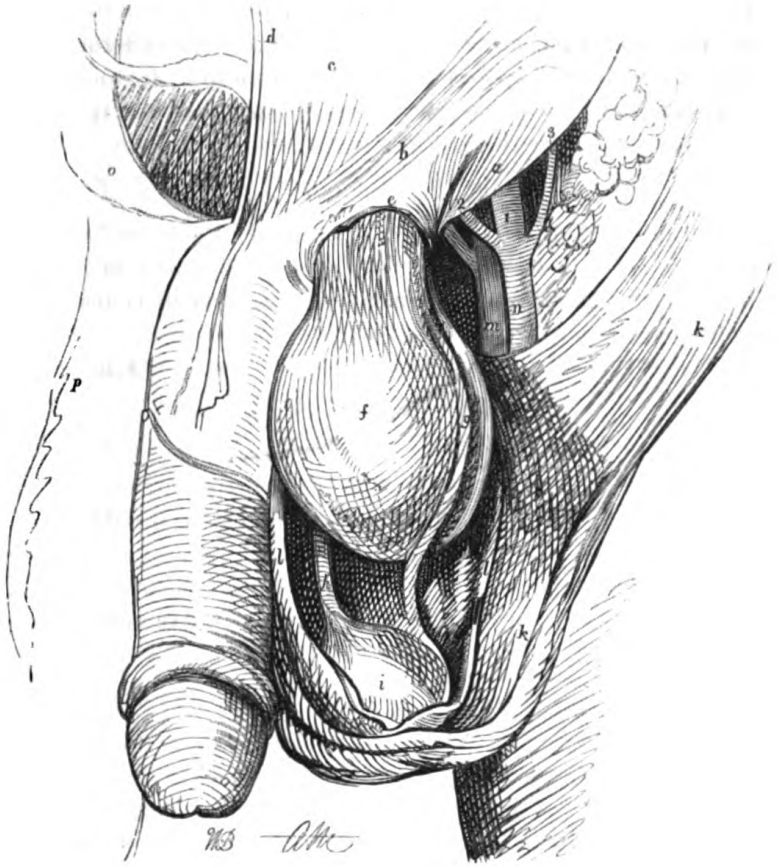

The wood-engraving represents, by a very clear and distinct view, the separation and displacement of the vessels of the spermatic cord, which frequently occur in large and old scrotal herniæ. The cremaster muscle and the other more superficial investments of the hernial sac have been dissected, and turned aside, so as to display more exactly the sac itself, and the relative position which it bears to the testicle and vessels of the spermatic cord. The drawing also serves to show the circular form which is assumed by the lower aperture of the inguinal canal, or external abdominal ring, when distended by the protrusion through it of the sac of a complete external inguinal hernia.

a. That part of the ligament of Poupart, which forms the lower and outer pillar of the external abdominal ring. *b.* The superior and internal pillar of the ring. *c.* Part of the tendinous aponeurosis of the external oblique muscle, covering the rectus muscle. *d.* The linea alba. *e.* The strong and

dense band which is formed by the lowermost of the fibres of the intercolumnar fascia being more closely aggregated together by the pressure of the sac of a large scrotal hernia. It constricts the hernial sac in this situation. *f*. The hernial sac, formed of the peritonæum, distended with air. *g*. The spermatic vessels separated from the vas deferens (*h*), and displaced to the outer side of the tumour, where they are situated not very far from its front surface. *h*. The vas deferens separated from the spermatic artery and vein, and forced to the inner side of the hernial tumour. *i*. The body of the testicle which, in the common form of scrotal rupture, lies underneath the fundus of the hernial sac. *k*. *k*. The skin and superficial fascia laid open and thrown aside. *l*. *l*. The cremaster muscle dissected from the front of the hernial tumour, and reflected to either side. *m*. The femoral vein. *n*. The common femoral artery, *o*. *p*. The abdominal parietes of the inguinal region of the right side laid open, and turned down upon the upper part of the thigh. *q*. The urinary bladder, partially covered superiorly by the peritonæum. 1. The trunk of the external iliac artery just below the crural arch. 2. The epigastric artery. 3. The internal circumflexa ilii artery.

Section II.

OF THE VARIETIES OF OBLIQUE OR EXTERNAL INGUINAL HERNIÆ.

I. OF CONGENITAL HERNIA. — CASE IN WHICH THE HERNIA DESCENDS INTO THE CAVITY OF THE TUNICA VAGINALIS TESTIS.

In the most common form of external or oblique inguinal hernia, the sac which contains the protruded intestines is a morbid production from the peritonæum lining the general cavity of the abdomen, and is usually situated in front of the spermatic cord; its fundus lying above, and being distinctly separated from the body of the testicle and its serous investment, the tunica vaginalis (see the woodcut No. 6, fig. *f*, *i*); but, in the congenital form of inguinal hernia the viscera, which are the subject of the disorder, descend into the natural cavity of the tunica vaginalis testis, the communication of which with the great bag of the peritonæum has never been obliterated; and, consequently, are permitted to come into close contact with the body of the testicle, to which they are sometimes adherent.

The appellation of *congenital hernia* was first given to this form of the complaint by Haller; who believed that it could not happen, except at or near the time of the birth of the individual, who became the subject of the affection; and previously to the usual period at which the process, by which the obliteration of the connection which originally exists between the cavity of the tunica vaginalis and that of the abdomen is ordinarily commenced.† This opinion of Haller has, however, been clearly proved, by later observers, not to be of such strict and universal application as he was inclined to consider it, and many examples are now satisfactorily established, in which this variety of external or oblique inguinal hernia could not have been formed until many years had elapsed since the birth of the patients; and even in some instances, indeed, not until the middle period of life had been arrived at.‡ There are sufficient grounds, however, for the belief that the majority of cases of inguinal herniæ which happen during early infancy, are likely to prove of the nature of congenital hernia; and, indeed, it is possible, also, that a congenital external inguinal hernia may occasionally be formed in the female subject, when the canal of Nuck remains unobliterated.

It will be recollected that in the fœtus the testes are at first situated within the cavity of the abdomen, in front of the psoas muscles, and at a short distance below the kidneys; and, also, that here they lie behind the peritonæum, which firmly adheres

† In sixteen out of seventeen newly born children, who were examined by Camper, the tunica vaginalis was not obliterated, as is usual, at its upper part, but its cavity remained continuous with the greater bag of the peritonæum. Hesselbach has seen the processus vaginalis peritonæi remaining open on both sides in the body of a man, aged thirty-eight years; but in whom no protrusion of the abdominal viscera had taken place.—*Vide* also Recherches sur les Hernies, par M. J. Cloquet, pages 40, 41, and Plate iv. of the same work.

‡ M. Velpeau has seen the congenital form of inguinal hernia occur for the first time in the persons of three young men, all of whom were above twenty years of age, and in whom the testes had descended at the ordinary period. The operation for strangulated hernia was performed by him in two of these instances:—one was cured, but the other died from an attack of peritonitis.—*Vide* Nouveaux Elémens de Médecine Opératoire, par Alf. A. L. M. Velpeau, 2d edit. tom. iv. pages 182 and 183.—For similar cases see Lawrence on Ruptures, 2d edit. pages 284 and 574.

to their anterior and lateral surfaces, leaving the posterior aspect of these glands wholly uncovered, except by the loose cellular tissue, through which the spermatic vessels run, in their way to reach their final distribution.† From this situation the testes slowly descend, passing through the inguinal canal, into the bottom of the scrotum, where they usually arrive about the eighth month; in this descent they bring along with them the same partial covering from the peritonæum which they had when situated just below the kidneys; which, with the production from the peritonæum already formed in the scrotum for their reception, constitutes the tunica vaginalis testis.‡

The formation of a congenital hernia would seem to be greatly promoted by the testicle not descending at the usual period, as in this case the communication between the cavity of the abdomen and the tunica vaginalis,—which always exists previously to the passage of the testis through the inguinal canal,—remains much longer open than ordinarily, and so a greater opportunity is constantly afforded for the escape of some portion of the intestines into it.

It is by no means an unfrequent occurrence, to find in the dissection of congenital herniæ that the descent of the testicle has been but very imperfectly effected, the gland remaining fixed, either within the inguinal canal, or, even still higher up, in the iliac fossa; and, under these circumstances, it will, also, generally be found that the developement of the organ is so incomplete, that reasonable doubts may be fairly entertained of its capability to execute its peculiar functions.

In other instances, again, a congenital hernia is produced by some portion of the intestines becoming adherent to the front surface of the body of the testicle, as it lies within the cavity of the abdomen, previously to its passage through the inguinal canal, and, in consequence of this unnatural connection, being dragged down along with the gland throughout its descent into the scrotum.§ It must not, however, be understood, from

† *Vide* a description of the situation of the testis in the fœtus, with its descent into the scrotum, by John Hunter, Plate . fig. *r*.

‡ Op. Cit. Plate III, fig. *u* and *v*.

§ *Vide* Nouveaux Elémens de Médecine Opératoire, 2d edit. tom. iv. p. 184.— Lawrence on Ruptures, 5th edit. pages 567 and 568.— Pott's works, new edit. 1779, vol. ii. p. 162.

what has just been said, that all the adhesions which are so commonly observed between the portion of bowel which is protruded, and the body of the testicle, in cases of congenital hernia, have taken place prior to the descent of the testes into the scrotum, for they are frequently formed very long after this change in their position has been completed.

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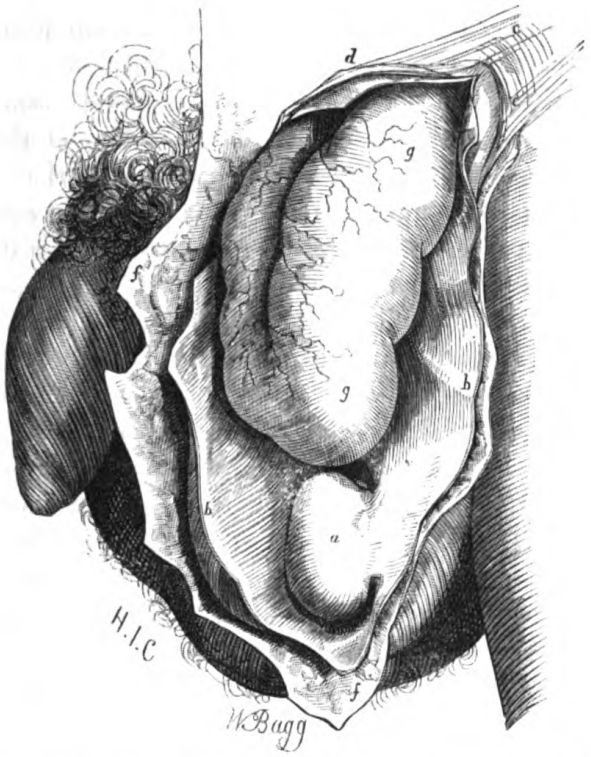


The wood-engraving represents the manner in which the prolapsed intestine, in a congenital hernia, is contained within the cavity of the tunica vaginalis testis. A comparison of this drawing with those represented in Plate V. at p. 266, and in the wood-engraving No. 6, at p. 277, will clearly demonstrate the characteristic differences which distinguish the common scrotal rupture from the congenital form of inguinal hernia.

a. The body of the left testicle, covered in front and upon its sides by the tunica vaginalis testis. *b*, *b*. The tunica vaginalis testis, which is a process from the great bag of the peritonæum, and, remaining open at its upper extremity, forms the sac in a congenital inguinal hernia. *c*. The intercolumnar fibres which bind together the pillars of the external abdominal ring. *d*. The

superior or internal pillar of the ring. *e*. The inferior or external pillar of the ring. *f.f*. The superficial coverings of the hernial sac in the scrotum. *g, g*. A fold of small intestine which, in the congenital inguinal hernia, descends into the cavity of the tunica vaginalis testis, where it frequently lies in apposition with, or is adherent to, the body of the testicle.

The superficial coverings of the sac of a congenital hernia are of the same nature as those of the ordinary scrotal hernia (see page 262), from which it only differs in the circumstance of the hernial sac not being formed, as in the latter case, by a morbid protrusion of a portion of the great bag of the peritonæum, but is constituted by the natural cavity of the tunica vaginalis testis, the superior extremity of which has never been closed. They consist of the skin, the superficial fascia and dartos, the external spermatic fascia, the cremaster muscle, and the funnel-shaped processes of the fascia transversalis and subserous cellular tissue (the *fascia propria*); within these structures is found the tunica vaginalis testis distended by the hernia.

In consequence, no doubt, of the constant disposition with which the processus vaginalis peritonæi is naturally endowed, of contracting itself towards its superior extremity, the seat of the stricture in those cases of strangulated congenital herniæ which have either been examined by dissection, or in which the operation has been performed, has very commonly been found in the neck of the sac, and in the immediate vicinity of the internal abdominal ring. It has, also, been remarked, when strangulation of the contents of the sac of a congenital hernia does occur, that the stricture upon the bowel is much more close than usually happens in the other forms of oblique or external inguinal hernia.

In cases of congenital hernia there is no such distinct line of demarcation or furrow observable between the fundus of the hernial sac and the upper part of the testicle, as is noticed in the ordinary form of scrotal hernia.

When the canal of Nuck still exists in the adult female it is quite possible that a hernia might be formed, which would bear the same relation to the round ligament of the uterus as the congenital hernia does to the spermatic cord in the male; but, the distinction of this from the common form of inguinal hernia of females can be of no practical importance, and, therefore, need not be insisted on.

Section III.

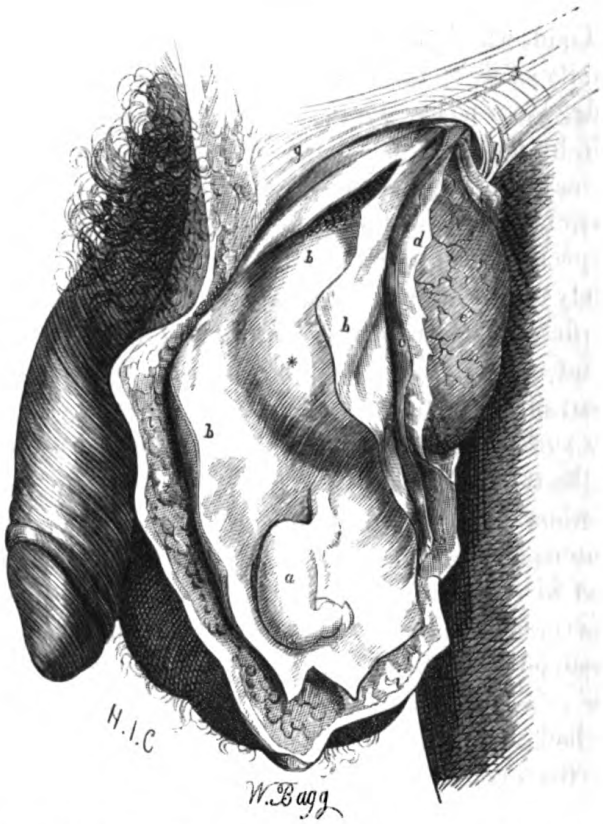
II. HERNIA INFANTILIS. ENCYSTED HERNIA OF THE TUNICA VAGINALIS. CASE IN WHICH THE HERNIAL SAC IS PROTRUDED INTO THE SHEATH OF THE SPERMATIC CORD, BEHIND THE TUNICA VAGINALIS TESTIS.

In this variety of the external or oblique form of inguinal hernia, the sac is protruded into the cellular sheath of the spermatic cord, and descends behind the tunica vaginalis of the testicle, instead of passing in front of it, as is the case in the common kind of scrotal hernia. In this manner the hernial tumour projects forwards against the upper part of the tunica vaginalis, the posterior layer of which invests, more or less completely, the lower and anterior surface of the sac, from which it is only separated by some loose cellular tissue. This affection is most likely to occur when only the abdominal aperture of the processus vaginalis peritonæi has been closed, and when, from some cause or other, the obliteration of that portion of it which lies within the inguinal canal, in front of the spermatic cord, and between the external abdominal ring and the upper extremity of the testicle, has not been so effectually completed as is ordinarily the case.

The wood-engraving represents, by a side view, the condition of the parts as they have been found upon dissection in cases of infantile hernia. The cavity of the tunica vaginalis of the left side has been laid open, and the hernial sac, with its contents, is seen as it projects behind the posterior layer of that membrane.

a. The body of the testicle, which is covered anteriorly and laterally by the tunica vaginalis testis. *b. b. b*. The tunica vaginalis, the cavity of which is much more extensive than is ordinarily the case;—a free incision has been made into it, so as to show more clearly the relative position of the hernial sac and testicle to one another; and, also, the mode in which the posterior layer of it is projected forwards by the hernial tumour, which is situated immediately behind it. *c*. A portion of the cellular substance, which separates the hernial sac (*d*) from the posterior layer of the tunica vaginalis (*). d. The proper hernial sac, which is a fresh production from the great bag of the peritonæum. *e*. A knuckle of small intestine, contained within the hernial sac. *f*. The intercolumnar fibres which bind together the pillars of the ex-

No. 8.



ternal abdominal ring. *g*. The superior and inner pillar of the ring. *h*. The inferior and external pillar of the ring. *i. i.* The superficial investments of the hernia, where it lies in the scrotum.

The late Mr. Hey, of Leeds, was the first to describe this species of inguinal hernia, which he proposed to distinguish by the term *hernia infantilis*, as he considered that it was not likely to be formed at any other time than that of early infancy. It was his opinion, that the intestine, in all such cases, is protruded soon after the aperture by which the tunica vaginalis originally communicates with the abdominal cavity has been closed, and, therefore, that the peritonæum is carried down along with the intestine, and forms the hernial sac. He believed, also, that the hernia must be produced while the original tunica vaginalis remains in the form of a bag as high as the abdominal ring, and is thus able to receive the hernial sac with

its included intestine, and so allow it to come into contact with the testicle.†

Mr. Todd, who has recorded two instances in which he had an opportunity of dissecting large herniæ of this description, differs from Mr. Hey in his opinions as to its nature, and considers that it is by no means peculiar to infancy; but, on the contrary, that it may be formed at any period of life,‡ and, also, that it does occur more frequently than surgeons are aware of. His idea of this species of rupture is, that in it the hernial sac is protruded completely within the cellular sheath of the cord; and, that when it descends near to the point of insertion of the spermatic vessels into the testicle, its fundus comes in contact with the upper part of the tunica vaginalis testis, and receives from it, on its lower surface, a serous covering proportioned to the magnitude of the tumour, or the degree of distension of the sac. Mr. Liston, whose views of the nature of this disorder accord with those entertained by Mr. Todd, operated upon a patient admitted under his care into the hospital of University College some years since, for an inguinal hernia of this kind, the contents of which had become strangulated, and could not be reduced by the taxis. This man did not become the subject of rupture until he had attained the twenty-first year of his age.§

The coverings of the hernial sac in this species of rupture are of the same kind as those which are met with in the common scrotal hernia, with the exception, however, that the upper part of the tunica vaginalis is interposed in front of the tumour, underneath the fascia propria, and hitherto has always been opened by the knife of the surgeon in those instances in which the operation has been performed.‖

† *Vide* Practical Observations in Surgery, by W. Hey, F.R.S. Second Edition, 8vo. London, 1810, p. 226.

‡ *Vide* Observations on Hernia, by Charles H. Todd, in the Dublin Hospital Reports, vol. i. p. 237. Mr. Todd relates the case of a man affected with a scrotal hernia of this nature, in which the disease did not occur until the thirty-seventh year of his age.

§ *Vide* A Clinical Lecture on Hernia, by Mr. Liston, in the Lancet of March 21, 1835, page 885. Also Mr. Liston's Operative Surgery. Second Edition, p. 468.

‖ Upon this subject see Mr. Liston's Operative Surgery. Second Edition, p. 468, and Sir Astley Cooper on Hernia. Second Edition. Part I. page 79—83.

Section IV.

OF INTERNAL OR DIRECT INGUINAL HERNIA.—VENTRO-INGUINAL HERNIA.

In this form of inguinal hernia the sac is protruded directly through some part of the posterior wall of the inguinal canal, and upon the inner or pubal side of the epigastric artery. (See the wood engraving, No. 9, at p. 287, fig. *r. p.*)

It has already been explained that the peritonæum naturally presents, in the triangular space included between the epigastric artery and the outer edge of the rectus muscle, two deep depressions, or fossæ,† which are separated from one another by the umbilical ligament, and that a direct or internal inguinal hernia may be protruded through the posterior wall of the inguinal canal at either of these points.

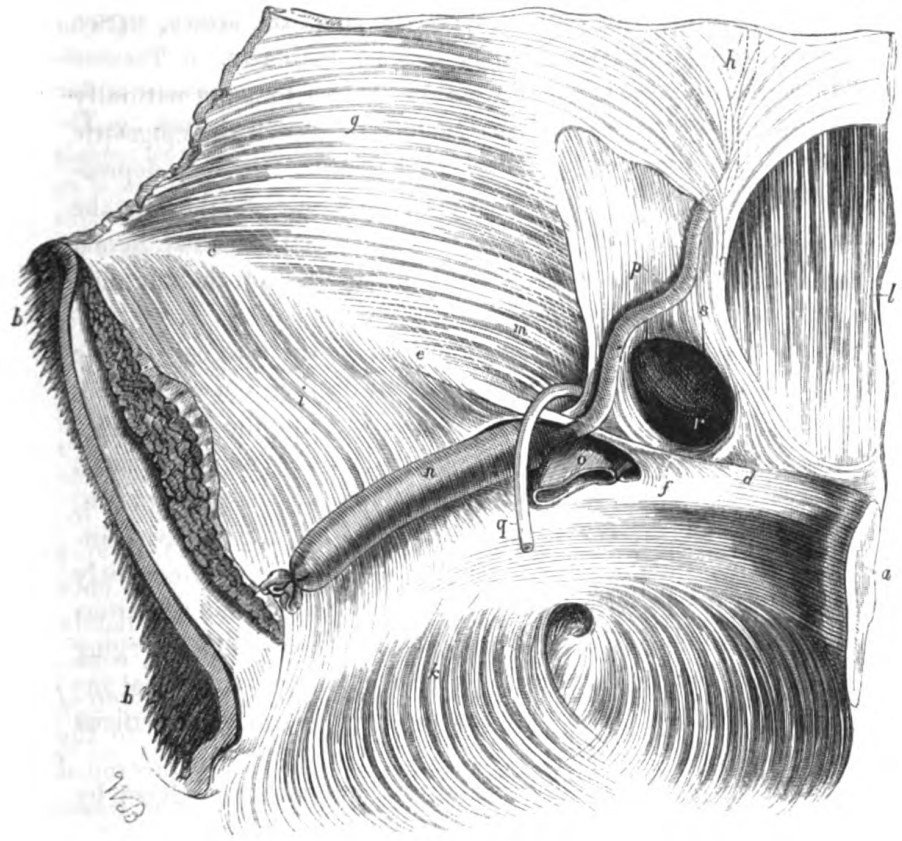
In most persons the conjoined tendons of the internal oblique and transversalis muscles do not extend farther outwards from the margin of the rectus muscle than the umbilical ligament, so that the portion of the posterior wall of the inguinal canal, which is situated opposite the middle fossa of the peritonæum, consists only of the fascia transversalis: if, then, an internal inguinal hernia should commence here,—as is not unfrequently the case,— it will force before it the peritonæum, the subserous cellular tissue, and the fascia transversalis, and, after emerging through the external abdominal ring, will receive additional investments from the external spermatic fascia, the superficial fascia, and skin.

On the other hand, if the hernia commence its descent by being protruded through the third or most internal of the inguinal pouches or fossæ of the peritonæum, the sac—besides being covered by the subserous cellular tissue and the fascia transversalis, as in the foregoing instance—must either break through the conjoined tendons of the internal oblique and transversalis muscles, or it must gradually distend them before it, and so derive an investment from them. In the latter case the hernial

† *Vide* the dissection of the posterior wall of the inguinal canal, at p. 258.

sac will be covered by the skin, the superficial fascia, the external spermatic or intercolumnar fascia, the conjoined tendons of the internal oblique and transversalis muscles, the fascia transversalis, and the subserous cellular tissue: but, in the former, there will be no covering to the sac from the conjoined tendons, whilst the other investments of it remain the same.

No. 9.



The wood-engraving represents a view, from within, of the neck of the sac of a direct or internal inguinal hernia. It will be observed, that the epigastric artery is situated upon the *outer* or *iliac* side of the opening in the posterior wall of the inguinal canal by which the hernia protruded.

a. The cut edge of the symphysis pubis. *b. b.* The ilium sawn across at a little distance from the sacro-iliac symphysis. *c.* The situation of the anterior superior spinous process of the ilium. *d.* The spinous process, or tuberosity of the os pubis. *e.* The posterior surface of the ligament of

Poupart, where the fasciæ iliaca and transversalis unite with each other. *f.* Gimbernat's ligament, which is implanted into the inner part of the iliopectineal line of the os pubis. *g.* The inner surface of the transversalis muscle, partially concealed from view by the fascia transversalis. *h.* A part of the tendon of the transversalis muscle, which forms the posterior division of the sheath of the rectus muscle. *i.* The fascia iliaca, which binds down the iliacus internus and psoas muscles. *k.* The fascia pelvica which is continuous along the brim of the pelvis with the fascia iliaca. *l.* The internal surface of the lower part of the rectus muscle, where the posterior lamina of its tendinous sheath is deficient. *m.* The internal abdominal ring, or upper aperture of the inguinal canal, by which an external or oblique inguinal hernia commences to protrude (see the wood-engraving No. 4, at page 263, fig. *o*). *n.* The trunk of the external iliac artery. *o.* The external iliac vein. *p.* The epigastric artery, which runs along the *outer* or *iliac* side of the neck of the sac of an internal or direct inguinal hernia. *q.* The vas deferens, cut across as it is descending from the inguinal canal towards the side of the bladder. *r.* The internal orifice or mouth of the sac of an internal or direct inguinal hernia. *s.* The line which leads downwards from this letter, marks the proper direction to be given to the incision of the neck of the sac in the operation for a strangulated internal inguinal hernia.

The name of Internal inguinal hernia has been given to this form of rupture by Hesselbach, with the view of indicating the situation which is held by the internal orifice of the hernial sac relatively to the course of the epigastric artery; which vessel, as is seen in the wood-engraving, runs along its outer or iliac side. By Sir Astley Cooper this affection is named Direct inguinal hernia, because, instead of following the same oblique course as the external form of the complaint, it passes at once through the posterior wall of the inguinal canal, immediately behind the external abdominal ring.† Professor Scarpa considers that it should be regarded as a combination of the *ventral* and *inguinal* forms of hernia; for it approximates itself to the nature of the first, inasmuch as the hernial sac is protruded through the conjoined tendons of the internal oblique and transversalis muscles, opposite the external abdominal ring; and, on the other hand, resembles the more common form of inguinal hernia, in passing in the same manner through the external abdominal ring, along with the spermatic cord.‡

Incomplete internal or direct inguinal hernia.— It sometimes happens that the hernial sac of an internal or direct in-

† *Vide* Sir Astley Cooper on Hernia, 2d edit. Part i. p. 67.

‡ *Vide* Scarpa on Hernia, translated by Wishart, 8vo. p. 82.

guinal hernia, instead of protruding at once through the external abdominal ring, passes into the inguinal canal, where it is closely bound down and compressed by the firm aponeurosis of the external oblique muscle. In this situation the tumour, formed by the hernia, is often exceedingly indistinct externally, especially in corpulent subjects; and is not likely to be recognized, unless a very minute and careful examination be made of the lower part of the abdominal parietes.

Under these circumstances, the existence of a strangulated hernia of this kind has been, on numerous occasions, overlooked; most frequently, however, in females, whose natural modesty induces them to conceal from their medical attendants their knowledge of the fact of there being any swelling or tenderness in the neighbourhood of the groin. So frequently, indeed, has the strangulation of a small knuckle of intestine in this situation passed unnoticed, or only been detected when it had become too late to prevent a fatal termination to the disorder, that it is an established rule of practice with all experienced surgeons, never to undertake the treatment of any case in which there are present any of the rational symptoms which are common to a strangulated hernia, and the several varieties of abdominal inflammation—such as vomiting, constipation, pain and tenderness of the belly, &c.—except they are permitted to institute a strict manual examination of all those regions in which herniæ are most likely to occur.†

Situation of the spermatic cord.—In most instances of direct or internal inguinal hernia the spermatic cord is situated along the external and posterior side of the sac, instead of being placed directly behind it, as is the case in the external or oblique form of inguinal hernia.

A very remarkable exception, however, to this rule was observed by the late Mr. Todd, of Dublin; in which he found, upon making a dissection of the parts, the spermatic cord extended, in an undivided state, across in front of the upper part of the sac to its pubal side, and then descending on that side to the posterior surface of the sac where the testicle was situated. In this case the hernia, in place of passing anterior to the cord,

† For cases where strangulated herniæ of this kind passed unnoticed until after the death of the patient, see Sir Astley Cooper on Hernia, 2d edit. Part I. p. 73.—Lawrence on Hernia, 5th edit. p. 228.

had protruded between it and the inferior pillar of the ring, in such a manner that the cord formed a sort of arch, embracing the neck of the sac for nearly two-thirds of its circumference, close to the external abdominal ring.†

It has been very generally stated by surgical writers, that, inasmuch as the sac of a direct or internal inguinal hernia does not follow, in its descent through the inguinal canal, the same course as the spermatic cord, it is not covered by any of the fibres of the cremaster muscle. This statement, however, is not invariably correct, for in several examples of this species of rupture, which have been met with in the dissecting rooms of University College during the last four winters, it was noticed that the hernial sac derived a partial investment from the cremaster muscle.‡

That direct or internal inguinal herniæ are of much less frequent occurrence than the oblique or external form of rupture, has been remarked by all those who have attentively examined the subject; and, if we adopt the opinion of M. Jules Cloquet, their comparative frequency may be estimated as 1 to 5.

There is no doubt, also, that direct inguinal hernia is much less frequently met with among women than men; indeed, Sir Astley Cooper mentions that he has never witnessed any example of it in a female.§ Professor Cooper, however, once attended a patient, a female, who was the subject of a hernia of this description, the contents of which had been strangulated for three or four days previously: under these circumstances he performed the operation at once, without trying any other means but the taxis, and, in a very short time, the woman perfectly recovered.‖

This rarity of the occurrence of direct or internal inguinal hernia amongst females is, in a great measure, attributable to the small size of the external abdominal ring, and to the very limited

† *Vide* Observations on Hernia, by Charles H. Todd, in the Dublin Hospital Reports and Communications, vol. i. p. 231.

‡ Similar cases have been observed by M. Jules Cloquet (Recherches Anatomiques sur les Hernies de l'Abdomen, p. 83, Proposition xxxviii.), and by Mr. Todd (Dublin Hospital Reports, vol. i. pp. 230-31).

§ *Vide* Sir Astley Cooper on Hernia, 2d edit. Part I. p. 73.

‖ *Vide* The First Lines of the Theory and Practice of Surgery, by Samuel Cooper, 7th edit. p. 560.

dimensions of the inguinal canal in them, as well as to the greater degree of resistance which the several structures composing its posterior wall are capable of affording to the protrusion of the abdominal viscera at any other point than the internal abdominal ring; while, on the other hand, the large size of the crural ring, and the greater laxity of the parts connected with it, necessarily predispose them to become rather the subjects of femoral hernia.

From the observations which have been made by Sir Astley Cooper, it would appear that a direct or internal inguinal hernia is very frequently occasioned in men by the inordinate muscular efforts which are requisite to effect the expulsion of the contents of the urinary bladder, in consequence of old and tight strictures of the urethra.†

The epigastric artery has been observed, in one case, the dissection of which was made by Hesselbach, to run along the inner or pubal side of the neck of the sac of a direct inguinal hernia, instead of taking its usual course along its external or iliac edge. In the subject, a female, in whom this variety in the course of the epigastric artery was noticed, the vessel took its origin from the obturator artery, in place of arising, as is usual, from the trunk of the external iliac artery; and ascended, in a perpendicular direction, upon the inner surface of the abdominal parietes. In such a position the epigastric artery could hardly escape from being wounded, should the operation be performed, and the stricture divided, as has been advised by many, inwards, in the direction of the linea alba.

Since the investments of the sac of an internal or direct inguinal hernia are, in general, rather thinner than those which cover an external or oblique inguinal hernia, a greater degree of caution is required to be observed by the surgeon during the operation, lest the contents of the sac should be exposed unawares, and injured by the edge of his knife.

† *Vide* Sir Astley Cooper on Hernia, 2d edit. Part II. p. 67, and plate x. of the same work.

Section V.

Inguinal herniæ containing the cæcum, the sigmoid flexure of the colon, or the urinary bladder. — An inguinal hernia is sometimes formed by the gradual descent of the more fixed portions of the large intestine; as, for example, on the right side, of the cæcum, and, on the left side, of the sigmoid flexure of the colon. The urinary bladder has, also, been observed to descend through the inguinal canal into the scrotum.† These cases are, however, comparatively of rare occurrence.

In these instances the protruded viscus is only partially covered by a peritonæal sac, usually upon its anterior aspect, but now and then only upon one side, generally the inner one; for, in descending from its natural situation, the bowel does not lose the relations which it previously held with the serous membrane, which lines the cavity of the abdomen. These changes are permitted to take place by the lax and extensible property of the cellular substance which is so abundant in the iliac fossæ, and it is owing to the same cause that their progress is so very gradual.

Herniæ of this kind do not admit of being replaced so readily as the more frequent forms of inguinal ruptures, and much caution is required, when they are the subject of strangulation, in the performance of the operation, lest the intestine should be laid open by the surgeon, who is apt to proceed too carelessly in the dissection of the parts as they present themselves under his knife, thinking himself secure because he has not arrived at a sac, which in reality does not exist.

It has just now been stated, that a partial investment from the peritonæum usually covers these herniæ upon their anterior and inner aspects; but it sometimes happens that there is no peritonæal sac at all; as when only the lower and posterior part of the cæcum forms the protrusion, and in some examples of herniæ of the bladder.

Herniæ of this nature are sometimes complicated by the

† Mr. Pott removed a calculus from the bladder of a boy, the subject of this disorder, by cutting into it as it lay in the groin. Pott's Chir. Works, vol. iii. pp. 322—328.

presence of a portion of omentum, or of the small intestine, which renders the case still more difficult.

When it is necessary to operate in order to relieve a rupture of this kind from strangulation, the surgeon must content himself with cutting down upon the seat of the stricture, and having enlarged this, he is, in many instances, obliged to leave the bowel where he finds it; from whence, however, it is sometimes withdrawn by slow degrees into the belly again by the simple efforts of nature.

CHAPTER IV.

OF THE DIAGNOSIS OF INGUINAL HERNIÆ FROM SOME OF THE DISEASES WITH WHICH THEY ARE LIKELY TO BE CONFOUNDED.

THE diseases with which inguinal herniæ are most liable to be confounded, are hydrocele, either of the tunica vaginalis, or of the spermatic cord; hæmatocele; varicocele; chronic abscess, having its seat in the iliac fossa; enlargement of the testicle from various causes; a suppurating inguinal gland; and steatomatous growths upon the spermatic cord within the inguinal canal. In the female, a femoral hernia is occasionally mistaken for a rupture of the inguinal species.

Hydrocele.—It occasionally occurs in practice that considerable difficulty is experienced, even by very distinguished surgeons, in determining the nature of the tumour of a hydrocele; for, when the collection of fluid in the tunica vaginalis is so large as to extend for some way upwards into the inguinal canal, the swelling may have the same form as a scrotal hernia, and, like it, may be very tense and elastic, and receive an impulse whenever the patient is made to cough. If the contents of such an hydrocele should be opaque, then an additional source of doubt is created, and the difficulty of coming to a decisive conclusion greatly increased.

But the sense of fluctuation which may generally be perceived on handling the tumour, its transparency when examined in the usual way with a lighted candle in a darkened room, its light weight as compared with that of a hernia, and the history of its progress, which shows that its first commencement was below, and that it gradually increased in size upwards,—joined with the possibility of feeling a portion of the spermatic cord free, betwixt the summit of the swelling and the abdominal rings,—are signs which, when taken collectively, are quite sufficient, at least in the cases of hydrocele which are ordinarily met

with, to serve as the basis upon which a correct diagnosis may be safely established.

When a hydrocele is combined with a hernia, the former is most commonly situated in front of and below the latter.

By a careless observer a congenital hydrocele, which is most likely to be met with in children, may be mistaken for an inguinal hernia, as the swelling can be easily made to disappear into the abdomen by pressure, but returns again whenever the patient coughs, or assumes the erect position; but its transparency and fluctuation clearly denote its true nature.

The diagnosis, however, of some cases of congenital hernia, where the intestine is adherent to and strangulated by the neck of the sac, may be rendered extremely difficult and obscure, on account of the presence of a large quantity of fluid in the lower part of the sac, which distends it and gives to it all the characters of a hydrocele.†

Hydrocele of the spermatic cord.—When an encysted hydrocele of the spermatic cord is situated below the external abdominal ring, it is easily recognized by its transparency when viewed against the light, by the sense of fluctuation which may be perceived on compressing it between the fingers, and by its mobility upon the cord; but the case is far different when the swelling is placed within the inguinal canal, as it is then concealed from sight, nor can we always distinguish a portion of the cord to be free betwixt it and the internal abdominal ring. I well remember a young man being sent into University College Hospital on account of a swelling of this nature in the inguinal canal, which was said to be a small inguinal hernia, and for which he had been recommended to wear a truss. Mr. Cooper, under whose care the youth was admitted, cut down upon it, and removed a portion of the front of the cyst, after which the lad was quickly discharged cured of his complaint.‡

But the round or ovoid form of the swelling, its constant unvarying size, which is commonly that of a chesnut, and rarely exceeding that of an egg, the ease with which it may be moved upon the cord, and its great tenseness and elasticity, to which

† For the details of two cases in which this difficulty was experienced, see Pott's Works, vol. ii. p. 415, Cases xxxiv and xxxv.

‡ This case is mentioned by Professor Cooper, in his First Lines of Surgery, 7th edit. p. 596.

signs may be added the absence of any disturbance or interruption of the functions of the alimentary canal, will be generally found sufficient to prove that the tumour cannot be an inguinal hernia.†

Hæmatocele.—This disease, which consists in a collection of blood either in the tunica vaginalis testis, within the tunica albuginea, or in the cellular tissue of the scrotum, is distinguished from inguinal hernia by many of the same signs as hydrocele, from which it chiefly differs in not being transparent, nor of so light a weight; while, on the other hand, it may present the same form, the same volume, and be of the same indolent character, accompanied, however, with a more obscure sense of fluctuation. I have, notwithstanding, known a hæmatocele mistaken for a strangulated inguinal hernia, and the operation proposed for its relief, in the case of an elderly person, who, it was afterwards found out, had long laboured under hydrocele of the tunica vaginalis. In this person the complaint was suddenly induced by a violent blow over the region of the inguinal canal, and was quickly followed by pain and tension of the part, accompanied by urgent sickness and vomiting, and constipation of the bowels. The patient was sent into the hospital, to have the operation performed, when a more strict investigation into the history of the case was made, and the conclusion arrived at that it was not a hernia, but a hæmatocele, suddenly supervening upon an old hydrocele; an opinion which was fully confirmed by the subsequent history of the case.

Varicocele.—There are few diseases, perhaps, which have been more frequently mistaken for an inguinal hernia than a varicose enlargement of the veins of the spermatic cord; and yet, to a close observer, it would seem hardly possible to confound the two complaints with one another. This disease more frequently affects the veins of the cord of the left side than those on the right. It presents itself under the form of a soft, indolent, and inelastic swelling, which is, for the most part, situated just above the body of the testicle, but sometimes extends as high as the external abdominal ring; its surface is unequal, and nodulated; it easily yields under the pressure

† For an interesting case where the presence of a small strangulated inguinal hernia was masked by a hydrocele of the cord, and the operation performed, see Liston's Operative Surgery, 3rd edit. p. 538.

of the hand, and, when examined attentively, communicates to the touch the sensation — as it has been very aptly designated — of grasping a bundle of earth-worms. In large varicoceles an impulse may be communicated to the tumour upon coughing; but the essential distinction between this complaint and an inguinal hernia, is drawn from the circumstance, that while the latter, when it has once been reduced, cannot redescend so long as the inguinal canal is maintained closed by pressure made upon it by the fingers, the former reappears even still more quickly than before; and this happens also, notwithstanding the patient keeps the recumbent position, and avoids the slightest exertion.

Chronic abscess of the iliac fossa, psoas abscess, &c.—Sometimes large deposits of pus are collected in the loose cellular tissue which abounds in the iliac fossæ, and, descending through the inguinal canal, form a prominent tumour in the situation of the external abdominal ring, presenting many of the characters of an oblique inguinal hernia; for example, such as a sudden disappearance of the swelling under pressure, or when the patient lays himself down in the recumbent position, and as quickly reappearing when he raises himself erect, and being always accompanied by a distinct impulse upon coughing. Psoas abscesses occasionally follow the same course, and may cause the same difficulty in establishing a correct diagnosis. Professor Cooper had the kindness to show me a case of this kind, which had been brought to him for his opinion, in which a truss had been previously worn by the patient for a considerable time, under the impression that he laboured under an inguinal hernia.

A careful examination into the whole history of the case, and a strict investigation of all the symptoms, will, however, rarely fail to enable us to steer clear of the error of mistaking either of these complaints for an inguinal hernia.

Enlarged testicle.—If the mistake had not actually occurred, some persons might feel inclined to ridicule the idea of the possibility of any enlargement of the testis being ever mistaken for an inguinal hernia; but several cases of this kind have been recorded by various writers on surgery, in which considerable difficulty was experienced in arriving at a correct diagnosis.

Sir Charles Bell mentions one instance in which he saw the

operation for bubonocele performed where there was only a tumour of the testicle.† These mistakes have usually occurred where the testicle has not descended completely into the scrotum, but remains within some part of the inguinal canal, and, becoming attacked by inflammation, induces a series of symptoms liable to be confounded with those accompanying a strangulated congenital hernia. An extremely interesting case came under the notice of Professor Cooper, in which the symptoms which accompanied an attack of acute inflammation of the testicle were such as very strongly resembled those usually regarded as pathognomonic of strangulated intestine, and, as Sir Astley Cooper has rightly observed, might have induced a less experienced surgeon to regard the case as one of strangulated hernia.‡ "I once attended," says Mr. Cooper, "a soldier, with acute inflammation of the testicle, in the Military Hospital of Canterbury, who experienced so much pain in the abdomen on the fifth day of the attack, accompanied by vast swelling of the cord, almost incessant vomiting, complete and obstinate stoppage of the stools, and severe constitutional disturbance, that a suspicion of hernia was raised. The absence of tension in the abdomen, the limitation of the pain to one side of the belly, the inability of feeling any thing like the testicle of its ordinary size below the tumour, as in a bubonocele, and the history which made it impossible that the case could be a congenital hernia, were circumstances which prevented an erroneous view of the complaint from being adopted."§ Several instances of a similar nature are related by the justly celebrated Mr. Pott in his excellent treatise upon Hydrocele. ‖

The solidity and peculiar form of the swelling, and the characteristic pain which is excited by pressure upon the part, added to the previous history of the case, will generally be sufficient to enable us to arrive at a correct diagnosis.

Suppurating inguinal gland.—It sometimes happens that

† *Vide* a System of Operative Surgery, founded on the basis of Anatomy, by Charles Bell, vol. i. 8vo. Lond. 1807, p. 258.

‡ *Vide* Observations on the Structure and Diseases of the Testis, by Sir Astley Cooper, Part II. p. 13.

§ *Vide* a Dictionary of Practical Surgery, by Samuel Cooper, 7th edit. p. 1215.

‖ *Vide* the Chirurgical Works of Percivall Pott, F.R.S. 2d edit. vol. ii. pp. 223—31.

a combination of symptoms, such as are commonly looked upon as indicating strangulation of a portion of bowel, accompany the formation of an abscess seated in one of the glands of the inguinal region, and have led hasty and careless observers to form an erroneous opinion as to the nature of the swelling, which is mistaken for a strangulated hernia, requiring the operation to be performed for its relief. Much judgment and discrimination is often required to be exercised in determining the nature of such cases.

On the other hand, the tumour formed by a small hernia, the contents of which are really strangulated, has been mistaken for an abscess, and much valuable time lost in the application of remedies which are incapable of affording the slightest relief. Sir Charles Bell tells us that he has seen four surgeons unanimously of opinion that a bubonocele was a suppurating gland.†

It is not very many years since I was shown a woman, a patient in a very large hospital, who soon afterwards died in consequence of this error in diagnosis having been committed by one of the dressers of the institution, who laid open a strangulated hernia under the impression that it was a simple abscess in the groin.

Steatomatous tumours upon the spermatic cord.—Large masses of adipose substance are not unfrequently formed in the inguinal canal, upon the spermatic cord and round ligament of the uterus, and form a tumour possessing many of the characters of an inguinal hernia. These steatomatous tumours are occasionally accompanied by a small protrusion of the membrane of the peritonæum, constituting a small hernial sac.

Femoral herniæ.—If close attention were always paid to the situation which is occupied by the neck of the tumour, it would be next to impossible to mistake a femoral for an inguinal hernia; for in the latter it is placed *above* the ligament of Poupart, while in the former it lies *below* it. The mistake is most liable to occur in the female, for the round ligament of the uterus does not afford us the same assistance in making a diagnosis, as the spermatic cord in the male.‡

† *Vide* a System of Operative Surgery, vol. i. p. 259. Also Sir Astley Cooper on Hernia, 2d edit. Note at foot of page 71.

‡ *Vide* Sir Astley Cooper on Hernia, 2d edit. Part I. p. 71.

Whenever a tumour in the groin is accompanied by obstinate constipation, and other symptoms resembling those of strangulated hernia, which are not clearly referrible to other causes, it is to be considered an established rule of practice to cut down upon the swelling, and thus ascertain its precise nature; for many instances have occurred where this rule has been neglected, and the patients permitted to die unrelieved from a small knuckle of intestine being strangulated behind swellings of the nature just described.†

† The reader will find several important cases, illustrating forcibly the propriety of this rule of practice, mentioned in the Surgical Anatomy of Femoral Hernia, pp. 138, 139.

CHAPTER V.

OF THE REDUCTION OF INGUINAL HERNIÆ BY THE TAXIS.

On many occasions the reduction of an inguinal hernia by the taxis is a very easy and safe proceeding, and one which may be undertaken by even the most ignorant persons without any risk being incurred by the patient; as, for example, when the constriction which confines the hernia is of so slight a nature as to yield readily to a very moderate and gentle compression of the tumour. But when the hernia is very tightly girded by the stricture, and has been so for a considerable time, then the nature of the case is very much altered, and it becomes a matter of the greatest importance that the efforts employed to return the contents of the sac by the taxis should be directed by superior judgment and skill. There can be no doubt that much of the danger which so frequently attends upon the operation for strangulated hernia is the result of the force—too often misapplied for an improper length of time—which it is thought requisite to employ before having recourse to the use of the knife. The details of numerous dissections have been recorded by different writers, which satisfactorily prove that the fatal termination of a great number of the cases in which the operation has been performed without success, may be fairly attributed to the extensive bruising and even laceration of the coats of the tender and inflamed intestines, which is caused by the rude force with which they had been compressed against the sharp, resisting edges of the openings through which they had been protruded.†

It is, nevertheless, on many occasions, and more particularly so in hospital practice, exceedingly difficult to decide whether the taxis should be tried any longer; for many examples con-

† *Vide* a very interesting case of strangulated inguinal hernia, in which the bowel was ruptured by the patient in his efforts to return it; with observations, by Benjamin Travers, F.R.S. in 23d vol. of Med. Chir. Trans. Lond. 1840, p. 1.

tinually occur in which an experienced surgeon is able to relieve the patient quickly and safely from a state of imminent danger, even after the most violent and long-continued attempts to effect the same object have been made in vain by others who preceded him in the treatment of the case. But it is, also, equally certain, that the chances of success from the operation which must eventually be had recourse to in all those cases where the taxis—no matter how carefully and skilfully it has been employed—fails to achieve the return of the strangulated parts, are greatly diminished in consequence of the violence which necessarily attends its use. Indeed, many excellent and experienced surgeons have denounced, in very strong terms, the indiscriminate employment of the taxis in all cases of strangulated hernia; and have not hesitated to affirm that it has, upon the whole, been productive of more harm than good, and that the operation is most likely to succeed when no attempts to reduce the hernia have previously been made.†

The principal question to be decided before proceeding to the employment of the taxis is, in the first place, to determine the exact nature of the hernia; whether it is really an inguinal rupture: and, secondly, whether it is of the external and oblique form, or of the internal and direct kind,—for in the former of these varieties the direction of the force which it is necessary to employ is essentially different from that required by the latter.

The other points of importance, which remain to be considered, are,—what is the period of time that has elapsed since the descent of the hernia, and the commencement of the urgent symptoms of strangulated intestine;—the degree of pain and tenderness under pressure of the tumour, but more especially of the belly generally;—and, also, what attempts to reduce the hernia have been made by other surgeons, taking particularly into account their duration, and the amount of force that has been employed, and how far it is probable that these attempts were directed by so much of surgical and anatomical knowledge as would render any further trial of the taxis not only unnecessary, but likely rather to be hurtful than beneficial towards securing the safety of the patient.

In the practice of all large hospitals, the correctness of the

† See the works of Pott, Richter, Petit, Velpeau, Cooper.

foregoing remarks is very strongly illustrated by the history of the cases of strangulated herniæ which are continually admitted into these institutions; for it will be found, upon making the inquiry, that in most of them the patients have undergone, previously to their admission, several long-continued, and, frequently, very violent attempts to reduce the hernia by the taxis, but which have not, however, been followed by success, on account of ignorance or forgetfulness in the operator of the principles by which he should be directed in his endeavours to attain the object sought for.

Before, then, proceeding to employ the taxis, care should be taken to place the patient in such a position in his bed, that all the structures connected with the formation of the inguinal canal may be relaxed to the utmost degree possible. Thus, for example, the thigh of the affected side should be raised and bent upon the pelvis, and, at the same time, rotated inwards, in order that all tension of the lower part of the abdominal parietes, depending upon the connexion between the iliac portion of the fascia lata, and the lower edge of Poupart's ligament, may be completely removed. Some additional benefit, in this respect, is frequently obtained by placing the opposite limb in a similar position. The shoulders and head of the patient should also be elevated as much as possible, by means of pillows introduced underneath them; and he himself should be held engaged in conversation, with the double object of diverting his attention from the operator, whose good intentions he is very likely to frustrate by opposing all his efforts; and of preventing him thereby from diminishing the space of the abdominal cavity by the contraction of the diaphragm, which is necessarily attendant upon the holding of the breath. The surgeon ought, also, to be very careful to obliterate at the first, by drawing the contents of the hernial sac slightly downwards, the angle which is formed by that part of the strangulated bowel which is immediately external to the seat of the stricture, with the portion of it which is embraced within its grasp; for if he should overlook this preliminary step, he is very liable to be foiled altogether in his attempt to reduce the hernia, and, on the other hand, is much more likely to injure the coats of the intestine, by rudely squeezing it against the firm resisting margins of the stricture.

Besides the risk of contusing and lacerating the coats of the prolapsed intestine, which is constantly attendant upon the violent and unskilful performance of the taxis, there is also another danger to be avoided, that of forcing back into the abdominal cavity the hernial sac along with its contents, still closely girt by the stricture, which in these cases commonly depends upon the altered and thickened state of the peritonæum, forming its neck or internal orifice. This reduction of the hernial tumour in a mass, which has been well described by the French writers upon surgery, under the term of *reduction en bloc*, has been frequently observed to happen in the hands of ill-educated practitioners, who are not generally made aware of their error, until the speedy death of the patient affords an opportunity for inspecting the parts, when the sac, with its contents still strangulated, is found rolled up in the loose cellular tissue which lies between the muscular parietes of the iliac fossa and the peritonæum.

The direction of the force which it is necessary to employ for the reduction of an incarcerated inguinal hernia by the taxis, must be varied according to the form of the rupture, whether it be of the oblique external or direct internal kind. In the first case the pressure upon the tumour should be made in the same line as the direction of the inguinal canal; that is to say, obliquely upwards and outwards, towards the centre of the space included between the anterior superior spinous process of the ilium and the symphysis pubis; whilst, in the latter, it should be made more directly backwards, in the course of an imaginary line drawn from the external abdominal ring towards the promontory of the sacrum.

The surgeon, grasping the tumour with one hand, fixes the parts in the vicinity of the neck of the sac with the other, and seeks to return, by a gentle and moderately increasing pressure, that portion of the strangulated intestine which descended the last. Any portion of the bowel that may be thus returned is to be prevented from again descending by making compression of the upper part of the sac with one hand, while with the other a fresh hold is taken of that which still remains down.

If it be thought advisable, the efforts of the surgeon to reduce the hernia by the taxis may be assisted by general bleeding, the use of the hot-bath, and all such other remedies as are

known to possess a powerful influence in diminishing muscular tone and vascular action.

When a judicious trial of the taxis fails to effect the return of the hernia, and there exist no good and sufficient grounds for believing that any benefit is likely to accrue from waiting to make any further attempt, it can be of no use to lose time in the employment of any of those local applications which are too frequently recommended to be tried in such cases; but it will be better for the interests of the patient if the operation be at once proceeded with.

It not unfrequently happens, after the reduction of a strangulated hernia by the taxis, that a certain degree of obscure tumefaction still remains about the parts in the inguinal canal, as well as in the scrotum, and excites a doubt in the operator's mind whether the whole of the protrusion has been effectually returned; but, it should be remembered, that this appearance is very deceptive, and very probably is owing to a serous infiltration of the cellular sheath of the cord, or to an effusion of serum into the interior of the hernial sac; in either case there is no just ground for alarm or anxiety.

It may not be altogether out of place to mention here, that it is only by the knowledge derived from practice, and not from descriptions, however carefully they may be given, that we are taught to estimate correctly the exact amount of force that may be safely used in employing the taxis in different cases of strangulated hernia, and to acquire that tact which is absolutely necessary to make an adroit use of those manœuvres which very frequently prove of essential service in our endeavours to secure a successful result.

CHAPTER VI.

OF THE OPERATION FOR STRANGULATED INGUINAL HERNIÆ.

THE patient should be placed upon the table, or on the edge of his bed, in the recumbent position; his shoulders being well supported by pillows, with the view of relaxing, as completely as possible, the abdominal muscles. The hair should be previously removed by shaving the parts.

The first incision — which should comprise in its depth the skin and subjacent adipose layer — ought to be commenced well over the neck of the tumour; at the distance, perhaps, of an inch and a half from the outer angle of the external abdominal ring: the object, in so doing, being to render more easy of execution the future steps of the operation, and, more particularly, the safe division of the stricture, which is most frequently seated near the superior aperture of the inguinal canal. The incisions necessary to expose the contents of the hernial sac should be made upon the centre of the front of the tumour, or rather more towards its inner than its outer side, so as more effectually to avoid the danger of injuring any of the component structures of the spermatic cord, should they happen to be separated from one another in the manner described at pages 276, 277. (See also the wood-engraving No. 6.)

In cases of large scrotal herniæ it is unnecessary to prolong the incisions quite to the fundus of the swelling; as, besides the greater risk which exists in such cases of injuring some of the elements of the spermatic cord, its great length could prove of no advantage to the surgeon; and, on the other hand, would be very likely to expose the patient to the unpleasant circumstances attendant upon making an opening into the cavity of the tunica vaginalis testis.

In small herniæ, however, and especially in incomplete bubonoceles, the external incisions should be carried over the

whole extent of the tumour; for, unless this were done, sufficient space would not be obtained for the secure and easy completion of the operation.

The first incision may be made, according to the choice of the operator, in one of three ways; viz. by simply sweeping the knife over the convex surface of the tumour, in the direction of its long diameter; or by raising the integuments covering the swelling into a thick transverse fold, one half of which is held by an assistant, while the surgeon takes the other in his left hand and cuts it through, either from its surface to its base; or in the opposite direction, first transfixing it below with the bistoury, the back of which is turned towards the sac, and then cutting outwards. The first of these modes of proceeding is to be preferred when the external investments of the hernia are unusually tense, whilst the other two are more applicable when they are very lax.

In the division of the integuments the external pudic artery is cut across, and, occasionally, also the superficial epigastric artery. If either of these vessels should bleed freely, it is best to secure it immediately with a ligature, before proceeding any further in the operation; since, if this be omitted, secondary hemorrhage is very likely to occur after the wound has been closed and the dressings applied, and so to give rise to considerable disturbance of the parts.

The several coverings which the hernial sac derives from the intercolumnar fascia, the cremaster muscle, the fascia transversalis, and the subserous cellular tissue, are, in the next place, to be divided either with the knife and dissecting forceps, or by cutting them layer by layer, a director being previously introduced underneath them. It should, however, be clearly understood, that such great variety is continually met with in the appearance, number, and thickness of the several investments of the hernial sac, that it is frequently impossible to recognize them separately in the operation.

It may be of some use to mention here, that the subserous cellular tissue is sometimes very thick, and resembles so closely the omentum, that it may for a moment deceive the surgeon in the operation, especially in cases of direct or internal inguinal herniæ, and lead him to conclude that the sac has been opened before it has been actually exposed.

The hernial sac having been in this manner brought into view, it is to be opened at first upon its lower and anterior part. For this purpose, a small portion of it should be taken up between the blades of the forceps, and an opening carefully made into it, the edge of the knife being directed horizontally. Some surgeons prefer pinching up a small piece of the sac between the finger and thumb of the left hand, and after rubbing it between them, in order to ascertain whether any of the intestine is included, which being decided in the negative, they proceed to open it as before. The aperture which is thus made is to be enlarged to the same extent as the external incisions, by dividing the sac upwards and downwards with the probe-pointed bistoury, guided upon the fore-finger or the director.

The next step in the operation is to seek for the seat of the stricture, by carrying the fore-finger of the left hand upwards, between the sac and the protruded viscera. In the greater number of cases the stricture will be found at the margin of the internal abdominal ring, or in the neck of the sac. Sometimes—but this occurs very rarely—the stricture is situated at the external abdominal ring, or, perhaps, about midway between it and the internal ring, being there produced by the lower edge of the internal oblique and transversalis muscles. It may, on the other hand, exist in a very few instances in some other part of the sac below the inguinal canal.

The sensation which the condensed band of cellulo-fibrous tissue, which commonly forms the stricture, communicates to the finger, strongly resembles what might be supposed would be produced if a piece of strong packthread were drawn so closely around the neck of the sac as to make a defined circular indentation in it, the free border of which projects towards its centre.

In a direct or internal inguinal hernia the stricture is frequently seated in the margins of the lacerated opening in the conjoined fibres of the internal oblique and transversalis muscles, through which the hernial sac has protruded.

The extremity of the common probe-pointed bistoury—guided upon the fore-finger of the left hand, which forms the best director—is now to be cautiously introduced underneath the stricture; which is then to be divided by turning forwards the edge of the instrument, and gently elevating its handle, at the

same time that its point remains steadily fixed in its position within the neck of the sac.

The direction of the incision necessary to divide the stricture should be, in all cases of inguinal herniæ, vertically upwards, parallel to the linea alba; since by so doing there can be no chance of doing any injury to the epigastric artery. A very slight cut, not exceeding, perhaps, the eighth part of an inch, will be generally found sufficient to liberate the strangulated bowel.

It is of the utmost importance, during the division of the stricture, that the prolapsed intestines should be completely protected from injury by the knife; which may be done either by the fingers of the operator's left hand being spread over them in such a manner as to prevent them from rising over the edge of the instrument; or, should he be otherwise engaged, then the same object may be fulfilled by the hand of an attentive and intelligent assistant.

It is also very necessary, while endeavouring to reduce the contents of the hernia into the belly, that the sac should be firmly held by its margins; since it has happened, in consequence of neglecting this very advisable precaution, that both it and its contents have been rudely thrust back into the abdomen together in a mass, the bowel remaining still girt by the stricture.

The stricture having been divided, the contents of the hernia must be reduced with great care and gentleness; and, if it should happen that both omentum and intestine have descended, the latter should be replaced before the former. It will facilitate the return of the parts, if the thigh be raised and rotated inwards, as has been already recommended while treating of the taxis.†

The operation being concluded, and the parts safely returned into the abdomen, which is to be ascertained by gently introducing the point of the finger into the mouth of the hernial sac, the edges of the wound should be brought together by a few points of the interrupted suture, and the dressings supported by a thick compress and spica bandage. A copious enema may now be administered by means of the patent syringe; and if this

† *Vide* page 300.

fail, which it seldom does, to produce the desired effects, its action may be promoted by some mild laxative mixture given by the mouth.†

Division of the stricture without opening the hernial sac.—Some very excellent surgeons have strongly recommended the stricture to be divided without opening the hernial sac, and there is no doubt but that this method should be practised whenever it is possible to do so; yet, at the same time that we acknowledge its superior advantages, we should not forget that it is only applicable to a very small proportion of the cases in which it is requisite to have recourse to the use of the knife. It is done by slipping the director underneath the fascia propria in the vicinity of the lower margin of the transversalis muscle, and dividing both of these structures, with any other tendinous band which may oppose the easy reduction of the contents of the hernia. This plan may also be employed with advantage when the stricture is situated at the external abdominal ring. Notwithstanding that I have seen this mode of operating tried in a great number of cases, I never saw it once succeed.

† For further observations upon the treatment after the operation, and the appearances which are found after death, when a patient dies from a strangulated hernia, the reader is referred to the Surgical Anatomy of Femoral Hernia, pp. 149—152.

THE SURGICAL ANATOMY

OF

THE TESTIS

AND ITS COVERINGS.

An intimate and accurate acquaintance with the anatomy of the several structures which compose the coverings of the testicle is a subject that demands, in the highest degree, the close attention of all those who are desirous of qualifying themselves to enter upon, with credit and satisfaction to themselves, and with safety to the patients who may be submitted to their care and superintendence, the consideration of the many difficult questions which constantly present themselves for solution by the practitioner, when engaged in the treatment of the numerous and varied diseases to which these organs are liable. Were the anatomy, natural as well as morbid, of this portion of the human frame more diligently studied, we should cease to find those errors in diagnosis so frequently committed by persons who ought to know better; by which an extravasation of urine underneath the dartos is mistaken for an inflammatory swelling of the testicle, hæmatocele for malignant disease of the same organ, and hydrocele and varicocele confounded with scrotal herniæ; with many other serious blunders of a similar nature.

1. *The scrotum.*—The cutaneous investment of the testicle is chiefly remarkable for the thinness of its texture, its deep brown hue, and the numerous rugæ by which its surface is wrinkled. It is partially furnished with some scattered hairs. The scrotum is divided symmetrically by an elevated line or *raphé*, which extends from the under surface of the penis, as far back as the anterior margin of the anus, and corresponds with the mesial line of the body. In hot weather, and in

debilitated persons, the skin of the scrotum becomes very long and lax; while, on the contrary, it is very short and corrugated in persons enjoying robust health, or under the influence of a cold temperature.

A large number of small sebaceous follicles are situated underneath the skin of the scrotum; the secretion from which, under some circumstances, acquires an extraordinary degree of acrimony, and excoriates the neighbouring surfaces in such a manner as to produce great distress to the patient. A strict attention to cleanliness by frequent ablution of the affected parts, and the use of Goulard's lotion, are generally sufficient to effect a speedy cure of the complaint.

The extreme facility with which the skin of the scrotum admits of being extended to an extraordinary degree, is well exemplified in those immense enlargements of this part which are so frequently met with among the inhabitants of eastern climates; and, in this country, is daily witnessed among those who are the subjects of large herniæ, hydroceles, or malignant disease of the testicle.

The extensible quality of the skin of the scrotum allows the surgeon to be less chary of removing large portions of it whenever he conceives it advisable to do so in any of the operations practised upon this part; as, for example, castration, the excision of tumours, fungoid growths, &c.

2. *The dartos.*—This covering of the testis was formerly considered to be of a muscular nature, but at the present day it is looked upon as a transition structure, intermediate betwixt muscular fibre and condensed cellular tissue, and, in many respects, possessing the properties of each. It is composed of numerous reddish-looking fibres, which are disposed longitudinally, following the same direction with each other, being continuous posteriorly with the superficial fascia of the perinæum, and anteriorly with the superficial fascia covering the body of the penis and lower part of the abdominal parietes. The dartos is divided into two separate cavities or compartments, by a process which is sent off from its inner surface, and separates the testicles from one another. This process or membranous partition (*septum scroti*) is not so complete, but that it readily allows of fluids, which may be effused underneath the dartos upon one side, to pass across to the other.

3. *The subdartoic cellular tissue.*—A large quantity of lax cellular tissue, containing in its cellules more or less adipose substance, is situated underneath the dartos, betwixt it and the external spermatic fascia. It is largely supplied with blood from the branches of the superficial perinæal vessels, which freely ramify in its thickness.

This covering of the testicles is deserving of especial notice, since it is into its structure that the copious effusion of serum, which constitutes the common form of anasarcous swelling of the scrotum, so frequently met with in patients the subjects of general dropsy, takes place. This structure is also the seat of that insidious and destructive form of diffuse inflammation, which has been denominated by Mr. Liston acute anasarca of the scrotum, as well also as of those devastating extravasations of urine which are liable to occur after any rupture of the urethra in front of the triangular ligament. Large effusions of blood also take place into it in consequence of any contusion of the scrotum, by which some of the branches of the superficial perinæal or pudic vessels are ruptured, or when they have been accidentally punctured in the operation of tapping for the cure of hydrocele of the tunica vaginalis; and the same kind of swelling is sometimes observed to happen after the operation of lithotomy. Violent inflammation of this tissue, followed by sloughing of the greater part of the scrotum, has been frequently occasioned by some of the irritating fluids usually made use of to inject the tunica vaginalis for the cure of hydrocele being permitted to escape into it, either through the awkwardness or carelessness of the surgeon, or some sudden and unforeseen movement of the patient, whereby the end of the cannula is not maintained in its proper position.

It is a question that is sometimes asked in the wards of an hospital, how it happens, while the whole thickness of the scrotum is destroyed by gangrene produced by some of the injuries and diseases just now described, that we see the testicles remain in the midst of the sloughing tissues wholly unaffected by the mischief which is going on around them? The explanation readily suggests itself, when it is recollected that these organs derive their nervous and vascular supply from a distant part of the body, which is far removed from

the influence of those deleterious agents which have caused the destruction of the scrotum.

4. *The external spermatic fascia.*—This covering of the testicle has already been fully described at p. 223; it is the same as the intercolumnar fascia of some writers. Commencing superiorly at the margins of the external abdominal ring, it is prolonged downwards upon the spermatic cord and testis, both of which structures it completely surrounds. It is occasionally found greatly thickened in large and old scrotal herniæ.†

5. *The cremaster muscle.*—As a full description of the cremaster has been given at p. 231, it is wholly unnecessary to repeat it here; suffice it to say, that it is formed by the displacement of the lowermost fibres of the internal oblique muscle, which are drawn downwards by the testicle in its descent through the inguinal canal into the scrotum. The changes which it undergoes in cases of herniæ are mentioned at p. 269.

6. *The funnel-shaped sheath of the fascia transversalis.*—This is the investment which the testis derives from the fascia transversalis, when it descends through the internal abdominal ring. In the natural state of the parts it is extremely thin and delicate. It has been fully described at p. 241, and at p. 268.

7. *The tunica vaginalis communis or cellular sheath of the spermatic cord.*—This is formed by a prolongation from the subserous cellular tissue of the lumbar region, and is capable of being largely distended, as happens in diffused hydrocele of the spermatic cord. It is also frequently the seat of copious extravasations of blood, when secondary hemorrhage takes place from any of the spermatic vessels after the operation of castration, particularly if the upper extremity of the cord has been permitted to be retracted far within the inguinal canal. The blood which is thus effused is liable to cause diffuse inflammation, followed by extensive abscess of the iliac fossa.‡ That part of the tunica communis which invests the spermatic cord is sometimes the seat of large masses of fat, which may form a tumour resembling, in many respects, an irreducible epiplocele. Again, serous fluid may be collected in some of its cellules, and, gradually increasing in quantity, form a species of encysted hydrocele of the spermatic cord.

† *Vide* p. 228 and p. 270. ‡ *Vide* also pp. 241 and 250.

8. *The tunica vaginalis testis propria.*—This is a small sac of serous membrane, originally a process from the peritonæal lining of the abdomen, but from any connexion with which, in the normal state of the subject, it is separated by the obliteration of that portion of it which intervenes between the internal abdominal ring and the lower part of the spermatic cord, and which is to be found on dissection lying in front of the spermatic vessels, as a delicate elongated band of condensed fibro-cellular tissue. (See the wood-cut at p. 243, fig. *m.*) Previous to the descent of the testicle, the tunica vaginalis already exists as a small narrow pouch of the figure of the finger of a glove. The tunica vaginalis testis is composed of two parts; one which covers the anterior and lateral surfaces of the testicle and epididymis and lower part of the spermatic cord, whilst the other lines the internal surface of the scrotum. Its internal aspect is smooth, polished, and glistening, being moistened by the serosity which constitutes its natural secretion. Upon the testicle its external surface is intimately adherent to the tunica albuginea, while elsewhere it is in apposition with the fibrous sheath common to the gland and spermatic cord.

In some subjects the tunica vaginalis testis still retains its original connexion with the cavity of the great bag of the peritonæum; and when the communication between them is very free, the intestines readily descend into it, forming a congenital hernia: but sometimes, although the connexion between the two serous membranes still remains open, yet it is through the medium of a very narrow tubular canal, the orifice of which may be suddenly dilated under the influence of any violent muscular effort, by which a portion of intestine is forced down into it, giving rise to a similar kind of hernia as the last, but occurring perhaps at a very late period of life, as happened in the cases observed by M. Velpeau, the details of which will be found in his valuable treatise on Operative Surgery.†

It is occasionally observed, that the portion of the tunica vaginalis, which lies in front of the cord, between the testis and the upper aperture of the inguinal canal, is not obliterated throughout its whole extent, but only at several distinct points,

† *Vide* Nouveaux Eléments de Médecine Opératoire, par A. L. M. Velpeau, 2d edit. tom. iv. p. 182.

and thus forms a series of small isolated sacs of serous membrane, which may become distended with fluid, and constitute another of the varieties of encysted hydrocele of the cord.

Small cartilaginous bodies are occasionally found in the cavity of the tunica vaginalis, either loose and unattached, or connected to the body of the testicle by a delicate pedicle. They are produced by inflammation of a chronic nature.

EXPLANATION OF FIG. 2, PLATE III, opposite p. 237.

The investments of the cord and testicle have been removed, and the cavity of the tunica vaginalis freely exposed by an incision on its anterior surface.

1. The spermatic cord divested of all its coverings, excepting that which it derives from the subserous cellular tissue, and named the *tunica vaginalis communis.*
2. The body of the testicle exposed to view. It is covered anteriorly and laterally by the *tunica vaginalis testis propria.*
3. The upper part of the epididymis, or, as it is termed, the *globus major*, or *caput.*
4. The *globus minor*, or *cauda epididymis.*
5. 5. That portion of the tunica vaginalis reflexa which lines the inner surface of the superficial investments of the testicle. It has been laid open by a free incision upon its anterior surface, and the edges of the opening turned aside.
6. The lower part of the cord, covered by the tunica vaginalis testis, which ascends for a short way upon it in the form of a wide cul-de-sac.

9. *The tunica albuginea.*—This, which is the proper coat of the testicle, and serves to give it its peculiar form, is a strong thick fibrous membrane, which resembles, in many respects, the sclerotic coat of the eye. It invests the whole of the body of the testicle; is of a white colour, opaque, and possesses, moreover, an extremely firm and resisting texture. It, nevertheless, is capable of great distensibility, as is well seen in those sudden and excessive enlargements of the testicle which depend upon an attack of acute inflammation of the gland; but, the causes of its distension being removed, it quickly regains its original dimensions. Externally it is invested upon its anterior and lateral aspects by the tunica vaginalis testis propria, which is very closely united with it; but posteriorly and inferiorly it is pierced by the spermatic vessels

as they enter into the body of the testis, and superiorly by the seminiferous tubes as they emerge to reach the epididymis.

Corpus Highmorianum.—The cavity of the tunica albuginea is divided unequally by a process which is furnished from its inner surface towards its upper and back part; this has been named the *corpus Highmorianum*, or *mediastinum testis*. It is situated nearer the posterior than the anterior surface of the gland. Numerous membranous bands are extended at different points from the front of the corpus Highmorianum to the inner surface of the tunica albuginea. These processes, which are named *sepimenta testis*, serve to separate and support the several masses into which the lobular structure of the gland is divided, and also to preserve the shape of the organ.

10. *The tunica vasculosa.*—This has been described by Sir Astley Cooper as the inner coat or layer of the tunica albuginea; the internal surface of which it not only lines, but it is also extended over the fibrous processes which connect the tunica albuginea with the corpus Highmorianum. It is formed of delicate cellular tissue, in which ramify the ultimate branches of the spermatic artery and vein.

According to Sir Astley Cooper, the outer layer of the tunica vaginalis bears a strong resemblance to the dura mater of the brain—like it, being tendinous and inelastic, and, like it, forming processes internally; whilst the inner membrane of it resembles the pia mater, being reflected inwards upon the lobes of the testis, and forming a bed, on which the branches of the spermatic artery ramify, and supply with vessels the membranes which envelope the tubuli.†

Structure of the testicle.—The glandular structure of the testicle, which is of a yellowish colour, slightly reddened by the vessels of the tunica vasculosa, is chiefly composed of a soft, pulpy, filamentous tissue, formed by the numerous convolutions of the delicate vessels which serve to receive and transmit the seminal secretion.

The tubuli seminiferi. — The seminiferous ducts of the testis are aggregated together into small pyramidal masses or lobules (*lobuli testis*), which are closely invested by the tunica vasculosa or pia mater. They are separated from one another by the membranous processes which have been already described

† Sir Astley Cooper on the Anatomy of the Testis, p. 16.

as connecting the anterior surface of the corpus Highmoranium or mediastinum testis with the interior of the tunica albuginea. The number of the seminiferous tubes is very great, being estimated at three hundred; and each of these is not less than sixteen feet in length, and about $\frac{1}{200}$th part of an inch in diameter. The extent of the whole, when added together, is said to be near 5000 feet.†

Vasa recta—rete testis. — The seminiferous tubes terminate, after passing through the anterior layer of the mediastinum testis, in another set of vessels, less numerous but larger than themselves, which are named, from the straightness of their course, *vasa recta.* These ascend vertically towards the upper part of the gland, where they emerge to join the epididymis. The portion of the testicle which they occupy is situated at the upper and back part of the gland, and is named the *rete testis.*

Vasa efferentia—coni vasculosi. — The vasa recta empty themselves by twelve or fifteen tubes, into the convoluted vessel, of which the epididymis is composed. These are at first straight, but soon assume a very tortuous course, (see the wood-cut No. 10, *b* and *c*,) and thus present a conical figure, whence is derived the name of *coni vasculosi*, which is sometimes given to them. These vessels form the globus major of the epididymis.

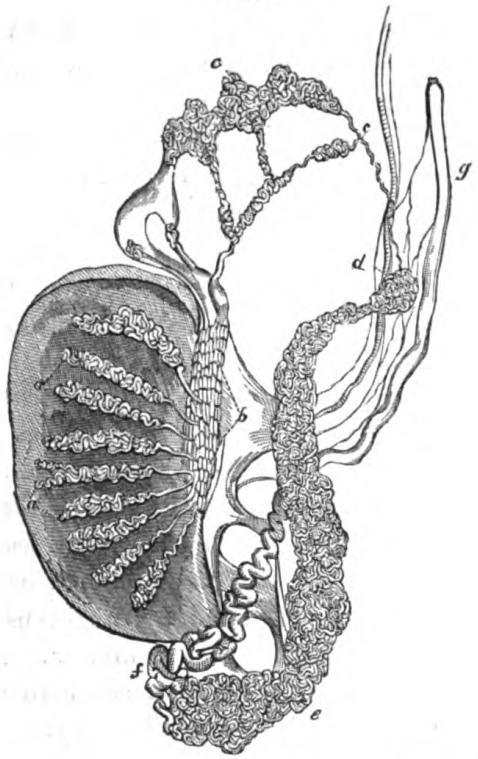
The epididymis.—The epididymis is an oblong, worm-like body, somewhat bent in upon itself at its extremities, which is loosely fixed to the upper and back part of the testicle. (See Plate IV. Fig. 2. 3 and 4.) The superior extremity of the epididymis is larger and more rounded that the inferior, and is named the *globus major.* (Plate III. Fig. 2. 3.) It lies upon the upper part of the testicle, and receives, as has been already described, the vasa efferentia. The middle portion of the epididymis has been named the *corpus;* it is but loosely connected to the body of the testicle by the reflexions of the tunica vaginalis testis. The lower extremity of the epididymis, also termed *globus minor*, or *cauda*, is elongated, and tapering in its figure, and gradually terminates in the vas deferens. The epididymis is formed by the frequent convolutions of the tube, which results from the union of the vasa efferentia; the curves which it forms are pretty firmly fixed

† Manuel d'Anatomie, par I. F. Meckel, tom. iii. p. 627. Paris, 1825.

together by small bands of condensed cellular tissue. Professor Monro has calculated the length of the vessel which forms the epididymis at thirty-two feet. The epididymis is covered in the greater part of its extent by the tunica vaginalis propria testis. The epididymis frequently remains hard and indurated after attacks of acute inflammation of the testicle; but the affection, although not easily removed, is of no serious consequence.

Vas aberrans. — Not unfrequently a long delicate vessel, terminating in a cul-de-sac, is found to extend from the epididymis for a considerable distance upon the cord, and has been named the *vas aberrans.* Sir Astley Cooper possesses a preparation in which is seen three of these tubes in the same testicle, each terminating in a blind extremity.†

No. 10.



The wood-engraving displays the whole of the seminiferous structure of the testicle, as it is seen when injected with mercury and partially unravelled. *a. a.* The *tubuli seminiferi*, which compose the lobules of the testicle; the

† *Vide* Sir Astley Cooper on the Anatomy of the Testis, p. 27.

basis of the cone, which they form, is directed towards the front of the gland, the apex towards the corpus Highmorianum. *b.* The *rete testis*, consisting of the *vasa recta*, which are eighteen or twenty in number: they connect the tubuli seminiferi with the vasa efferentia. *c. c.* The *globus major* or *caput epididymis*, which is chiefly formed by the vascular cones of the vasa efferentia. *d.* The *corpus* or body of the epididymis. *e.* The lower extremity (*globus minor*) or *cauda* of the epididymis. *f. g.* The vas deferens: at *f*, which is the commencement of the tube, it is observed to be larger and more convoluted than higher up, as at *g*.

The vas deferens.—The vas deferens, or excretory duct of the testicle, extends from the lower part of the epididymis—of which it is the continuation—to the prostatic portion of the urethra. Very tortuous, and larger in size at its commencement and termination, the vas deferens follows a straight course in the remaining parts of its extent. It ascends, with the rest of the structures that compose the spermatic cord, as far as the internal abdominal ring, where it separates at an acute angle from the spermatic artery and veins; and then, bending over the epigastric artery, dips down into the pelvis, and becomes closely applied against the side and base of the bladder, as far as the base of the prostate gland. At this point it joins with the duct of the vesicula seminalis. The vessel which results from their junction (*ductus ejaculatorius communis*) traverses the substance of the prostate gland in an oblique direction upwards, forwards, and inwards; and finally opens into the prostatic portion of the urethra, upon the anterior surface of the veru-montanum. In its course along the side and base of the bladder, the vas deferens lies in the angle formed by the reflection of the peritonæum from the posterior and lateral surfaces of that viscus to the side of the pelvis. It also lies on the inner side of the ureter and vesicula seminalis. The interior of the duct,—which, excepting near its extremities, is of very narrow calibre,—is lined by a mucous membrane, which is continuous with that of the urethra. Its external coat is fibrous, very thick, and almost as dense and hard as cartilage. It is accompanied by a small artery, a branch from one of the vesical arteries. The vas deferens may be distinguished from the rest of the constituents of the spermatic cord by its hard wiry feel, and by its position, for it lies behind and to the inner side of the spermatic artery and vein.†

† *Vide* The Surgical Anatomy of the Perinæum, pp. 34 5.

The spermatic cord.—The structures which compose the spermatic cord have been already sufficiently noticed in detail in the preceding pages. They consist of the vas deferens, and the small artery that accompanies it, a branch from the vesical artery; the spermatic artery and veins, with several filaments from the renal plexus of the great sympathetic nerve which accompany these vessels in their course from the loins to the testicle; and the ligamentous cord which remains after the obliteration of the tubular process of the tunica vaginalis in the interspace between the testis and the internal abdominal ring. All these are closely invested by sheaths, derived from the subserous cellular tissue, and the fascia transversalis, opposite the internal abdominal ring.

Towards the lower part of the inguinal canal, the cremaster muscle furnishes a partial investment to the spermatic cord, covering its anterior and lateral surfaces. This muscle is supplied by the cremasteric branch of the epigastric artery, and by the oblique branch of the external pudic or genito-crural nerve.

As the cord emerges through the external abdominal ring, it receives another covering from the external spermatic or intercolumnar fascia; and lastly, from the dartos and integuments of the scrotum. These are freely supplied with blood from the external pudic and superficial perinæal vessels.

CHAPTER II.

OF SOME OF THE MORE FREQUENT DISEASES OF THE TESTIS AND ITS COVERINGS.

Anasarca of the scrotum.—This affection, when chronic, is usually dependent upon a dropsical habit, and is generally accompanied by other signs of organic disease; as, for example, swelling of the feet and legs, ascites, &c. It is distinguished by its indolent character, and, generally, by the absence of any inflammatory action in the parts affected: the tumour is soft and doughy, readily pitting under the pressure of the finger: its surface is regular, having a pale, glistening, and semi-transparent appearance. In aggravated cases, however, the skin of the scrotum is sometimes affected with an erythematous inflammation.

The complaint usually disappears under the use of such remedies as are generally beneficial in the treatment of the primary affection; but if much uneasiness should be experienced by the patient from the excessive distension of the part, considerable relief may be procured by puncturing the swelling at several points with a fine needle, by which the serosity is permitted to drain off; but, under these circumstances, it is by no means a safe plan to make incisions into the scrotum or to scarify it, as has been recommended by some, for such proceedings are apt to induce gangrene of the part, and even cause the death of the patient.

Acute anasarca—diffuse inflammation.—Sometimes the scrotum is the seat of an acute inflammation of an erysipelatous character, which is attended with excessive redness, swelling, and tension of the part. This disorder is frequently met with in persons whose constitutions have been impaired by habits of intemperance, and in these it may occasionally seem to arise without any obvious cause. On other occasions it would appear to be excited by exposure to wet and cold, or by the irritation

consequent upon the lodgment among the rugæ of the scrotum of some acrimonious fluid, such as the urine, ichorous pus, &c. A similar kind of swelling, though perhaps not quite so acute or violent in its nature, frequently attends upon the spreading of erysipelas to the scrotum from the adjacent surfaces.

Acute anasarca of the scrotum should be treated, in its early stages, by the removal of any exciting causes of a local nature,—should these still exist;—by the application of hot fomentations to the swollen part, which should be well elevated upon a pillow of sufficient size, introduced between the thighs of the patient. If these means, aided by such general treatment as is suited to the character of the complaint, do not succeed in diminishing the inflammation and tension, then free incisions should be practised without delay, if we would prevent the sloughing of the whole of the affected structures.

Sarcomatous tumour.—Enormous enlargements of the scrotum have been frequently observed, but more particularly among the natives of hot climates. These growths are of an innocent character, but may attain an extraordinary magnitude. The only mode of cure which they admit of, is their removal by the knife; nor can this always be done without injury to the penis and testicles.†

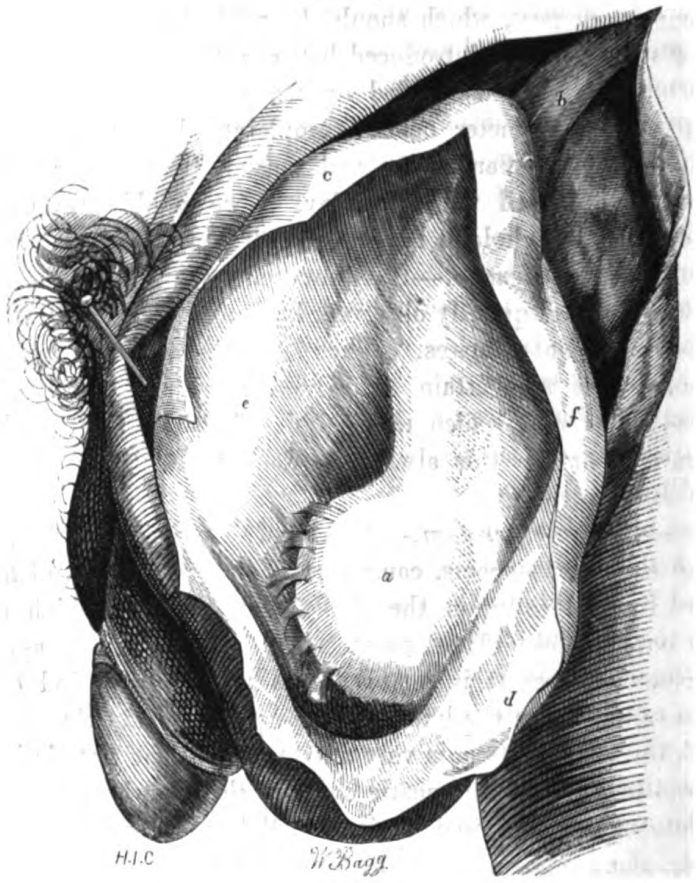
Cancer of the scrotum.—This disease, which is frequent among chimney-sweepers, commences by the formation of hard, warty excrescences upon the skin of the scrotum, which soon break out into foul ulcers, presenting a very malignant appearance; and, except it is removed at a very early period of its existence, either by the knife or some powerful caustic, such as the chloride of zinc, &c. is very apt to involve the testicle itself, and spread along the spermatic cord to the absorbent glands of the lumbar and inguinal regions. When these are once affected, there remains very little prospect of any permanent benefit being derived from an operation.‡

† Dictionary of Practical Surgery, by S. Cooper, 7th edit. p. 1135. Liston's Practical Surgery, 3d edit. pp. 340-1. Titley on Diseases of the Genital Organs, pp. 299—325.

‡ *Vide* the Chirurgical Works of Percivall Pott, F.R.S. Lond. 1779, vol. iii. pp. 225-9. First Lines of the Practice of Surgery, by Samuel Cooper, 6th edit. p. 601. Cases of Diseased Prepuce and Scrotum, by William Wadd, 4to. Lond. 1817, p. 23.

Hydrocele.—The form of this disease, which consists of an accumulation of serous fluid in the cavity of the tunica vaginalis, (*hydrocele of the tunica vaginalis,*) is of the most frequent occurrence. The complaint ordinarily commences without any very obvious cause, though it is highly probable that it is frequently connected with a state approaching to a chronic

No. 11.



The wood-engraving exhibits the cavity of a hydrocele of the tunica vaginalis exposed to view by an incision upon its anterior surface.

a. The body of the testicle, somewhat flattened by the pressure of the effused fluid, and situated at the back part of the swelling, about two-thirds of the way downwards. Small bands of lymph, of old standing, connect it to the sides of the sac. *b.* A portion of the spermatic cord, free betwixt the upper part of the swelling and the external abdominal ring. *c. d. e. f.* The membrane of the tunica vaginalis, forming the parietes of the sac.

inflammation of the membrane of the tunica vaginalis. The swelling is usually of a pyriform shape, and of a very light weight in comparison with its magnitude; it is also free from pain, except when, from its large size, it gives rise to a dragging sensation in the course of the cord towards the lumbar region. The principal diagnostic sign of the disorder is, however, the transparency of the tumour when viewed against the light of a candle in a darkened room; but I have seen many fail in their attempt to observe this sign, because they neglected the necessary precaution of rendering the skin of the scrotum quite tense, by firmly grasping it from behind. The tumour is unaffected, except in very rare instances, by coughing or any other muscular effort on the part of the patient. The growth of the swelling increases gradually from below upwards, and, generally, a portion of the cord may be felt to be free above, between it and the external abdominal ring.

Sometimes the testicle is situated in front of an hydrocele, instead of lying behind it, as is most usually the case. I have witnessed this variety in three instances, which, upon making a dissection of the parts, seemed to depend upon an original transposition of the gland, by which that part of it which is lined by the tunica vaginalis, was turned towards the posterior aspect of the scrotum. Other cases have also been observed, in which this unusual condition of the parts might have been produced by a morbid adhesion of the anterior surface of the testicle to the front of the sac.†

Occasionally it happens that an hydrocele is not transparent when examined with a candle, which circumstance may depend upon the opaque nature of the fluid which it contains, or the great thickness of the tunics of the scrotum, more particularly of the external spermatic fascia and cremaster muscle.

† Sir Astley Cooper mentions the following case in his work on the Anatomy and Diseases of the Testis, which shows the necessity of being acquainted with the possibility of the testicle varying from its usual situation in hydrocele: "A gentleman consulted a surgeon for a swelling in his scrotum, which he pronounced to be hydrocele. He put a trocar into it, no water followed, and he said, "I am mistaken; this is a solid enlargement of the testis, and it must be removed." The patient, excessively alarmed at so severe a sentence, said he should require time to think of it; and another surgeon was consulted, by whom it was injected from the side instead of the fore-part, and the patient perfectly recovered." Op. cit. p. 168.

Sometimes an hydrocele of the tunica vaginalis is divided into several compartments, by numerous membranous septa, which spring from the inner surface of the sac. In many cases these cells or sacculi communicate freely with each other, while in others they form separate and distinct cavities.

An hydrocele may attain an immense size. Mr. Gibbon, the celebrated historian, laboured under this complaint, and was tapped for it by Mr. Cline, who drew off six quarts of fluid.† When an hydrocele is very large, it is not advisable to inject it at once, for the irritation of so extensive a surface might be productive of very dangerous consequences: on the contrary, it would be much better to tap it repeatedly, and at short intervals; and when it has been reduced by this means to a moderate size, then the cure of it by injection may be safely undertaken.

Effusion of urine.—Extravasation of urine into the cellular tissue of the scrotum is a frequent consequence of injuries done to the urethra by rude and awkward attempts to introduce a catheter or bougie in cases of retention from stricture: it may, also, ensue upon the bursting of the urethra behind a tight and old stricture, for in this situation the canal is not only greatly dilated, but its coats are weakened by inflammation and ulceration; or it may take place when the urethra has been torn by falls or blows upon the perinæum.

In all these cases the urine generally makes its way from the perinæum into the scrotum with destructive rapidity, being directed in this course by the connections of the superficial fascia with the arch of the pubes and the triangular ligament. The scrotum may be distended to the size of a child's head; it is of a dusky red colour, pits and crepitates on pressure with the finger, and these symptoms are usually accompanied with a burning pain in the affected parts; which soon fall into gangrene if relief be not speedily afforded by incisions of sufficient length and depth.

In neglected cases the urine ascends upon the front and sides of the belly, and may even reach as high as the scapulæ, diffusing itself through the delicate cellular tissue which connects the superficial fascia of the abdomen to the outer surface of the external oblique muscle. In this situation it is usually

† Sir Astley Cooper's Lectures on Surgery, by F. Tyrrell, vol. ii. p. 92.

prevented from extending upon the thighs by the connection between the superficial fascia and the lower edge of Poupart's ligament; but, in one instance, which fell under my notice in the Hôtel Dieu of Paris, it had broken through this barrier, and spread its ravages as far downwards as the knees: the patient, I need hardly add, died exhausted by the excessive discharge attendant upon the separation of the sloughs; which, as will be readily imagined, were of extraordinary extent. The extravasation of a fluid, possessed of such acrimonious qualities as the urine, is necessarily accompanied by constitutional disturbance of a very serious and alarming character, such as frequent rigors — cold clammy perspirations — feeble rapid pulse — dry brown tongue — anxious and haggard countenance — with, frequently, a peculiar dirty yellow hue of the surface of the body.

I have been made acquainted with several instances in which this disorder was mistaken for inflammation of the testicle, and treated as such during several days—a blunder which was followed by the total destruction of the coverings of the scrotum.†

† The subjoined case may serve to exemplify the preceding remarks: T. C. æt. 52, a tinworker, was admitted into University College Hospital in the month of November 1838, on account of extravasation of urine into the scrotum. This man states, that three days since he perceived the right side of the scrotum to swell suddenly while endeavouring to pass his water; to effec which he is obliged to strain considerably, as he has long been the subject of an old inveterate stricture. The part was very red and painful. The next day he was visited by the surgeon of his parish, who said that the swelling of the scrotum was an inflamed testicle, depending upon irritation about the neck of the bladder, for which he prescribed him to take small doses of blue pill and opium at night. As matters, however, got worse, he was brought to the hospital late in the evening of the fourth day. On admission, the right side of the scrotum was tense, shining, and of a dark colour, painful, and crepitating when handled, with evident fluctuation. The house surgeon immediately laid the swelling freely open by an extensive incision, and gave exit to a large quantity of thin, fetid, dirty-coloured pus, mixed with urine. No. 4 catheter was introduced into the bladder with considerable difficulty, and retained there for two days; when it was withdrawn, and changed for No. 7, which, as it passed easily, was not kept in as before.

This man had laboured under stricture of the urethra for the last fifteen years, during which period he has twice suffered from effusion of urine into the scrotum and perinæum; the first time was about six years ago, and the

The treatment which is proper to be pursued in these cases consists chiefly in making free incisions through the integuments and fasciæ which confine the effused fluid; taking care afterwards that too much blood is not lost from any of the vessels that may chance to be divided. If the bladder should be distended, a catheter ought to be introduced, but this is not necessary when the urine flows freely through the wound, until the reparative process is commenced.

Hæmatocele.—Two varieties of this affection are usually recognised in the schools; in one of which the blood, that is effused, escapes into the loose cellular tissue of the scrotum, giving rise to a general and diffused swelling of the part, accompanied by an evident ecchymosis; whilst in the other, —which is the only form of the disease recognised by some surgeons,—the blood is collected in one mass within the cavity of the tunica vaginalis of the testicle.

The treatment of the first case does not differ in any essential respect from that which is adopted in ecchymoses of other parts of the body, for it usually disappears by degrees when the parts are kept at rest, combined with the use of purgative medicines, and the local application of discutient lotions. If, however, in an aggravated case of this nature inflammation should occur in spite of these means, and be followed by suppuration, then a free incision should be made to permit the easy escape of any matter or sloughs that may be formed.†

The second case, or that in which the blood is contained within the cavity of the tunica vaginalis, is not unfrequently the consequence of hydrocele, upon which it may supervene with-

second about a year after the first. On each occasion the complaint was at first treated as an inflammation of the testicle, by leeches and purgative medicine; and his life only saved by going into the hospital, where he was relieved by free incisions, the cicatrices of which are still to be observed upon the scrotum and perinæum.

On account of the thickened and condensed state of the parts consequent upon the destruction of the tissues of the scrotum at the time of the former attacks, the present effusion was neither so rapid or so extensive as it otherwise would have been; but, as it was, the man was restored to health with great difficulty.

For a strange misapprehension in case of rupture of the urethra, see Surgical Observations, by Sir Charles Bell, Part V. p. 25.

† *Vide* the Surgical Anatomy of the Perinæum, p. 69.

out any very apparent existing cause—perhaps, from the rupture of some of the vessels of the tunica vaginalis, which, becoming varicose, burst and pour their contents into the sac. It is, also, frequently produced by wounding one of the vessels of the scrotum or testicle with the point of the lancet or trocar used in tapping a hydrocele; or it may follow a blow upon the scrotum, especially when it is distended by a collection of water in the tunica vaginalis. In this way hydrocele is frequently complicated with hæmatocele; a combination of the two diseases that may render it necessary to lay open freely the tunica vaginalis by incision for its cure.

It is sometimes exceedingly difficult to determine with correctness the nature of the swelling of a hæmatocele, and to distinguish it from disease of the testicle itself; for the tumour in either case possesses the same figure, opacity, and weight; but it would be right, in all cases, where any doubt exists upon this point, to make an opening into the tunica vaginalis before proceeding to perform the operation of castration.

Hæmatocele, depending upon extravasation of blood into the tunica vaginalis, rarely admits of being cured by any milder means than a free incision into the part, by which the coagulated blood may be removed; after which the wound heals by the second intention.

Scrofulous fungus of the testicle.—A peculiar granular protrusion frequently takes place after the bursting of a scrofulous abscess of the testicle, and has often been mistaken for a malignant disease of the gland, requiring its extirpation; but the nature of the affection is quite simple, and is dependent upon much the same causes as a hernia cerebri, which it resembles in the disposition to form an exuberant growth; — the resistance afforded by the containing membranes of the organ affected being impaired at one point by a wound or ulceration.

The fungus may be removed by the application of strong caustics; but the readiest method of curing it consists in slicing it off upon a level with the opening in the tunica albuginea, and then bringing the edges of the wound together by a slip of adhesive plaister, or, if the condition of the integument admit of it, by a few sutures.

No doubt, some cases do now and then occur where the swelling is so large, and the testis so completely involved in it, that it would prove the best practice to remove both.†

† This disease is very accurately and beautifully represented in Plate I. figs. 2 and 3, and Plate II. fig. 1, of Sir Astley Cooper's work on the Anatomy and Diseases of the Testicle, Part II.

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ADVERTISEMENT.

The following pages, written at the request of the Publishers, are intended as a Commentary on the plates illustrative of the Surgical Anatomy of the Head and Neck, and Upper Limb, already published.

The necessarily restricted limits to which the writer was confined, have obliged him to omit much that he would otherwise have mentioned, and to treat concisely and briefly, that which is included; it is hoped, however, that he has in some measure, succeeded in carrying out the object with which the work was originally designed, viz., to facilitate the student in his dissection of some of the more important regions of the body, and, at the same time, to lead him to connect the knowledge thus obtained, with the study of the diseases occurring within their limits, and the surgical operations which may be required for their relief.

With the exception of Plate IV., which is copied from Arnold's "Treatise on the Nerves of the Head," the following engravings have been executed from original drawings made from Mr. Morton's dissections of the parts represented.

WILLIAM CADGE.

University College,
October 15, 1850.

THE SURGICAL ANATOMY

OF THE

HEAD AND NECK.

To commence the dissection of the right side of the neck, place a block beneath the shoulders, and rotate the head forcibly to the opposite side; carry an incision from the chin to the sternum, continue it along the clavicle to the acromion, and make another above, along the base of the lower jaw to the mastoid process. In raising the flap thus marked out, use the knife in a direction downwards and outwards, and expose fully the *platysma myoides*, a muscular lamina which varies in strength and thickness in different subjects; its direction is upwards and inwards, from the region of the deltoid and pectoral muscles to the side of the jaw and face; it lies upon the sterno-mastoid muscle and jugular vein, and covers in the whole side of the neck, crossing with the opposite one below the chin. In venesection of the jugular vein, the wound should be made upwards and outwards, across, and not between, the fibres of the muscle, and thus patency of the opening will be insured.

By removing the platysma, the *cervical fascia* will be brought into view, and deserves, from its surgical importance, a careful examination; it is thin, but resistant, forms a continuous covering for the neck, and from its deep surface processes are sent inwards to form sheaths for vessels, and investments for muscles; above, it is connected to the zygoma, covers in the parotid gland where it is very thick, and is joined to the cartilage of the external meatus, and also to the angle of the jaw. When suppuration occurs in this situation the thickness of the fascia retards pointing, and the matter may either descend in the sheath

of the sterno-mastoid, or make its way into the external meatus of the ear, through the fissures of the cartilages. Tracing the fascia downwards from the ramus of the jaw, it covers the anterior triangle, is fixed to the os hyoides and thyroid cartilage, forms a strong covering in front of the trachea, and is attached to the top of the sternum; at the edge of the sterno-mastoid, it divides into two layers to encase the muscle, reunites at the posterior border, passes across the posterior triangle, and divides again at the free border of the trapezius to be attached to the spinous processes of the vertebræ; it is likewise firmly fixed to the clavicle below, but at this part there is a deeper process which passes round and binds down the mid-tendon of the omo-hyoid, and descends behind the clavicle upon the subclavian artery and brachial nerves, to join the costo-coracoid membrane. Fluid effused, or tumours developed beneath this layer may not only form a swelling in the hollow of the neck, but also follow the course of the vessels and nerves into the axilla. In that kind of encysted tumour, sometimes described as hydrocele of the neck, I have more than once known the surgeon, after carefully dissecting out the cervical part of the tumour, obliged to cut off the cyst on a level with the clavicle, and the finger would pass nearly to its full length behind this bone towards the axilla. Indeed, from the important connexion and uncertain extent of these tumours, the surgeon now seldom has recourse to the knife for their cure; the seton; or drawing out and cutting off as much as possible of the serous bag, through an incision, and leaving the rest to suppurate, are far less dangerous and equally efficient modes of treatment.

The fascia may now be removed from the sterno-mastoid muscle and posterior triangle of the neck, care being taken to preserve descending branches of the nerves from the cervical plexus. The *external jugular vein* (Pl. I., fig. 3) commences in the substance of the parotid by the union of the superficial temporal, and internal maxillary veins; it descends, lying upon the sterno-mastoid and crossing it obliquely from before backwards, and after piercing the cervical fascia at the lower part of the neck, ends by joining the subclavian vein. In tying the subclavian artery, the jugular vein may cross the inner part of the incision, and impede the deep dissection, and if it cannot be easily held aside, it should be cut through and tied.

The *posterior triangle* of the neck is formed, its base by the clavicle, and its two sides by the sterno-mastoid and trapezius muscles; it is subdivided by the posterior belly of the omo-hyoid into two lesser triangles, the lower one being the smaller and deeper of the two, and contains the subclavian artery and brachial plexus of nerves.

The nerves of the triangle are, 1, *superficial branches of the cervical plexus*, which, after escaping from beneath the sterno-mastoid muscle about the middle of the neck, divide into ascending, descending, and tranverse branches; the ascending are two—auricularis magnus (Pl. IV, fig. 28), which passes up to the parotid gland and lobe of the ear; and occipitalis minor (Pl. IV., fig. 30), which is distributed to the integument between the ear and occiput; the descending are large branches which lie at first beneath the cervical fascia (Pl. I., fig. 12, 13, 14), and pass over the clavicle to the integument of the pectoral and deltoid regions: the transverse branch is named superficial cervical; it winds round the sterno-mastoid muscle, and is distributed to the platysma and skin, covering the anterior triangle.

2. The *spinal-accessory nerve* leaves the sterno-mastoid muscle, which it supplies, crosses the posterior triangle, and enters the under surface of the trapezius (Pl. I., fig. 15).

3. *The large trunks of the brachial plexus* are deeply placed; they emerge from between the scaleni muscles, pass downwards behind the clavicle, and are close to the outside of the subclavian artery.

Beneath the posterior border of the sterno-mastoid are a great number of lymphatic glands embedded in cellulo-adipose tissue; if these are cleared away, we arrive at the anterior scalenus muscle, descending parallel to, but beneath the sterno-mastoid, to the first rib; it is covered by the phrenic nerve, which crosses it obliquely, and at the lower part of the muscle is close to its anterior edge; it is crossed also by the transverse cervical and supra-scapular arteries and the omo-hyoid muscle.

The *subclavian artery*, for convenience of description, is divided into three parts; the third, which extends from the scalenus anticus to the lower border of the first rib, is now dissected Being comparatively superficial and usually free of branches, this part is most suitable for deligation, and therefore possesses the greatest interest and importance to the surgeon. When the shoulder

is depressed, the artery will be seen to emerge from beneath the scalenus a little above the level of the clavicle. It then arches downwards and outwards to reach the first rib, where it takes the name of axillary. The length of this part of the vessel is little more than an inch ; it is covered by the platysma, deep fascia, and descending clavicular branches of the cervical plexus of nerves. Above, and to the outer side, are the omo-hyoid muscle and large nerves of the brachial plexus ; to the inner side is the pleura ; the subclavian vein is superficial to, but below the artery ; and being behind the clavicle, it is seldom seen either in dissecting or operating.

Ligature of the subclavian may be required on account of secondary hemorrhage, or aneurism of the axillary ; and if the patient be thin, and the anatomy normal, the operation should not be difficult. The skin is drawn down and divided, together with the platysma, upon the clavicle, the centre of the incision being placed over the supposed site of the artery ; if necessary, a second vertical cut may be made along the border of the sterno-mastoid ; the flaps being raised, and the cervical fascia divided, the omo-hyoid will come into view, likewise the scalenus muscle which forms a good guide to the artery. By searching deeply in the angle between this muscle and the clavicle the artery will be felt lying close to the tubercle on the first rib, and the ligature is passed round it from within, to avoid injuring the adjoining vein. But the operation may be difficult for various reasons—thus, the artery may be higher in the neck than I have stated, owing to a high division of the innominate : or, from the presence of a tumour in the axilla, and the consequent elevation of the shoulder, it may be more deeply situated behind the clavicle, and even below the level of that bone ; or the vessel may be placed normally as regards its height, but at a greater depth from the surface than is usual ; and this will be the case when it arises, as it sometimes does, from the left side of the arch of the aorta and crosses to the right between the vertebral column and œsophagus, or when it arises from the back part of the innominate on a deeper plane than the carotid. This was the case in a patient of the late Mr. Liston's, and caused some embarrassment and delay during the operation.

Occasionally, the sterno-mastoid and trapezius muscles have a wider attachment to the clavicle than usual, so as partially or

even completely, to cover in and close the posterior triangle with their fibres. The omo-hyoid, also, not unfrequently arises in part or entirely from the clavicle, in which case it would impede the dissection and require division.

For the most part, the distal third of the subclavian gives no branch, but no arterial variety is more frequent than the origin of a large branch, (usually the posterior scapular division of the transverse cervical) close to the scalenus; if such a branch were present and detected during an operation, the ligature would be placed above it, even though it required a partial division of the scalenus to effect this.

After completing the examination of the posterior triangle, the anterior may be proceeded with, from which the skin and platysma are already raised; the deep cervical fascia has also been partially described; some deep processes of it, at the lower part of the neck, will be mentioned afterwards.

The *anterior triangle* is bounded in front by the middle line between the chin and sternum; behind, by the sterno-mastoid muscle; the base is above, at the body of the lower jaw; and the apex below, at the sterno-clavicular articulation. The space is conveniently subdivided by the digastric muscle into an upper and lower part, the former including the submaxillary and parotid regions, the latter the tracheal and carotid regions.

The *sterno-mastoid muscle* now dissected is attached above to the mastoid portion of the temporal bone, and below by two processes; one rounded and tendinous, to the sternum; the other, broader and more muscular, to the inner end of the clavicle. The extent of the clavicular attachment varies greatly; usually it is about one inch and a quarter broad, but not unfrequently it is two or three inches; in the latter case, it would cover the third part of the subclavian artery, and require to be divided in an operation. The muscle is covered by the platysma myoides, superficial fascia, external jugular vein, and branches of the cervical plexus of nerves; beneath it are the carotid artery and internal jugular vein, and the omo-hyoid and scalenus anticus muscles; the spinal accessory nerve passes through it on its way to the trapezius and supplies it with branches. Above, it rests on the posterior belly of the digastric muscle, and is in relation with the parotid gland.

Contraction of one sterno-mastoid muscle is sometimes chiefly

instrumental in causing wry-neck, and its division is necessary for the cure of the disease; the point usually chosen for section is close to the sterno-clavicular attachment; beneath this point is the junction of the subclavian and internal jugular veins, separated from the muscle only by some cellular tissue. Section may be made either from within or without; perhaps the safest plan is to run the knife between the skin and muscle, then putting the latter on the stretch, press the edge of the knife against it, and thus none but the tense and resisting muscle will be cut, and the veins not endangered.

Beneath the muscle is a chain of lymphatic glands, which receive the absorbents of the head and neck, and upper part of the chest; these glands are subject to chronic and simultaneous enlargement, and if, as is common, both sides are affected, the circumference of the neck will be increased to an enormous extent: the sterno-mastoid muscles pass over and constrict the mass so much as to cause, by pressure on the windpipe and œsophagus, serious impediment to respiration and deglutition. A case of this kind has lately come under my notice, in which the whole neck was immensely enlarged, the return of blood from the head was impeded, causing drowsiness and stupor, the trachea and recurrent nerve so implicated as to reduce the voice to a whisper, and lead to frequent severe attacks of laryngismus stridulus.

The *anterior jugular vein* varies greatly as to size and position —usually it commences below the jaw, runs down the front of the neck, and near the sternum dips beneath the sterno-mastoid, and joins either the internal jugular or subclavian vein; not unfrequently, it passes over the muscle and joins the external jugular; the anterior jugular may traverse the incision made for ligature of the common carotid artery, and if not easily held aside, must be divided.

The sterno-mastoid should now be cut from its origin and turned aside, and the great vessels and nerves at the root of the neck, cleared of fascia and cellular tissue; when this is done the muscle can be replaced so as not to destroy the relative anatomy of the parts. The *omo-hyoid* and *sterno-thyroid* and *hyoid muscles* are first exposed; the former arises from the superior border of the scapula, and is inserted into the body of the os hyoides near the middle line; between these points it

forms an arch across the neck, with its convexity downwards. It is divided by a central tendon into two parts; the posterior has already been observed; the anterior belly crosses the common carotid artery obliquely, and therefore covers it for some extent.

Their names sufficiently express the origin and insertion of the sterno-hyoid and thyroid muscles, the former is longer, narrower, and superficial to the latter; they cover the thyroid body and trachea; one border is close to the mesial line of the neck, separated, however, from the muscles of the opposite side by an interval, which increases as we descend, and into which the knife enters in tracheotomy. The outer border of the sterno-thyroid overlays (on the right side) the innominate, subclavian, and lower part of the carotid arteries. If these three muscles be divided about their middle, and reflected downwards, the deep layer of cervical fascia before mentioned will appear; it is thin, but very strong. Above, it divides at the thyroid body and incases it; internally, it passes across the trachea and is continuous with a similar sheet from the opposite side; externally, it covers the carotid and subclavian arteries, forming their sheaths, and it is continuous with that process of fascia which covers the scalenus anticus, and surrounds the omo-hyoid; below, it is usually described as following the great vessels down to the aorta, and ending in the fibrous layer of the pericardium, and it is sometimes said to form this membrane. From careful and oft-repeated dissections, I am convinced that this fascia does not reach to the pericardium; on the contrary, I have always found it firmly attached to the inner surface of the sternum and clavicle close to the sterno-hyoid and thyroid muscles. This firm fascia forms the chief barrier between the superficial parts of the neck, and thorax; it is necessarily cut through in operations on either of the three great vessels at the root of the neck, and if inflammation should be excited by the ligature, the whole cellular tissue of the mediastinum will partake in its effects. This actually happened in a patient whose innominate artery was tied by the late Mr. Liston. If, however, the fascia followed the large vessels, and ended in the pericardium, these effects would scarcely have followed; the inflammation would probably have been confined to the neighbourhood of the vessels and the tissue of the mediastinum would have escaped.

The *innominate artery*, the first branch of the aorta, usually about an inch and a half in length, extends from the aortic arch to the right sterno-clavicular articulation, opposite which it divides into subclavian and carotid; in its course it is at first in front of the trachea, but leaves it as it ascends,—in more than one body I have noticed it so much in front of the trachea, that a needle passed vertically upon the spine, on a level with the top of the sternum, would have punctured the vessel; externally it is covered by the pleura, and is in relation with the innominate vein and par vagum—it is covered by the sterno-thyroid and hyoid muscles, and is crossed in the thorax by the left brachio-cephalic vein; occasionally the artery is increased in length, and bifurcates higher in the neck than is usual; more rarely it is shortened, or it may be entirely absent;* commonly it gives no branches, but a thyroid or thymic branch not unfrequently arises from it, and sometimes the left carotid. The uniformly fatal results of ligature of the innominate artery, together with the expressed determination of those who have had most experience, not to have recourse to it again, have contributed almost to exclude it from the category of surgical operations; it has hitherto been performed on account of aneurism of the third part of the subclavian, or of the lower part of the carotid. With regard to the latter case it is probable, that in the present state of surgery its cure would be attempted by applying a ligature on the distal side of the tumour. Notwithstanding the ill repute of the operation of ligature of the innominate, a careful examination of the cases in which it has been performed will prove, I think, that recovery is not altogether hopeless—in some of them a firm clot was found filling the innominate itself, and the hemorrhage which caused death came from the distal side of the ligature; in others a sufficient barrier was found in this situation, but hemorrhage occurred from the unclosed innominate, while in others death occurred from some fortuitous circumstances, such as inflammation within the chest, constitutional irritation, &c. What is possible may yet happen; and though some untoward accident has hitherto always occurred to prevent recovery, still the total number of cases on record is so small, and the patient has so nearly recovered in one or two instances, that until some better plan can

* See Quain's Anatomy, fifth edition, p. 465.

be devised for treating subclavian aneurism, a conscientious surgeon will still be justified, in certain cases, in having recourse to ligature of the innominate. To accomplish this object two incisions are necessary; one of two to three inches in length, from the centre of the top of the sternum upwards, along the tracheal edge of the sterno-mastoid, the other from the same point to the same extent along the clavicle; the sternal origin of the sterno-mastoid is to be cut through, the sterno-thyroid muscle held aside, and after dividing the deep fascia, the artery will be discovered at the point of its division; the anterior jugular and some veins from the thyroid body are likely to be troublesome, and must be successively divided and tied; the par vagum must also be carefully avoided, as it crosses over the root of the subclavian artery.

A few years ago Mr. Quain proposed to secure the two trunks of the subclavian and carotid, close to their origin, in lieu of the innominate, thereby affording a better prospect of the formation of an efficient clot; this was tried in one case, but without success: the propinquity of the large branches coming from the subclavian, led to secondary hemorrhage from the distal side of the ligature, and proved fatal.

The *right subclavian artery* commencing, as before mentioned, opposite the sterno-clavicular articulation, arches outwards to be placed behind the anterior scalenus muscle; this, the first third, is not more than an inch in length, and has complicated and important relations; it is placed behind the sterno-thyroid and mastoid muscles, and rests upon the longus colli; it is crossed by the par vagum, which gives back its recurrent branch round the artery, the internal jugular vein passes over it; the sympathetic nerve sends branches both before and behind it, and the pleura and subclavian vein are in relation with it below.

The *left subclavian* differs from the right, in that it arises from the aorta, and ascends behind the left lung and pleura to its usual position between the scaleni. The internal jugular vein joins with the subclavian in front of the artery, and the thoracic duct, after ascending between it and the œsophagus, turns outwards to join the angle of the two veins. The vagus nerve lies parallel to, and rather in front of, the artery: its depth from the surface is greater than the corresponding part of the right subclavian.

The branches from this part of the artery are three:—The vertebral, internal mammary, and thyroid axis. 1. The vertebral arises from the upper part of the artery, ascends for a short distance, lying deeply behind the internal jugular vein, enters the foramen in the transverse process of the sixth, occasionally of the fifth or fourth cervical vertebra; and, after reaching the skull, through the foramen magnum, ends by joining with the artery of the opposite side to form the basilar. 2. The internal mammary arises from the lower part of the subclavian, and enters the chest behind the clavicle and first rib; and after descending close behind the costal cartilages, divides opposite the sixth into its two terminal branches; in the upper part of its course it crosses behind the subclavian vein, and is itself crossed by the phrenic nerve—it is in close contact with the pleura. 3. The thyroid axis, a short thick trunk, leaves the fore part of the artery, close to the tracheal edge of the anterior scalenus, and almost immediately divides into its three branches, viz., inferior thyroid, supra-scapular, and transverse cervical.

The inferior thyroid ascends for about an inch, curves downwards behind the sheath of the carotid artery, and again ascends to enter the lower angle of the thyroid body; at its first curve it gives off the small ascending cervical. The transverse cervical crosses outwards in front of the anterior scalenus, traverses the posterior triangle, and divides beneath the trapezius into the posterior scapular and superficial cervical. This artery is often smaller than it should be, in consequence of the posterior scapular branch arising separately from the third part of the subclavian. The supra-scapular descends in front of the scalenus to the clavicle, close behind which it runs outwards to reach the upper border of the scapula, where it divides into its terminal branches.

The *second part of the subclavian artery* is interposed between the anterior and posterior scaleni; it has been observed to pass through the fibres of the anterior scalenus, or to be entirely in front of the muscle; usually, however, the scalenus separates it from the subclavian vein and phrenic nerve; the pleura is in contact with it below. One branch only arises from this part of the artery—the common trunk of the superior intercostal and deep cervical,—it leaves the back part of the

vessel, and after passing deeply downwards to the neck of the first rib, divides into its two branches. The subclavian may be ligatured as it lies behind the anterior scalenus, in cases where the shoulder is so much raised by the presence of a large aneurism in the axilla, as to make the artery almost inaccessible beyond the muscle; or when disease of the coats of the vessel is present. Bearing in mind that the phrenic nerve at the lower part of the neck is close to the anterior margin of the scalenus, the muscle may be carefully cut through to the requisite extent, and the artery exposed.

The divided parts may now be replaced in order to study the relative anatomy of the common carotid artery; or the dissector may turn to the opposite and untouched side of the neck, and repeat the dissection as far as necessary.

The *right common carotid artery* (Plate II., fig. 1), extends from the sterno-clavicular articulation to a level with the top of the thyroid cartilage, where it divides into internal and external. It has been said to divide somewhat lower in women than in men; but repeated examinations have proved to me that this is not a correct observation; its position is indicated externally by a line drawn from a point midway between the mastoid process and angle of the jaw, and the sterno-clavicular articulation. With regard to the surface, the artery is much more deeply seated below than above; but with reference to the middle line of the neck, it is more remote from it above than near its commencement, owing chiefly to the inclination forwards of the larynx. This distance from the front of the neck, together with the resistance interposed by the box of the larynx, usually saves the artery from being wounded by the suicide. The upper half of the artery is comparatively superficial, being covered only by the skin, platysma myoides, and cervical fascia; the lower half, in addition to those parts, is covered by the sternal origin of the sterno-mastoid, sterno-thyroid and omo-hyoid muscles. The descendens noni nerve (Plate II., fig. 20) lies upon, sometimes within, the carotid sheath, and the small branch, or branches, from the cervical plexus which join it, wind round the outer border of the artery. The other nerves in relation with it, are the par vagum and the sympathetic; the former is enclosed in the sheath of the vessels, lies on the outside and behind the artery, between it and the vein; at the lower part of the neck

it comes forwards to cross over the origin of the subclavian, and is nearly on the same plane as the carotid; its recurrent branch ascends behind the sheath to the larynx; the sympathetic nerve is behind the carotid in its whole course; the internal jugular vein (Plate II., fig. 11) lies to its outer side, in close contact with it above, but separated by a slight interval below; the superior thyroid vein crosses the upper part of the artery, and the anterior jugular, when present, passes over its lower end to reach the subclavian or internal jugular. When the external jugular vein is absent, as in the body from which Plate II. was taken, the conjoined temporal and internal maxillary veins emerge from the parotid gland, and, after receiving the facial, form a large trunk (fig. 12), which crosses over the bifurcation of the carotid, and ends in the internal jugular; the artery rests upon the longus colli muscle and, through it, upon the root of the transverse processes of the cervical vertebræ, against which the vessel may be compressed. To its inner side are the œsophagus, trachea, and thyroid body; the latter frequently overlaps it.

The *left common carotid* differs from the right, since it arises from the top of the aortic arch, behind the sternum, and in front of the trachea; from this point it ascends outwards to the sterno-clavicular articulation; the thoracic duct is situated at first behind, and afterwards, when it makes its curve, outside the vessel; it is crossed in the thorax by the left innominate vein. In the neck there are slight differences between the two sides; the sheath is always extremely thin and indistinct, sometimes absent, on the left side; the left jugular vein is much more in front of the artery than the right, and may prove very embarrassing during an operation.

The peculiarities of the carotid relate chiefly to its point of origin and division; the right carotid may arise from the aorta, or the innominate may be of greater or less length than usual—more frequently the former; the left carotid occasionally arises from the innominate instead of the aorta, and very rarely are there two innominate arteries.*

The bifurcation of the artery may be higher or lower than usual, more frequently the former; or, there may be no division at all, the internal carotid being absent; and it has happened

* *Vide* Quain's Anatomy, fifth edition, p. 470.

for the common carotid to be entirely absent, the internal and external carotid arising separately from the aorta.

Its length, freedom from branches, and comparatively superficial position combine to render ligature of the common carotid one of the most successful of the great operations of surgery; it may be required on account of aneurism, true or false, secondary hemorrhage arising from wounds high in the neck or from the tonsil, vascular tumours of the orbit, or aneurismal dilatations of the temporal or occipital arteries. The point most accessible and suitable for deligation, is opposite the cricoid cartilage, above the omo-hyoid; but in aneurism which commonly engages the bifurcation of the artery, the ligature will, probably, be required to be placed lower, where the vessel is covered by muscles, and is more remote from the surface; the patient is placed nearly recumbent, with the chin raised from the sternum and turned to the opposite side; the sterno-mastoid muscle, one of the guides to the artery, is both seen and felt, and an incision about three inches long is made along its tracheal border, through the skin and platysma, the deep cervical fascia is exposed, and perhaps the anterior jugular vein, which must be held aside, or divided, and tied if necessary; the fascia is next carefully cut through, and the sterno-mastoid pulled outwards, the position of the head being slightly altered to allow of this; the sheath of the vessels covered by the descendens noni, and crossed by the omo-hyoid, should now appear; carefully avoiding the nerve, the sheath is to be opened well to the inside, and after separating the artery to the requisite extent, the needle is passed from the outside, so as to be sure of excluding and leaving uninjured the par vagum and jugular vein. If from the presence of an aneurismal tumour it is necessary to secure the artery below the omo-hyoid, the external incision must be made nearer the sternum, the sterno-mastoid will require to be pulled more outwards, or, perhaps, partially cut across; the sterno-thyroid and hyoid are displaced towards the trachea, and the sheath having been opened, the ligature is applied as before. On the left side, where the jugular vein is more in front, considerable embarrassment may ensue from its overlapping the artery;*

* Dr. Hargrave has practised a different method of tying the carotid, which he thinks may be adopted with advantage in persons with short necks, and in children. The occasion of the operation was on account of hemor-

pressure in the upper angle of the wound may prevent its distension and allow it to be held aside.

Behind the carotid artery and on each side of the œsophagus, are a number of lymphatic glands which receive the absorbents from the gullet, pharynx, fauces, &c.; these glands, when they enlarge and suppurate, give rise to very perplexing symptoms; by pressure on the recurrent nerve they produce partial loss of voice and hoarseness, and dysphagia is a common and distressing symptom. A case came under my observation a few years ago in which there was difficulty of swallowing, hoarseness, and noisy respiration; no swelling in the pharynx or neck could be detected; such symptoms frequently characterise thoracic aneurism, but I could find no other signs of such a lesion; in a few days the patient was almost suffocated by the bursting of a large abscess into the trachea; he regained the power of swallowing, but the profuse discharge and low bronchitis which ensued, proved fatal.

The *thyroid body* rests upon the cricoid cartilage and trachea, and consists of two lobes, connected by a transverse slip or isthmus; each lobe is from two to three inches long, irregularly oval in shape, and closely applied to the side of the cricoid cartilage and four or five upper rings of the trachea; the isthmus is about half an inch deep, and crosses the trachæa a few lines below the cricoid cartilage; the body is enclosed in a capsule, is covered in by the sterno-thyroid and hyoid muscles, and is in close contact with the sheath of the carotid artery. It receives blood from four large arteries, two superior thyroid, which, coming from the external carotid, enter the upper angle of each lobe, and two inferior, from the subclavian, which pass behind the common carotid and enter the lower angle of each lobe; the blood is returned by three veins on each side, the two upper join the internal jugular, but the lower descend in close contact with the trachea, forming a plexus in front of it, and join either the innominate or subclavian veins.

The thyroid body is subject to a variety of diseases, generally

rhage from the tonsil. He made a transverse incision two fingers breadth above the clavicle, then divided the sterno-mastoid muscle entirely, opened the sheath, and passed the needle as usual. Secondary hemorrhage took place; it was arrested by pressure and the use of matico leaves, and the patient recovered.—*Vide* Dublin Quarterly Journal, No. XV., p. 95.

chronic, but sometimes acute. A year or two ago, a case occurred in University College Hospital of sudden enlargement of this gland; all remedies failed to arrest its progress: the sterno-mastoid, hyoid, and thyroid muscles were stretched tightly over it; great impediment to respiration ensued, and death by apnœa followed. The thyroid body was found enormously distended with venous blood, loosely coagulated, amongst which there were many cretaceous masses. The chronic affections are most frequently of the nature of serous cysts, generally single, and affecting the whole gland, sometimes multilocular, and confined to one lobe or the isthmus, or the tumour may be sarcomatous and solid; chronic abscess of the thyroid gland is not uncommon. I have lately seen one filling up the whole front of the neck, and falling over the sternum; a free opening was made in the centre of the swelling at its lower part, and the pus allowed to drain away, the cyst of the abscess contracted gradually, and the quantity of matter diminished, the opening was kept patent by the repeated application of potassa fusa, and when I last saw the patient (a healthy farmer), the tumour was no larger than an orange. Mr. A. Burns mentions a similar case in which the abscess, after attaining a great size, burst, and a perfect cure resulted.*

Enlargement of one lobe of the thyroid body may simulate very closely carotid aneurism; the tumour overlays the vessel and in part surrounds it, and the communicated pulsation is very decided and general over the whole swelling; the diagnosis will depend on the history of the case, the thyroid tumour being usually of slow growth, and without pain; moreover, during the act of deglutition, the tumour will follow the movements of the larynx, whereas an aneurism would remain stationary. Nevertheless, with these apparently safe guides, it is not always easy to distinguish between them. During the time I acted as house-surgeon to University College Hospital, two cases of enlargement of one lobe of the thyroid body were sent up from the country, to have the artery tied, under the belief that the patients were labouring under carotid aneurism.

The attempts to remove the diseased thyroid gland, or one lobe of it, with the knife, have been so uniformly without success, that in the present day I suppose no judicious sur-

* *Vide* Surgical Anatomy of the Head and Neck, p. 215.

geon would undertake such an operation; tumours affecting the isthmus alone, if they resist milder means, and seriously annoy the patient, may be removed by incision and ligature; but even in this operation, which I have seen performed a few times, there has always been profuse hemorrhage at the time, and, in one case, during the sloughing of the tumour also.

In the front of the neck we meet with the following parts in order from above; about two inches below the chin is the body of the os hyoides (Pl. III., fig. D.), which is connected below to the top of the thyroid cartilage by means of the thyro-hyoid membrane; the distance between them is about three quarters of an inch; the membrane is pierced on each side by the superior laryngeal nerve and laryngeal branch of the superior thyroid artery; this is the part most frequently wounded in cases of cut throat, and if the incision be extensive the superior thyroid artery (Pl. III., fig. 5), will be endangered, and the epiglottis may be partially severed from its connexions to the cartilage.

The thyroid cartilage is subcutaneous, and can always be felt; it is more prominent in men than in women; a synovial bursa is interposed between it and the skin, and is not unfrequently the seat of disease, being usually converted into a cyst, which contains and secretes a thick, glairy, transparent or yellowish fluid; these tumours are not very amenable to external remedies, and occasionally they resist the more violent means.* Half an inch below the thyroid cartilage is the narrow, firm rim of the cricoid cartilage, the two are connected in front by the firm crico-thyroid membrane, and on each side by the strong crico-thyroidei laterales muscles; into this space the knife enters in the operation of laryngotomy; after dividing the skin, fat and fascia, the membrane is exposed and opened in the interval

* A boy ten years of age was admitted, November, 1844, into University College Hospital, under Mr. Liston, with a tumour over the thyroid cartilage, about the size of a hen's-egg. All kinds of treatment had been tried: puncture, setons repeatedly, incisions, and caustic; and finally it had been dissected out; but during the operation the contents were evacuated, and therefore the removal of the whole cyst was rendered uncertain. However that might have been, the tumour was re-produced; Mr. Liston dissected it out entire, and the wound healed; but in less than a twelvemonth another bursa had formed and become diseased, so that the patient was as far removed from a cure as ever.

between the sterno-hyoid muscles; the crico-thyroid branch of the superior thyroid artery lies in close contact with the membrane as it crosses to join a similar branch from the opposite side; usually it is small, but sometimes it is absent on one side, and a large compensating branch from the other side traverses the space, and, if divided, might afford a troublesome hemorrhage. A few lines below the cricoid cartilage, and opposite the third and fourth tracheal rings, is the isthmus of the thyroid body. From the lower edge of the isthmus to the top of the sternum, the distance varies between somewhat less than an inch to fully two inches; this is the part of the trachea opened in tracheotomy, and its length and depth should be well studied before proceeding to an operation. In children, and short-necked persons, its depth is considerable, increasing towards the sternum. The parts necessarily divided in tracheotomy, are, first, the skin and superficial fascia, and perhaps a cross branch of vein, which passes between the two anterior jugulars. The strong, deep process of cervical fascia is next arrived at, and must be carefully divided in the mesial line, and the muscles separated. There is still another layer of fascia over the trachea, beneath which is a plexus of veins from the thyroid body — these should be turned aside with the handle of the scalpel, or tied, if the bleeding is serious; the patient is now directed to swallow his saliva, and when the larynx is raised, the knife is entered into the trachea, and a sufficient division of the rings is made upwards. Sometimes the operation may be performed quickly, and without any waiting for the cessation of hemorrhage. I assisted the late Mr. Liston to operate on an elderly gentleman, whose trachæa was very superficial and large; he drew the scalpel downwards for about an inch and a half, and without waiting, turned its edge upwards and dipped it into the trachea, made an opening of the requisite size, and thrust in the tube as the knife was withdrawn, using the latter as a guide; the operation was almost instantaneous: it should not, however, be attempted in this expeditious manner except in cases where there is need for haste, and the trachea is close beneath the skin. It should be borne in mind, in operating upon patients of advanced age, that the rings of the trachea may be so much ossified as to resist all attempts to divide them with a knife. I have had occasion, in one instance, to witness

great embarrassment from this reason, and it was necessary to use a pair of bone-pliers.

We may now conveniently proceed to examine briefly the parotid and submaxillary regions. The skin and fascia already removed to a level with the lower jaw, may be raised from the side of the head and face to the extent figured in Pl. III.; the parts to be sought for and carefully dissected, are the parotid and submaxillary glands, the chief branches of the external carotid artery, the spinal accessory, hypoglossal, gustatory and portio-dura nerves, and the digastric, stylo-hyoid, masseter, and temporal muscles.

The *parotid gland* is seated in the interval between the jaw and mastoid process; above, it reaches nearly to the zygoma; below, it extends as far as a line continued backwards from the base of the jaw, posteriorly, it rests upon the mastoid process, and anteriorly it covers the masseter muscle; the excretory duct leaves this margin, and after crossing the muscle on a level with a line drawn from the meatus auditorius externus to the angle of the mouth, passes between the fibres of the buccinator muscle, and opens within the cheek opposite the second upper molar tooth; a process of the gland (the socia parotidis) accompanies the duct for about half an inch, the transverse facial artery runs parallel to, but above it, and branches of the portio-dura surround it. Remove the gland piecemeal, taking care to avoid the arteries, veins, and nerves which run through it; one deep process reaches towards the base of the skull, fills up the posterior part of the glenoid cavity, and surrounds the styloid process; another reaches beneath the mastoid process and digastric muscle, and it extends also behind the ramus of the jaw; it is separated from the submaxillary gland by the stylo-maxillary ligament. The external carotid artery enters the lower part of the gland, and divides into its two terminal branches the superficial temporal, and internal maxillary arteries, and the external jugular vein commences by the union of the two corresponding veins, and is superficial to the artery in the parotid; the portio-dura nerve divides into branches in its substance, and these emerge from it at all points, to supply the platysma and many of the muscles of the head and face.

The parotid has no distinct, proper capsule, but the cervical fascia over it is much thickened, and a thinner membrane from

the same fascia passes behind it and between its lobes. The parotid and the other salivary glands are liable to inflammation, specific and mercurial; the former, known as the mumps, is attended by general swelling, slight pain, no increase of secretion, seldom proceeding to suppuration, sometimes quickly disappearing, and affecting the testicle or mamma; contagious and not recurrent; the latter attended by profuse salivation, and affecting the lining membrane of the ducts more than the parenchyma. Tumours affecting the parotid are, fortunately, rare; for extirpation with the knife would be wholly impracticable, by reason of the important parts contained in its substance.

Tumours, however, originating in the lymphatic glands, over the parotid, are very common; they are generally of a fibrous character, prone to steady growth, and may reach an enormous size; by pressure they cause atrophy of the parotid, and come to occupy its position, and extend deeply behind the jaw; their removal may be safely undertaken with the knife, assisted sometimes, when the dissection has proceeded deeply into the neck, by ligature. The lymphatics from the eyelids and temporal region, pass through a gland which is always to be found a little in front of the ear, and those from the back of the head through one or two small glands, situated upon the mastoid process: all these are prone to be the seat of chronic enlargement and tumours which may require ablation. It should be remembered in removing them from the front, or below the ear, that branches of the portio-dura are likely to be divided and so cause paralysis of those parts which are supplied by such nerves, and if possible, the external incisions should be made parallel with the nerves, rather than with reference to the direction of the subjacent muscular fibres. That a divided nerve may regain its function, is undoubtedly possible; but that this is the common, or even a frequent result, is very questionable. Sometimes paralysis does not occur at the time of operation, showing that the nerve is uninjured, but supervenes during the healing of the wound, probably from implication of nerves in the necessarily inflamed and swollen part; in these cases, after cicatrization and the absorption of needless deposit, the functions of the nerves will return, and the paralysis slowly disappear.

The *submaxillary gland* is placed beneath the horizontal ramus of the jaw; it is covered by the platysma myoides, and

deep cervical fascia which surrounds it with a kind of sheath; it rests chiefly upon the mylo-hyoid muscle; but a deep process projects beneath it, from which the Whartonian duct escapes to reach the mucous-membrane of the mouth beneath the tongue, where it opens on a transverse fold of membrane: the gland is bounded below by the digastric muscle, and the facial artery passes over it, or through it, to reach the jaw. Placed over it are several lymphatic glands, which become affected in diseases —particularly those of a malignant character—of the face, lips, jaws, or tongue; they are frequently the seat of chronic strumous inflammation, and are sometimes mistaken for enlargement of the submaxillary gland itself.

The *external carotid artery* (Pl. III., fig. 4) extends from the bifurcation of the common carotid, opposite the top of the thyroid cartilage to a little below the condyle of the lower jaw, where it divides into the temporal and internal maxillary arteries; superficial in its lower half, it becomes deeply placed as it ascends. Near its origin it is covered by the integument, platysma-myoides, superficial cervical nerve, and perhaps the facial and superior thyroid veins; a little higher in its course it is crossed by the digastric and stylo-hyoid muscles and the hypoglossal nerve, and finally it enters the substance of the parotid gland, where it is covered by the facial nerve and external jugular vein. The internal carotid and internal jugular vein are placed at first behind it, on the same plane, but presently they get beneath the external carotid, and are separated from it by the stylo-glossus and stylo-pharyngeus muscles and glosso-pharyngeal nerve. It were out of place here to give more than an outline of the course, distribution, and surgical relations of the numerous branches of the external carotid—

1. The *superior thyroid* (Pl. III., fig. 5) is the first branch, and is given off from the front of the artery close to its commencement. It inclines forwards and downwards to the thyroid cartilage, passes beneath the sterno-thyroid and hyoid muscles, and ends by ramifying in and upon the thyroid body. This vessel is liable to be wounded by the suicide, and so furious is the hemorrhage, that it has frequently been supposed to arise from a wound of the carotid itself. The artery gives a *laryngeal* branch, which passes through the thyro-hyoid membrane and supplies the larynx, and the *crico-thyroid* before described.

2. The *lingual artery* (Pl. III., fig. 7*) springs from the carotid, between the former and the facial, not unfrequently by a common trunk with the latter. It runs forwards and a little upwards, to be placed close above the os hyoides, passes behind the hyo-glossus muscle, at the anterior margin of which it divides into the ranine and sublingual branches. It is covered by the platysma, fascia and lingual vein. The hypoglossal nerve runs parallel with the artery; at first below it, but at the posterior border of the hyo-glossus it mounts over it and passes on the cutaneous surface of the muscle. The lingual artery is occasionally tied on account of hemorrhage from, or vascular tumours of, the tongue. The point most suitable for deligation is between its origin and the hyo-glossus; the guide to the artery is the great cornu of the os hyoides, close above which it will be found. It is deeply seated, and is crossed by the ninth nerve, and some large veins, which must be carefully separated before the vessel will appear.

3. The *facial artery* (Pl. III., fig. 8) leaves the front of the external carotid a little above the lingual, ascends beneath the digastric and stylo-hyoid muscles, makes a double curve in a groove of the submaxillary gland, and turns over the jaw a little anterior to the insertion of the masseter; in the face, the artery takes a tortuous course to the angle of the mouth, and thence to the inner angle of the eye, where it divides into small branches, which join with the ophthalmic artery. The branches of the facial are numerous; those on the neck are *tonsillitic and inferior palatine*, small and irregular branches which ascend, deeply placed upon the pharynx, to the tonsil and soft-palate; the *submental* runs forwards upon the mylo-hyoid muscle, and ends about the chin in small branches; in the face it gives off the *coronary and labial* to the lips and *lateral nasal* to the side of the nose. The facial vein lies to the outside of the artery in the face, takes a straighter course, and ends by joining either the internal or external jugular.

4. The *occipital artery* (Pl. III., fig. 12) is given off from the back of the carotid, and after ascending, deeply placed, beneath the digastric and sterno-mastoid muscles, it turns horizontally backwards, close to the occiput, between the splenius and complexus muscles: having thus reached the back of the neck, it finally curves upwards, passing through the origin of the tra-

pezius, to end in branches which cover the back of the head, and reach to the vertex, where they anastomose with branches of the temporal artery. Near its origin, it is in relation with the hypoglossal nerve, which hooks round its outer side, to cross the neck; on the skull, its branches are surrounded by those of the great occipital nerve; besides muscular offsets, the only branch of importance from the occipital, is the *princeps cervicis*, which is given off where the artery lies beneath the splenius; it runs down beneath the muscles of the back of the neck, and its terminal branches anastomose with the vertebral and profunda cervicis, and thus a communication is established between the subclavian and external carotid arteries.

5. The *posterior auricular artery* (Pl. III., fig. 14) arises from the carotid above the digastric muscle; it passes through the parotid gland to the mastoid process, on which it ascends to the back of the ear.

6. The *ascending pharyngeal* can be only partially seen in this dissection; it springs from the carotid near its commencement, and ascends, deeply placed behind the internal carotid, to the base of the skull, where it turns downwards and divides into branches, some of which pass over the superior constrictor muscle to reach the soft palate and tonsil; others supply the deep nerves and muscles in front of the spine, while one or two small meningeal branches enter the skull through the foramina at its base and ramify on the dura-mater.

7. The *temporal artery* (Pl. III., fig. 15) appears like the continuation of the carotid; it emerges from the upper part of the parotid gland in which it is at first deeply seated, passes over the zygoma, a few lines in front of the ear, and soon divides into an anterior and posterior branch; the former takes a tortuous course towards the forehead, where it ends in small branches, which anastomose with the ophthalmic artery; the latter arches backwards over the parietal region, and divides into branches which communicate with the posterior aural and occipital arteries. The artery is placed upon the strong temporal fascia and subsequently upon the aponeurosis, which constitutes the tendon of the occipito-frontalis: its chief branch is the *transverse facial*, which leaves the artery while it is embedded in the parotid gland, runs forwards over the masseter, parallel to but a little above Stenson's duct, and on the face it divides into

branches which communicate with the facial artery. The temporal and occipital arteries, both of considerable size, are situated immediately beneath the skin, and it is owing to the abundant vascular supply that sloughing of the scalp so rarely occurs; they are enclosed in a dense resisting cellular tissue, which, in case of wounds, tends to prevent their retraction, and hence hemorrhage is frequently a troublesome symptom: a free communication exists between the vessels on the outside and those on the inside of the skull, and an extensive denudation of the bone from injury is sometimes followed by inflammation and suppuration beneath the dura-mater. Arteriotomy is generally practised upon the anterior branch of the temporal artery; a portion of the vessel is fixed between the thumb and forefinger, and the incision is made obliquely and carried through only half the calibre of the tube: when sufficient blood is withdrawn, the lancet should be used to complete the division, and so to allow of retraction.

8. The *internal maxillary* (Pl. III., fig. 18), one of the terminal branches of the carotid, passes deeply behind the neck of the lower jaw, between it and the internal lateral ligament; it crosses over or under the external pterygoid muscle and enters the spheno-maxillary fossa, where it divides into its terminal branches; the artery is too securely situated to be wounded, except by the surgeon's knife, and by this only when he is removing the lower jaw at its articulation; but even in this operation it will generally escape if the joint be opened from the front and the knife passed down close behind the bone: the branches are exceedingly numerous, and require a careful and complicated dissection to expose them.

The *internal carotid artery* (Pl. III., fig. 3) may be examined in the cervical part of its course; it commences opposite the upper border of the thyroid cartilage and is placed at first on a level with, but to the outer side of, the external carotid; as it ascends it gets beneath the parotid gland; it is crossed by the stylo-hyoid and digastric muscles and the hypoglossal nerve, higher up also by the stylo-glossus and pharyngeus, and glosso-pharyngeal nerve, which separate it from the external carotid; behind it is the spine covered by the rectus anticus, and to its inner side are the pharynx and tonsil; the internal jugular vein is external to it in its whole course, and the vagus and sym-

pathetic nerves are also in close proximity to it. Neither the external nor internal carotid are likely to be made the subject of operation except for wounds, and in such cases the wound itself must influence the surgeon as to his incisions and dissection. An accurate knowledge of the relative anatomy of the neck is indispensable in forming a correct opinion as to which vessel is injured and in the irregular operation which may be requisite for the deligation of such vessel; if in cases of secondary hemorrhage from any of the branches of the external carotid, circumstances render it necessary to forsake the original wound, the proper practice is to place a ligature on the common carotid; this has now been done in a sufficient number of cases with success to warrant its repetition.

It is well to examine the relation of the tonsil to the vessels of the neck, and this may be done by removing the ramus of the jaw, pterygoid muscles and superior constrictor; it is placed between the pillars of the soft palate, having the palato-glossus in front and the palato-pharyngeus behind it; to its outside is the superior constrictor of the pharynx, and still more externally is the internal carotid; looking from the mouth, the artery will be situated behind as well as external to the tonsil; when the parts are in a healthy condition they are at least half an inch apart, but when the gland is enlarged the two are in close contiguity; the tonsil receives blood from two sources, the facial and ascending pharyngeal arteries: they vary in size, and enter the gland on its outside.

THE SURGICAL ANATOMY OF THE AXILLA.

Before proceeding with the surgical dissection of the axillary space, the student should well observe the relative situation of the folds, depressions, and prominences which indicate the position of important subjacent parts; a well marked depression leading from the centre of the clavicle, downwards and outwards, marks the interval between the pectoralis major and deltoid muscles. It contains the cephalic vein, and deeper still the axillary vessels, which are, however, a little nearer the middle line. By pressing the fingers into the axilla the head of the humerus will be felt, rotating with the arm. Along the inner and upper part of the arm, besides the prominence of the biceps, is the smaller elevation due to the coraco-brachialis, to the inner side of which are the axillary vessels and nerves; beneath the fold of the pectoralis major, but close to the chest is the long thoracic artery, and under cover of the fold of the latissimus dorsi is the large subscapular artery.

The subject may be placed, and the integument raised in the manner described in the explanation of Plate V. The fascia which covers in, and forms the base of the axilla, is thick and strong—it reaches between the anterior and posterior folds, and sends a thin process beneath the pectoralis major and latissimus dorsi muscles; externally it is blended with the strong aponeurosis of the arm, and towards the chest it unites with the fascia, covering the serratus magnus and external oblique muscles. The close connection of this fascia to the edge of the pectoralis major, tends to prevent matter formed beneath the muscle from pointing in the axilla; it thickens and forms a partial cyst for tumours developed in the space, whether fatty, fibrous, or aneurismal.

Remove the fascia from the whole space, and dissect out the lymphatic glands, observing at the same time their number, situation, and vascular supply. The cellular tissue of the axilla is loose and abundant; in some subjects, loaded with fat, in

thinner ones the large cells are filled with a thick transparent gelatinous fluid; in all it is favourable to the formation of abscesses; and these, as a general rule, require early incision in order to avoid the formation of sinuses which are prone to occur in all parts abounding in loose cellular tissue, and covered in by a strong investing fascia.

The *lymphatic glands* of the axilla are numerous, and chiefly occupy the lower part or base of the space; they receive the absorbents of the arm, breasts, integuments covering the scapula, and even some from the cavity of the chest.* Not all the absorbents, however, from the mamma pass through the axilla; those from the upper part of the gland and integument covering it, ascend over the pectoralis major, and enter the glands at the lower part of the neck, which are continuous with those of the axilla, beneath the clavicle; they receive their vascular supply from the contiguous branches of the axillary artery.

The axillary glands are very liable to be secondarily affected in diseases implicating any of the parts from which they derive their absorbents, particularly in dissection, or poisoned wounds of the fingers, whitloes, cancer of the breast, &c.; in the latter instance their enlargement, however slight in appearance, generally betokens the unfitness of the case for operation. It is impossible to be certain of removing all those which are diseased; and there is considerable risk of wounding the axillary vein and causing death. Many of the glands are situated in close proximity to the vessels; a few are placed nearer to the thorax, upon the serratus magnus, and it is sometimes possible to ascertain which set are most diseased by raising the arm from the side, and observing if they follow its movement or remain fixed to the walls of the chest.

One or two small lymphatic glands are commonly found on the pectoralis major in women, midway between the breast and arm-pit,

* In a subject, dead of phthisis, dissected at the college last winter, I found in the axilla, a mass of crude tubercular matter affecting chiefly the glands, placed on the serratus magnus; the corresponding part of the lung was firmly connected to the costal parietes and affected in a similar manner; the two masses were connected together through the intercostal spaces. I have little doubt that the disease was originally transmitted by the lymphatics from the cavity of the chest to the axillary glands.

they are subject to a slow strumous enlargement; and, I have reason to believe, have been extirpated under the impression that they were tumours of the breast itself.

The *axilla* is a conical space, the apex being beneath the clavicle, and the base below towards the dissector; it is bounded in front by the two pectoral muscles; behind by the latissimus dorsi, teres major, and subscapularis muscles, internally by the walls of the thorax, covered by the serratus magnus, and externally by the upper part of the humerus, the coraco-brachialis and biceps muscles; by the convergence of the pectoralis major, and latissimus dorsi towards the bicipital groove of the humerus, the space is much narrowed towards its outer boundary: its depth varies with the position of the arm, decreasing as the latter is carried away from the chest.

In the space are contained the axillary vessels and brachial plexus of nerves with their branches, lymphatic glands, and a large quantity of loose cellular tissue; crossing it are the two *intercosto-humeral nerves* (Plate V., fig. 13, 12); they leave the trunks of the second and third intercostal nerves, emerge from between the digitations of the serratus magnus, and reach the inner side of the arm, to the integument of which they are distributed. In the arm-pit they are surrounded with glands, which, when diseased, press first on these nerves and cause the numbness and pain so constantly complained of along the inside of the arm. The *external respiratory*, or the nerve of Bell, arises from the fifth and sixth cervical nerve, descends behind the clavicle to the serratus magnus, upon which it is now seen, and to which it is finally distributed.

The *axillary artery* extends from the first rib to the lower margin of the teres major; it is divided into three parts by the pectoralis minor; the lower third (Pl. V., fig. 1) is now exposed, and will be first described: it is situated close to the outer boundary of the axilla and head of the humerus, somewhat behind the slight muscular prominence of the coraco-brachialis (*f*). It rests upon the subscapularis (*e*), latissimus dorsi (*b*), and teres major (*c*); it is covered for a short distance by the lower margin of the pectoralis major; but in the greater part of its course it is superficial, being covered only by the integuments, adipose tissue, fascia of the axilla, and by the axillary vein. The terminal branches of the bra-

chial plexus are usually disposed in the following manner: to the outer side of the artery, are the external cutaneous and median nerves (fig. 9), the former soon enters the coraco-brachialis and disappears; the latter, as it descends, crosses in front of the vessel, and at the elbow is placed on its inner side—to its thoracic side are the ulnar, internal cutaneous, and nerve of Wrisberg (fig. 10); and behind it, the large musculo-spiral and circumflex. Some of these nerves are in close contact with the artery, and may partially overlap it. The relations of the artery show that its deligation at this part of its course should not be difficult; but it is an operation which can only be required for wounds of itself, or aneurism of the brachial. An incision is made two to three inches in length, behind the coraco-brachialis; and after carefully dividing the fat and fascia, the axillary vein and perhaps the median nerve will appear; the former should be displaced towards the chest, and the latter in the opposite direction, when the artery will be found lying behind the vein. Sometimes there are two arteries instead of one, and the additional branch may be either the radial, ulnar, or interosseous;* most frequently the first: the branches given off from this part of the axillary are, the long thoracic, subscapular, anterior, and posterior circumflex: their course and distribution are sufficiently indicated in the explanation to Plate V.

To complete the dissection of the axillary artery, place the arm nearer to the chest, and remove the skin from the whole of the pectoralis major and part of the deltoid, observing, at the same time, the fibres of the platysma-myoides, which descend over the clavicle, also some descending branches of the cervical plexus of nerves, which supply the integument of the upper part of the chest and shoulder.

The *pectoralis major* arises from the cartilages of all the true ribs, and from the inner half of the clavicle, the fibres converge towards the humerus, and after folding on themselves, are inserted into the outer ridge of the bicipital groove. An interval is observed between the costal and clavicular portions of the muscle, and a still deeper one between the clavicular part and the margin of the deltoid, in which the cephalic vein and coracoid process are seen; the mammary gland occupies the cutane-

* Quain, op. cit. 523.

ous surface, and it should be observed how large is the base of this gland, and how extensive must the dissection be to remove it entire when diseased. The muscle may now be turned down by dividing it near its origin: the large branches of the acromial thoracic artery are observed entering its under surface a short distance from the coracoid process, together with branches of the anterior thoracic nerves. In abscess beneath the pectoral muscle, the matter is a long time making its way to the surface, and if it gravitates towards the axilla, the strong axillary fascia, equally with the muscle, retards pointing. The severe constitutional disturbance which usually attends suppuration in this region, indicates early incision even though a great thickness of soft parts intervene. It should be remembered, however, if the abscess be opened through the pectoralis major, there is some risk of wounding a branch of the acromial thoracic artery; if, on the other hand, the matter be evacuated, by an incision parallel with, and beneath the lower margin of the muscle, the long thoracic branch occupies that position and may be divided; still, these risks are not equal to that of delay, and if an artery spring, the wound must be enlarged and the vessel tied, as I have once had occasion to do.

The *costo-coracoid membrane* is a strong band of fascia, connected above to the clavicle; internally, to the first rib, and externally to the coracoid process; it covers in and protects the subclavius muscle and axillary vessels, descends upon the latter, and is soon lost in the common cellular sheath. A process of fascia from the posterior triangle of the neck passes down behind the clavicle and joins the costo-coracoid membrane beneath the subclavius, and thus encases this muscle. The membrane may now be removed, the subclavius and pectoralis minor muscles, the axillary vessels and brachial nerves cleanly dissected.

The *first part of the axillary artery* extends from the first rib to the upper border of the small pectoral muscle; its direction is outwards as well as downwards; it is deeply placed, and is covered by the integument and platysma, the clavicular portion of the pectoralis major, and the costo-coracoid membrane; it is crossed likewise by the subclavius muscle and the cephalic vein; it rests upon the first intercostal space and the upper part of the serratus magnus; the two large cords of the brachial plexus are

to its outer side, and the axillary vein to its inner side; the artery is rather deeper than either the vein or nerves, and is usually somewhat overlapped by the former. Two branches are given from this part of the artery, the thoracica suprema, an irregular and insignificant branch which ramifies over the two upper intercostal spaces, and the thoracica acromialis, a short thick branch, which leaves the front of the parent trunk close to the pectoralis minor, perforates the costo-coracoid membrane, and soon divides into its terminal branches, many of which enter the pectoral muscles, a few run outwards beneath the clavicle to the acromion, and inosculate with the supra-scapular branch of the subclavian; one large branch descends beneath or in the fibres of the deltoid. Beneath the pectoralis minor the artery is closely surrounded by the brachial plexus which now consists of three cords, and these, as before mentioned, soon divide into their terminal branches.

The axillary artery has been ligatured several times with success, between the subclavius and pectoralis minor, both on account of aneurism of the lower part of the artery, and for secondary hemorrhage; for the last quarter of a century, however, by the common consent of the profession, the operation has been relinquished in favour of the more practicable, successful, and safer one upon the third part of the subclavian; and a late attempt to revive it met with no approval from the surgeons of the present day; nevertheless, there are circumstances in which a judicious surgeon may have recourse to the operation—in cases, for example, of aneurism of the subclavian, outside the scalenus muscle, and close above the clavicle. Ligature of the vessel below the clavicle, on the distal side of the tumour, seems to offer the best chances of success with the smallest risk to life. There are no branches worth mentioning between the tumour and ligature, and if the plan should fail, as a means of cure, there would still remain the option of placing a ligature on the cardiac side of the tumour—on the innominate or first part of the subclavian—or of amputating the arm at the shoulder-joint. The depth of the artery from the surface, and the bleeding from numerous small vessels, necessarily divided, combine to make the operation difficult and tedious. The patient being placed in the recumbent position, an incision of sufficient extent is made, either in the direction of the artery between the

pectoral and deltoid, or nearly parallel with the clavicle, beginning about an inch and a half from its sternal end ; the clavicular portion of the pectoralis major is exposed and cut through to the necessary extent. Much should now be done with the handle of the knife ; the acromial thoracic vessels and the cephalic vein are to be carefully avoided, and held aside if necessary ; the axillary vein and one of the cords of the brachial plexus will now appear, the latter must be displaced outwards, and the former inwards, when the artery will be discovered deeply between the two.

THE SURGICAL ANATOMY OF THE BEND OF THE ELBOW.

Before removing the integuments in front of the elbow-joint, it is well to observe the several eminences and depressions which point out important subjacent structures, and serve to guide us in the diagnosis of injuries; thus in the centre is the prominent tendon of the biceps muscle, marking the centre of the articulating end of the humerus; on either side of the tendon is a depression, one leading upwards to the inner side of the arm contains the brachial artery and median basilic vein; the other, leading to the outer part of the arm, contains the median cephalic vein, and external cutaneous nerve; these two depressions end below in a lesser one which leads down the middle of the forearm, and contains the radial artery and median vein. The bony points to be noticed are the two condyles of the humerus, nearly on a level, the inner being the most prominent; between them on the posterior part of the limb is the large olecranon process, the tip of which reaches slightly above the level of a line drawn from one condyle to the other, when the forearm is extended; close below the outer condyle is felt the rounded head of the radius, rotating with the movements of the hand. A knowledge of the relative position of these points is necessary to lead us to a right appreciation of the nature of the various dislocations and fractures to which the elbow is liable.

The skin, which is here delicate and thin, may be raised by making one incision six or seven inches in length along the axis of the limb near its outer border, and from each extremity of this a transverse cut is to be made, and the flaps thus marked out thrown aside; in the superficial adipose tissue now exposed are contained the superficial veins and cutaneous nerves; the amount of this varies in different subjects, but it should be remembered that it covers the veins, which are always close upon the deep investing fascia, and hence in very fat persons they are at considerable distance from the surface, and to reach them in

venesection requires the lancet to be used cautiously but freely. The superficial veins in front of the elbow are subject to much variety of size and position : the most frequent distribution is as follows—the *median vein*, Pl. VI. fig. *b*, *b* (in the subject from which the drawing was made, there were two), ascending along the middle of the fore-arm, divides opposite the centre of the elbow-joint into three branches—1. The median cephalic (*d* Pl. VI.), which runs upwards and outwards in the external bicipital groove, and joins with the radial vein (*g*). 2. The median basilic (*c*), which passes upwards and inwards in the internal bicipital depression and joins with the anterior and posterior ulnar (*i*, *i*). 3. The perforating or median communicating (*e*) which leaves the back of the vein, pierces the deep fascia, and joins at once with one of the venæ comites of the radial artery.

The *radial vein* ascends along the outer border of the fore-arm, and by its junction with the median cephalic, forms the cephalic vein (*f*) ; usually there are two or three *ulnar veins* which pass up along the inner border of the fore-arm and join at short but irregular distances above the elbow with the median basilic, thus forming the large basilic vein of the arm. Those which join in front of the inner condyle are called anterior (*i*, *i*, *i*), and those behind, posterior ulnar veins (*k*).

In the operation of venesection at the bend of the elbow, that vein is chosen which is most prominent ; it is generally recommended to open the median cephalic, and if it is easily seen through the skin it is undoubtedly right to do so ; but by reason of the greater depth of the outer bicipital depression it is generally not so easily found, nor is it commonly so large as the median basilic : this vein usually crosses the brachial artery obliquely from within outwards, and therefore there will be less risk of touching the artery by opening the vein as high or as low as possible, rather than in the centre, where it lies directly over the artery, and is separated from it merely by the fibrous expansion from the tendon of the biceps.

The *aponeurosis* or deep investing fascia, exposed by clearing away the fat and superficial veins and nerves, is a strong fibrous covering, continuous throughout the limb, but strengthened at the elbow by superadded transverse and oblique fibres, derived from the subjacent muscles, particularly by a strong expansion from the tendon of the biceps, which, passing inwardly between

the brachial artery and median basilic vein, spreads itself out, and is lost upon the flexor muscles of the fore-arm. From its deep surface muscular fibres take origin, and processes are sent which separate layers of muscles and invest and support individual ones ; it is connected to the periosteum of the olecranon and condyles of the humerus, and above them a layer is sent inwards on each side, to be fixed to the rough lines leading to the condyles, the two intermuscular septa, the internal separating the triceps from the brachialis anticus ; the outer, the triceps from the supinator longus and extensor carpi radialis longior. The aponeurosis is perforated at various points with apertures for the transmission of small arterial twigs to the superficial fascia and skin ; and in the centre of the elbow is a larger opening through which passes the perforating or communicating branch of the median vein.

Beneath the aponeurosis, which is now to be entirely removed, is a quantity of cellulo-adipose tissue, filling up the hollow of the elbow, and containing the brachial artery, venæ comites and their branches, also the median and musculo-spiral nerves and their branches ; these are all to be carefully cleaned, together with the muscles arising from the two condyles of the humerus, forming the two fleshy prominences of the fore-arm.

The space now dissected is somewhat triangular in form, and resembles the popliteal space of the lower limb ; the two sides of the triangle are formed by the flexor and extensor muscles, particularly by the pronator radii teres and supinator longus ; the apex being at the point of meeting of these two muscles, the base is formed irregularly by the brachialis anticus and biceps muscles ; in the space or hollow thus marked out are the vessels and nerves before mentioned, it is covered by the superficial fascia, veins, &c., and its floor is formed by the supinator brevis and articulation.

The muscles arising from the inner condyle of the humerus are—pronator radii teres, flexor carpi radialis, palmaris longus, flexor digitorum sublimis, flexor carpi ulnaris ; of these the *pronator teres* only requires to be described in this place ; it arises by two processes, the larger from the inner condyle, in common with the muscles just named, and a smaller tendinous band from the coronoid process of the ulna external to the insertion of the brachialis anticus ; the muscle thus formed crosses the fore-arm

obliquely downwards, and is inserted into the rough surface on the outer border of the radius; the ulnar artery crosses beneath the muscle to reach the inner side of the fore-arm, the small head of origin being interposed between it and the median nerve, the radial artery and nerve cross over it near its insertion, the nerve being most external. In fractures of the radius below its middle, the muscle exerts an evil influence on the upper fragment by pulling it against the ulna and tending to obliterate the interosseous space.

The *supinator longus* arises from the upper part of the external condyloid ridge of the humerus, and from the intermuscular septum, in front of which it lies, and is inserted into the styloid process of the radius; it is superficial in its entire course, and forms the outer boundary of the triangular space in front of the elbow-joint; it covers the musculo-spiral and radial nerves, and slightly overlaps the radial artery; it lies on the extensor carpi radialis, longior and brevior, supinator brevis, and pronator teres.

The *tendon of the biceps* occupies the centre of the space; its course is backwards, and somewhat outwards, to reach the tuberosity of the radius, close behind which it is inserted; between the tendon and the tuberosity a synovial bursa is interposed; its inner margin corresponds to the brachial artery, and gives off the strong tendinous expansion, which separates the artery from the median basilic vein.

The *brachialis anticus* arises from the whole anterior part of the humerus, as high as the deltoid, and is inserted into the ulna, in front of the coronoid process; the muscle is covered by the brachial vessels and median nerve, and it lies upon the articulation, which it protects.

The *brachial artery* in the part of its course now exposed, lies along the inner border of the biceps, upon the brachialis anticus; in this extent it is superficial, being covered only by the skin, superficial fascia, and median basilic vein; as it descends, it dips into the hollow in front of the elbow-joint, and divides opposite the bicipital tuberosity of the radius into radial and ulnar. The median nerve, which crosses the artery in the arm, lies at the elbow on its inner side, diverging as we descend, so that the two are separated by a considerable interval at the point of division of the artery; there are two venæ comites,

between which the artery lies, and which, when filled with injection, or during life, overlap it so much as nearly to hide it from view: the vessels are enclosed in an indistinct cellular sheath.

The brachial artery at the bend of the elbow is almost, but not absolutely, exempt from liability to spontaneous aneurism; and false aneurism, and aneurismal varix from accident in venesection, are far less common than they were formerly; still they occasionally happen, and the accident which leads to them is indicated at the moment by the bright florid colour of the blood, and its violent pulsatory flow. If pressure, firm and energetic enough, be made on the whole limb, and especially at the wounded part, to occlude permanently both arterial and venous canals, no further mischief may follow. If, on the other hand, the pressure be merely sufficient to prevent external hæmorrhage, and allow the integumental wound to heal, varicose aneurism, or aneurismal varix, will surely follow; the former indicated by a pulsating tumour, loud, harsh bruit, and varicose distension of the neighbouring veins; the latter by the absence of distinct tumour, by the greater varicose enlargement and thrilling vibration of the veins, by the loud whizzing murmur at the point of communication, and by the numbness and weakness of the fore-arm and hand. Fortunately, in these cases, the interference of the surgeon by operation is seldom necessary; a well applied elastic bandage is all that is required to palliate the disease, and allow of a moderate use of the limb; occasionally, however, in the case of varicose aneurism, the tumour may increase, and require, if it be soft and recent, incision of the sac, and ligature of the artery, above and below the wound; or if it be of some standing, and partially filled with laminated fibrin, deligation of the brachial in the middle of the arm. The possibility of a high division of the artery should be borne in mind, and perhaps this is the more likely to be the case in varicose aneurism, since the abnormal branch is often subcutaneous at the bend of the elbow, and therefore very liable to be wounded by the lancet.*

* The museum of University College contains a preparation, in which is seen a varicose aneurism, with a high division of the brachial; the radial was wounded, and a ligature appears to have been applied to the wrong vessel in the arm. There is no accurate history of the case.

Suicide is not unfrequently attempted by opening the vessels opposite the elbow-joint; sometimes the veins only are divided, at others, both veins, arteries, and nearly all the soft parts are cut across. When the artery is wounded, it is incumbent in this place, of all others, considering the free inosculations around the elbow, to place a ligature below, as well as above the wound.

The *radial artery* is marked out by a line, drawn from the middle of the elbow to the lower end of the radius: it is superficial in the lower half, but is slightly overlapped above by the supinator longus; it rests upon the supinator brevis, pronator teres, flexor sublimis, and pronator quadratus, two venæ comites surround it; the radial nerve is external to, and some distance from it. The only branch requiring notice is the radial recurrent, which arises close below the bifurcation of the brachial, and curves, first outwards and then upwards, between the brachialis anticus and supinator longus, and joins a little above the elbow with one of the terminal branches of the superior profunda; it supplies the muscles which form the external fleshy prominence of the fore-arm.

To tie the radial in the upper third of its course, make an incision of two to three inches along the depression in the middle of the arm, turn aside the median vein, and external cutaneous nerve, which come first into view, then cautiously divide the deep fascia, and by slightly lifting the edge of the supinator longus, the artery will appear.

The *ulnar artery*, the larger of the two branches of the brachial, is much deeper than the radial, takes a course towards the inner side of the fore-arm, and passes beneath the pronator teres, flexor sublimis, and carpi radialis. The median nerve is at first to its inner side, separated from it by the short head of the pronator teres, but it soon crosses over the artery to get to its outer side. The ulnar nerve comes into relation with it at the middle of the fore-arm, when it is under cover of the flexor carpi ulnaris, and continues down to the wrist along its inner side; two venæ comites accompany the artery. Its branches are—1. recurrent, which passes between the flexor muscles, and ascends behind the inner condyle of the humerus, to join with the terminal branch of the inferior profunda; before getting beneath the muscles, it gives off a small branch (anterior recur-

rent), which ascends in front of the condyle, to join with the anastomotic artery. 2. The interosseous, a short thick branch, nearly equal in size to the ulnar itself, arises about an inch from the brachial division, passes deeply beneath the muscles, to reach the interosseous membrane, where it divides into anterior and posterior interosseous arteries. Deligation of the ulnar towards the upper part of its course requires an incision along the radial border of the flexor carpi ulnaris, which is the guide to the vessel; by carefully separating this muscle from the adjacent ones, the artery will be discovered at a considerable depth from the surface, attended by its two venæ comites. The median nerve takes a course internal to the brachial artery; at first it lies above it, but as it descends, it rests upon the brachialis anticus, near the inner condyle of the humerus; it then dips into the triangular space of the elbow, and passes beneath the superficial layer of muscles. The musculo-spiral nerve is observed on the outer side of the front of the arm, between the brachialis and supinator longus, having this relation it descends in front of the outer condyle, and divides into the posterior interosseous, which passes round the radius in the fibres of the supinator brevis, and the radial which runs down the fore-arm external to the artery of the same name.

The *lymphatics* are divided into a superficial and a deep set; those from the inner fingers accompany the ulnar veins, spread out on the fore-arm, and finally converge to a gland, which is situated close above the inner condyle of the humerus (Pl. VI. fig. 9); this gland is frequently the seat of acute inflammation in poisoned or other wounds of the fingers, and occasionally chronic tubercular inflammation and abscess befal it in persons, particularly children, of strumous habit. The lymphatics from the thumb and adjoining finger, accompany the radial and cephalic veins, and join the glands beneath the clavicle; the deep set attend the arteries, one lying on each side of the vessel: they join the axillary glands.

THE SURGICAL ANATOMY OF THE RADIAL AND ULNAR ARTERIES AT THE WRIST.

The position of the *radial and ulnar arteries in front of the wrist* may always be ascertained in the living body by their pulsation, but the tendons of the flexor carpi radialis and ulnaris are their anatomical guides. These tendons are always to be felt, and are generally indicated by two depressions; one, in which lies the flexor carpi radialis, a little to the outer side of the middle line; the other, formed by the flexor carpi ulnaris, close to the inner border of the fore-arm, leading directly to the pisiform bone, in which the tendon is inserted. The radial artery is placed a little to the outer side of the tendon of the flexor carpi radialis, and the ulnar is found close to the radial border of the flexor carpi ulnaris, between it and one of the tendons of the flexor sublimis digitorum; both vessels are superficial, but the ulnar is less so than the radial, being covered, in addition to the skin and superficial fascia, by a thin aponeurosis, that separates the two layers of muscles of the fore-arm.

The dissection of this region, and the ordinary descriptive anatomy of it, are sufficiently given in the explanation to Plate VIII., to which the student should refer; but there are some surgical diseases and injuries especially prone to occur about the wrist, which deserve mention. Ganglia are proverbially common on the back of the wrist and hand; they are occasionally also met with in front, frequently between the extensor tendons of the thumb and the radius, or beneath the flexor carpi radialis, near the base of the thumb. In this situation they are close to the radial artery, which may be elevated by the tumour, and, by its pulsation, give a doubtful character to the signs. The same treatment is required as for similar tumours in other situations; if they cannot be easily ruptured by pressure, their contents may be evacuated into the neighbouring cellular tissue, by introducing a tenotomy knife through them from a point most remote from the artery.

Not unfrequently effusion takes place in the synovial sheath of the deep flexor tendons as they are about to enter the palm of the hand; an elastic, fluctuating swelling forms in front of the wrist-joint, extending beneath the annular ligament into the palm; the disease is attended with more or less pain and greatly diminished power of the hand; it generally occurs in weak chlorotic young women. It is often impossible to cure this disease in this situation by any of the ordinary methods of treatment: more than a century ago Warner* operated on two cases successfully by dividing the annular ligament and dissecting the cyst away from the tendons; and within these few years Mr. Syme† has proposed and practised with success a modification of Warner's operation, merely dividing the annular ligament, opening the cyst, and promoting suppuration and granulation.

Notwithstanding the frequent deviation of the radial and ulnar arteries from their usual origin and course, they seldom fail to obtain their proper position in front of the wrist. In the hand again their varieties are very numerous, but of no great importance in a surgical point of view; it should, however, be remembered that occasionally a third artery enters the hand beneath the annular ligament and joins the palmar arch: it is usually a branch of the interosseous, near the elbow, and accompanies the median nerve. Occasionally, though rarely, a "vas aberrans" coming from the brachial or axillary artery, descends along the middle of the fore-arm, between the skin and fascia, and finally passes beneath the annular ligament to join the superficial palmar arch. Such varieties as these may interfere with the success of certain modes of treatment of secondary hemorrhage from the palm of the hand; in such cases, well applied pressure or enlarging the wound and searching for the bleeding vessel will generally be sufficient. Sometimes, however, the inflamed state of the hand and the condition of the wound render both these methods inapplicable, and it becomes necessary to arrest the flow of blood into the hand. Some surgeons recommend the radial and ulnar to be tied in front of the wrist; others advise ligature of the brachial in the middle

* Warner's Cases in Surgery, p. 166.

† Syme's Surgery and Pathology, p. 212.

of the arm; either plan will, in nine cases out of ten, succeed, but both have been known to fail. Ligature of the radial and ulnar is open to objections to which the operation on the brachial is not liable. Thus, if there be a large median artery, or a "vas aberrans" passing under the annular ligament and joining the palmar arch, the latter plan is obviously the more likely to succeed.* Again, two wounds in front of the wrist must of necessity add to the inflammation already existing in the neighbourhood; three cases of secondary hemorrhage in which the radial and ulnar were tied in University College Hospital, have been followed by increased swelling of the hand and mortification of the tips of several fingers.

Deligation of the radial at the wrist is easily accomplished: an incision about an inch and a half in length is made over the vessel, the scalpel being used lightly, so as to avoid wounding the artery at the first cut; the superficial fascia is next divided, and the artery is seen lying between its two venæ comites; the wrist is now slightly flexed, so as to allow the vessels to be separated, and a thread is passed under the artery. The same steps are required for the ulnar, but it must be remembered that it is placed somewhat deeper than the radial, and that both the superficial and deep fascia require to be divided.

* A case occurred last winter in University College Hospital, which showed the necessity of studying the varieties to which the arteries of the upper limb are subject—a young man wounded his palmar arch; secondary hemorrhage took place several times; the radial and ulnar were tied, but the bleeding returned; an artery of some size, a "vas aberrans," was discovered beating in the middle of the fore-arm, close under the skin; a ligature was put on the brachial in the middle of the arm with the hope of getting above the origin of the abnormal branch; it continued however to pulsate after the ligature was tightened; the vas aberrans itself was therefore tied at once, close below the elbow, but notwithstanding all these precautions, hemorrhage occurred on the following day as violent as ever; the wound was a second time enlarged, and fortunately the blood burst forth at the time of operation, and the wounded artery was easily tied: the patient recovered rapidly.

ENGRAVINGS

ILLUSTRATING

THE SURGICAL ANATOMY

OF THE

HEAD AND NECK, AXILLA, BEND OF THE ELBOW, AND WRIST,

WITH DESCRIPTIONS.

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THE Publication of the Commentary, which, it was intended, should have accompanied this part of the work, is unavoidably delayed for the present. It is expected, however, to be ready by October 1845.

With the exception of Plate IV., which is copied from Arnold's "Treatise on the Nerves of the Head," the following Engravings have been executed after original Drawings made from Dissections of the parts represented.

UPPER GOWER STREET,
February 1845.

PLATE 1

Wm Fairland lithe

Printed by Fairland

EXPLANATION OF PLATE I.

SURGICAL DISSECTION OF THE POSTERIOR TRIANGLE OF THE NECK.

In making the dissection which is necessary to expose the subclavian tery in the latter part of its course, the skin should be raised with care, in rder that the fibres of the platysma myoides, which cover the interval etween the sterno-mastoid and trapezius muscles, may be preserved. They ursue an oblique course, on the side of the neck, as they ascend from the egion of the mamma to their insertion into the lower part of the face.

Underneath the platysma myoides will be found the external jugular ein and superficial descending branches of the cervical plexus.

The cervical fascia is next to be examined. It extends from the sterno-mastoid to the trapezius, both of which muscles it invests; and, inferiorly, is inserted into the superior border of the clavicle. The external jugular vein, as it descends to join the subclavian vein, pierces the fascia a little above the clavicle.

A quantity of loose cellular tissue which lies under the cervical fascia is to be removed, and the posterior belly of the omo-hyoideus sought for. This muscle is invested by a deep process of the cervical fascia, which binds it down in its place, and also covers the subclavian artery and brachial plexus of nerves.

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a. a. The sterno-mastoid muscle in the middle of the neck. *b.* The tendon of the muscle, which attaches it to the anterior part of the sternum. *c.* The clavicular portion of the muscle.

d. The sterno-hyoid muscle.

e. The inner edge of the trapezius muscle, where its fibres turn forwards to their attachment to the upper edge of acromial third of the clavicle.

f. The upper extremity of the splenius colli muscle.

g. Part of the levator anguli scapulæ muscle.

h. The scalenus posticus muscle.

i. The scalenus anticus muscle, lying deeply underneath the sterno-mastoid muscle. The phrenic nerve (16) runs obliquely across its anterior surface. It is also crossed by the transverse artery (2) and vein (8) of the neck. Lower down the subclavian vein (4) lies on its tendon, by which it is separated from the subclavian artery.

k. The posterior belly of the omo-hyoideus muscle.

l. The pectoralis major muscle, where it is attached to the clavicle.

m. The clavicle.

n. The sternal extremity of the same bone.

ARTERIES.

1. The subclavian artery in the third part of its course, where it rests upon the first rib.

The brachial plexus (17, 17) is situated on its upper and outer aspect, and the subclavian vein (4) lies between it and the clavicle.

2. The transverse artery of the neck. This vessel is a branch of the thyroid axis, and passes over the scalenus anticus muscle (*i*) and phrenic nerve (16) in its course across the lower part of the neck. In many subjects the place of this artery is supplied by a large branch from the third part of the subclavian,—a distribution which might influence the success of an operation in which a ligature had been placed on the latter vessel.

VEINS.

3. The external jugular vein.

4. Part of the subclavian vein, seen obscurely behind the clavicle.

5. 5. The anterior jugular vein, which was very large in the subject from which the drawing was taken.

6. 7. Smaller veins descending from the neighbourhood of the os hyoides to join with the anterior jugular. They were placed between the cervical fascia and the sterno-hyoid muscle.

8. The transverse vein of the neck.

NERVES.

9. The occipitalis minor nerve.

10. The auricularis magnus nerve.

11. The cervicalis superficialis nerve.

12. The descending branches of the cervical plexus.

13. 13. 13. Supra-clavicular branches of the preceding.

14. 14. Supra-acromial branches of the same.

15. The spinal accessory nerve.

16. The phrenic nerve, lying deeply upon the scalenus anticus muscle.

17. 17. 17. Branches of the brachial plexus of nerves; they are situated close to the posterior and upper border of the subclavian artery, in the third part of its course.

18. The cervical fascia and platysma thrown down upon the chest, exposing the clavicular portion of the pectoralis major muscle.

19. The integuments of the lower part of the neck, reflected in a similar manner.

PLATE II.

EXPLANATION OF PLATE II.

ICAL DISSECTION OF THE ANTERIOR TRIANGLE OF THE NECK.

ose the great vessels of the neck, the integuments and platysma with the cervical fascia, must be removed, and the muscles dissected resented in the drawing. The sterno-mastoid muscle should be twards, and the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles he opposite direction, so that the common carotid artery and great vein may be seen in the lower part of the neck.

attachments of the cervical fascia to the mastoid and zygomatic processes f the temporal bone, the base of the lower jaw, and the os hyoides, deserving of particular attention; for, until these have been divided, the es and vessels of the neck are much more closely approximated to each than they afterwards appear.

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a. a. The masseter muscle.

The buccinator muscle. Its fibres are pierced by the duct of the otid gland (*x*) nearly opposite the second molar tooth of the upper-jaw.

c. The depressor anguli oris.

d. d. The digastric muscle.

*d**. The fibrous expansion from the tendon of the digastric muscle by which it is fixed to the os hyoides.

e. The stylo-hyoideus muscle.

f. f. The mylo-hyoideus muscle.

g. The hyo-glossus muscle. The ninth, or hypo-glossal nerve (19), lies upon its outer surface, and under it is placed the lingual artery.

h. The pharynx.

i. The sterno-hyoid muscle.

k. The sterno-thyroid muscle.

l. The anterior belly of the omo-hyoid muscle. The tendon of the muscle is seen on the large vessels, which it crosses in the lower third of the neck.

These muscles receive several small nerves from the plexus formed between the descendens noni (20) and two small branches of the cervical nerves (21, 22).

m. Part of the thyro-hyoid muscle.

n. The sterno-mastoid muscle. The inner border of the muscle has been freely drawn outwards in order that the great vessels, which it naturally conceals in the lower part of the neck, might be exposed to view.

o. The zygomatic arch.

p. The base of the lower jaw bone, between the depressor anguli oris and masseter muscles.

q. The body of the os hyoides.

r. The great cornu of the os hyoides.

s. The pomum Adami, or prominence formed by the anterior and superior surfaces of the thyroid cartilage.

PLATE II.

EXPLANATION OF PLATE II.

SURGICAL DISSECTION OF THE ANTERIOR TRIANGLE OF THE NECK.

To expose the great vessels of the neck, the integuments and platysma myoides, with the cervical fascia, must be removed, and the muscles dissected as is represented in the drawing. The sterno-mastoid muscle should be drawn outwards, and the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles in the opposite direction, so that the common carotid artery and great jugular vein may be seen in the lower part of the neck.

The attachments of the cervical fascia to the mastoid and zygomatic processes of the temporal bone, the base of the lower jaw, and the os hyoides are deserving of particular attention ; for, until these have been severed, the muscles and vessels of the neck are much more closely approximated to each other than they afterwards appear.

---

a. a. a. The masseter muscle.

b. The buccinator muscle. Its fibres are pierced by the duct of the parotid gland (*x*) nearly opposite the second molar tooth of the upper-jaw.

c. The depressor anguli oris.

d. d. The digastric muscle.

*d**. The fibrous expansion from the tendon of the digastric muscle by which it is fixed to the os hyoides.

e. The stylo-hyoideus muscle.

f. f. The mylo-hyoideus muscle.

g. The hyo-glossus muscle. The ninth, or hypo-glossal nerve (19) lies upon its outer surface, and under it is placed the lingual artery.

h. The pharynx.

i. The sterno-hyoid muscle.

k. The sterno-thyroid muscle.

l. The anterior belly of the omo-hyoid muscle. The tendon of the muscle is seen on the large vessels, which it crosses in the lower third of the neck.

These muscles receive several small nerves from the plexus formed between the descendens noni (20) and two small branches of the cervical nerves (21, 22).

m. Part of the thyro-hyoid muscle.

n. The sterno-mastoid muscle. The inner border of the muscle has been freely drawn outwards in order that the great vessels, which it naturally conceals in the lower part of the neck, might be exposed to view.

o. The zygomatic arch.

p. The base of the lower jaw bone, between the depressor anguli oris and masseter muscles.

q. The body of the os hyoides.

r. The great cornu of the os hyoides.

s. The pomum Adami, or prominence formed by the anterior and superior surfaces of the thyroid cartilage.

t. The cricoid cartilage.
u. The thyro-hyoid membrane.
v. The parotid gland.
w. The socia parotidis.
x. The duct of the parotid gland.
y. *y*. The submaxillary gland.
z. The temporal fascia.

ARTERIES.

1. 1. The common carotid artery.
2. The internal carotid artery.
3. 3. The external carotid artery.
3.* The temporal artery.
4. The superior thyroid artery.
5. The lingual artery.
6. 6. 6. The facial artery.
7. The submental artery, as it runs along the mylo-hyoideus musc
cover of the jaw.
8. The inferior labial artery.
9. A small branch which runs up along the anterior margin of the
muscle.
10. The tranverse artery of the face.

VEINS.

11. 11. The internal jugular vein.
B. The temporal vein.
12. A very large vein formed by the union of the temporal a
veins ; it crosses over the external carotid artery to empty itself
internal jugular.
13. The vein formed by the union in the parotid gland of the
and internal maxillary veins.
14. The facial vein. This vessel commences at the inner angle o
by a very small branch, the angular vein, that anastomoses with the
mic vein.
15. The superior thyroid vein.
16. The pharyngeal vein.

NERVES.

17. The auricularis magnus nerve.
18. The superficial cervical nerve.
19. 19. The lingual or hypo-glossal nerve. It crosses the externa
artery, and as it does so furnishes
20. 20. The descendens noni, which in the lower part of the ne
a plexus by joining with two filaments of the cervical nerves.
21. 22. Two delicate branches of the cervical plexus which uni
the sheath of the carotid artery, with the descendens noni.
23. 24. 25. Small branches distributed to the sterno-hyoid, sterno
and omo-hyoid muscles.
26. The spinal accessory nerve.

EXPLANATION OF PLATE III.

RGICAL DISSECTION OF THE BLOOD VESSELS WHICH LIE NEAR THE ANGLE OF THE JAW.

In this dissection, the parotid gland is to be removed piecemeal, with ıe portio dura nerve, so as to expose the external carotid artery and several ſ its principal branches. The veins may also be taken away.

A. The malar bone.

a. The root of the zygoma.

b. Part of the capsular ligament of the lower jaw.

B. The base of the lower jaw. The facial artery is easily compressed in this situation, as it turns over the bone, in front of the masseter muscle.

C. The angle of the jaw.

c. The neck of the condyle of the same bone.

D. The body of the os hyoides.

d. The greater cornu of the same bone.

e. The temporal fascia.

E. The sterno-mastoid muscle, which has been drawn outwards to display the common carotid artery.

F. The masseter muscle.

f. Some fibres of it which descend obliquely forwards from the zygoma to be inserted into the coronoid process.

G. The buccinator muscle.

g. The duct of the parotid gland, piercing the fibres of the buccinator.

H. Part of the depressor anguli oris muscle.

I. The posterior belly of the digastric muscle.

K. The anterior belly of the same.

L. The tendon of the digastric muscle.

M. The process of the cervical fascia which binds the tendon of the digastric to the os hyoides.

N. The stylo-hyoideus muscle, the fibres of which are pierced by the tendon of the digastric.

O. O. The mylo-hyoid muscle.

P. The hyo-glossus muscle.

Q. Q. Q. The superior constrictor of the pharynx.

R. The sterno-hyoid muscle.

S. Part of the omo-hyoid muscle.

T. Part of the sterno-thyroid muscle.

W. The thyro-hyoid muscle.

V. Middle constrictor of the pharynx.

h. h. The fascia of the neck which has been detached from the lower jaw and zygomatic arch, and turned downwards on the lower part of the neck.

ARTERIES.

1. The trunk of the common carotid artery, as it lies superficially in the anterior triangle of the neck.

2. The division of the common carotid into the external and internal carotid arteries. The vessel here presents a dilated appearance.

3. 3. The internal carotid artery.

4. 4. The external carotid artery.

5. The superior thyroid artery.

6. Marks the point where the artery turns beneath the sterno-thyroid muscle to reach the thyroid gland.

7. A superficial branch of the superior thyroid artery.

7.* The lingual artery.

8. 8. 8. The facial artery.

9. The inferior palatine artery.

10. The submental artery.

11. A small branch of the facial artery which runs upwards on the anterior margin of the masseter muscle.

12. 12. The posterior occipital artery.

13. Sterno-mastoid branch of the external carotid artery.

14. The posterior auricular artery.

15. 15. The temporal artery.

16. The transverse artery of the face.

17. The anterior temporal artery.

18. The internal maxillary artery, passing, deeply, behind the neck of the condyle of the lower jaw.

NERVES.

19. 19. The lingual or hypo-glossal nerve.

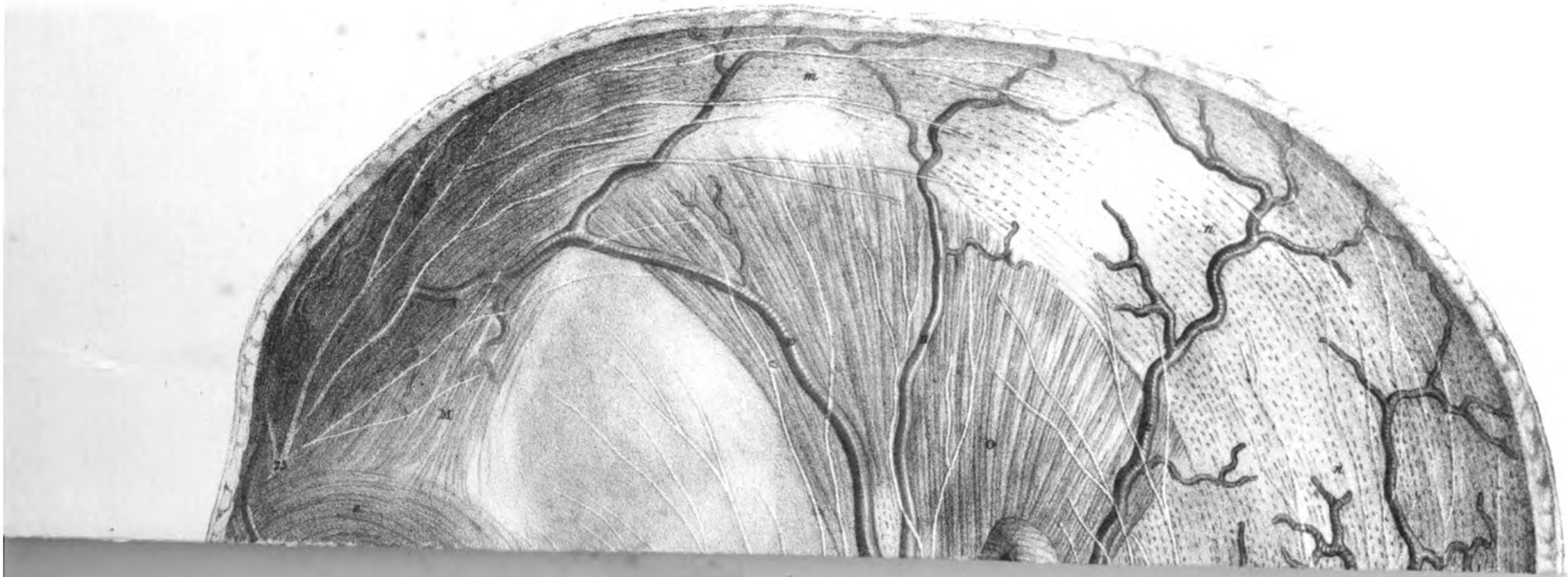
20. The descendens noni.

21. 21. The par vagum, lying behind and to the outer side of the carotid artery.

22. Part of the superficial cervical nerve.

23. 24. The auricularis magnus nerve.

PLATE



W. Fairland Litho.
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EXPLANATION OF PLATE IV.

DISSECTION OF THE SUPERFICIAL NERVES OF THE HEAD AND FACE.

This plate is taken from Arnold's* work on the nerves of the head.

The integuments and subcutaneous adipose tissue have been removed, as well as the parotid gland. The levator labii superioris muscle has been cut in order to show the second division of the fifth nerve as it issues from the infra-orbital canal. The quadratus menti muscle has also been removed to show the mental branch of the third division of the same nerve, as it escapes from the foramen mentale of the lower jaw, to be distributed to the structures which compose the lower lip.

A. The malar bone. *a*. The root of the zygomatic process of the temporal bone.

B. The lower jaw. *b*. The angle of the jaw. *c*. The neck of the condyle of the same bone.

C. The platysma myoides muscle. *d*. That process of it which is sometimes named m. risorius Santorini.

D. The depressor anguli oris, detached from its origin.

E. The orbicularis oris muscle.

F. The buccinator muscle.

G. The zygomaticus major muscle.

H. The zygomaticus minor muscle.

I. The levator labii superioris muscle, which has been cut partly away to show the infra-orbital nerve (22), which lies beneath it.

K. The levator anguli oris muscle.

L. The orbicularis palpebrarum muscle.

e. e. The external fibres of the muscle.

f. f. The innermost fibres which—more delicate than the others—cover the cartilages of the eyelids.

M. Anterior fibres of the occipito-frontalis muscle.

N. Posterior fibres of the same muscle.

m. n. n. Tendinous aponeurosis of the occipito-frontalis, sometimes called galea capitis.

O. The attollens aurem muscle.

P. The retrahens aurem muscle.

Q. The masseter muscle.

R. The posterior belly of the digastric muscle.

S. The superior half of the sterno-mastoid muscle.

T. Part of the trapezius muscle.

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* Frederici Arnoldi Icones Nervorum Capitis. Folio, Heidelbergæ, M.D.CCCXXXIV. Tabula nona.

U. Part of the splenius capitis muscle.
V. Part of the splenius colli muscle.
W. Part of the levator anguli scapulæ muscle.
X. Part of the complexus.
Z. Duct of the parotid gland, cut across.

ARTERIES.

1. 1. The external carotid artery, which is crossed by the digastric muscle (R), and portio dura nerve (15).

2. The superior thyroid artery.

3. 3. 3. The facial artery; this vessel springs from the external carotid near the angle of the jaw, and at first runs deeply in the submaxillary gland, covered by the lower border of the bone, after which it turns over its edge and runs in an oblique course across the side of the face to the angle of the eye, where it ends in a very small branch.

4. The superior coronary artery.

5. The nasal artery.

6. The frontal artery.

7. Nasal branches of the ophthalmic artery.

8. The transverse artery of the face, a branch of the temporal artery.

9. The temporal artery, ascending over the zygoma.

10. The anterior branch of the temporal artery.

11. A branch which ascends to the vertex.

12. The posterior temporal artery.

13. The internal carotid artery, lying deeply behind the angle of the jaw.

14. The occipital artery.

NERVES.

15. The trunk of the portio dura nerve, as it is issuing from the stylo-mastoid foramen to cross the external carotid artery.

16. 16. The temporal branches of the portio dura.

17. The dotted lines extending from this figure include the buccal or infra-orbital branches of the nerve. They supply the muscles of the middle part of the face, and join with the buccal and infra-orbital branches of the fifth nerve.

18. The figure and dotted line extending downwards from it, mark the cervico-facial branches of the portio dura.

19. The posterior auricular nerve.

BRANCHES OF THE FIFTH NERVE.

20. The auriculo-temporal nerve, a branch of the third division of the fifth nerve.

21. The mental branch of the inferior maxillary division of the fifth.

22. The infra-orbital nerve, which is the terminal branch of the superior maxillary or second division of the fifth.

23. The supra-orbital nerve.

24. The supra-trochlear nerve.

25. The infra-trochlear nerve.

26. Nervus subcutaneus malæ.

27. The buccal nerve.

SUPERFICAL BRANCHES OF THE CERVICAL PLEXUS.

28. The auricularis magnus nerve.

29. The superficialis cervicis nerve.

30. The occipitalis minor nerve, which, in the subject from which the drawing was made, divided into two large branches.

31. Cutaneous branch of the cervical plexus which is distributed to the integuments of the lower and front part of the neck.

32. The par vagnum or pneumo-gastric nerve, as it lies on the outer side of the internal carotid artery.

33. The spinal accessory nerve passing to the trapezius after having traversed the fibres of the sterno-mastoid muscle.

34. Supra-clavicular branches of the cervical plexus.

35. The great occipital nerve, or posterior branch of the second cervical nerve.

EXPLANATION OF PLATE V.

SURGICAL DISSECTION OF THE AXILLA.

As a preparatory step to the dissection of the axilla, the arm should be withdrawn from the body, and thrown over a large block of wood; as is represented in the drawing. An incision should then be carried along the lower border of the great pectoral muscle, extending from the ensiform cartilage of the sternum, to the insertion of the muscle into the outer edge of the bicipital groove of the humerus. Two other incisions should now be made, one from each end of the preceding cut; the first passing downwards and backwards, on the side of the chest, over the digitations of the external oblique muscle; the other, over the coraco-brachialis and biceps muscles, to the inner and back part of the arm. (See the Plate.)

At first the integuments only should be raised, and reflected upon the block supporting the shoulders of the subject. In doing this, a large number of very small follicular glands will be seen, occupying the inner surface of that part of the skin, which, externally, is covered with hair.

The fascia of the axilla is strongest, externally, where it blends itself with the aponeurosis of the arm. It extends across from the pectoralis major to the latissimus dorsi; and, inferiorly, is expanded over the obliquus externus.

Let the fascia be carefully opened, by dividing it as it leaves the border of the great pectoral muscle, and turn it downwards in the same manner as the skin.

A large quantity of loose cellular tissue, containing much fat and many lymphatic glands, is now to be removed; which must be done with great care, if the dissector would preserve the vessels and nerves which abound in this region.

The Axilla is a conical cavity, which extends upwards, behind the clavicle, into the lower part of the neck; internally, it is bounded by the ribs and serratus magnus muscle (*d. d. d.*); anteriorly, by the two pectoral muscles (*a. a.*); externally, by the shoulder-joint; posteriorly, by the subscapularis (*e*), teres major (*c*), and latissimus dorsi muscle (*b*); inferiorly, its base is formed by the fascia already spoken of.

The great vessels and nerves are placed at the upper and outer part of the region; but some large arteries run in the direction of each fold; for example, the external mammary (7) is found under the edge of the great pectoral muscle, and the subscapular (8) near the latissimus dorsi.

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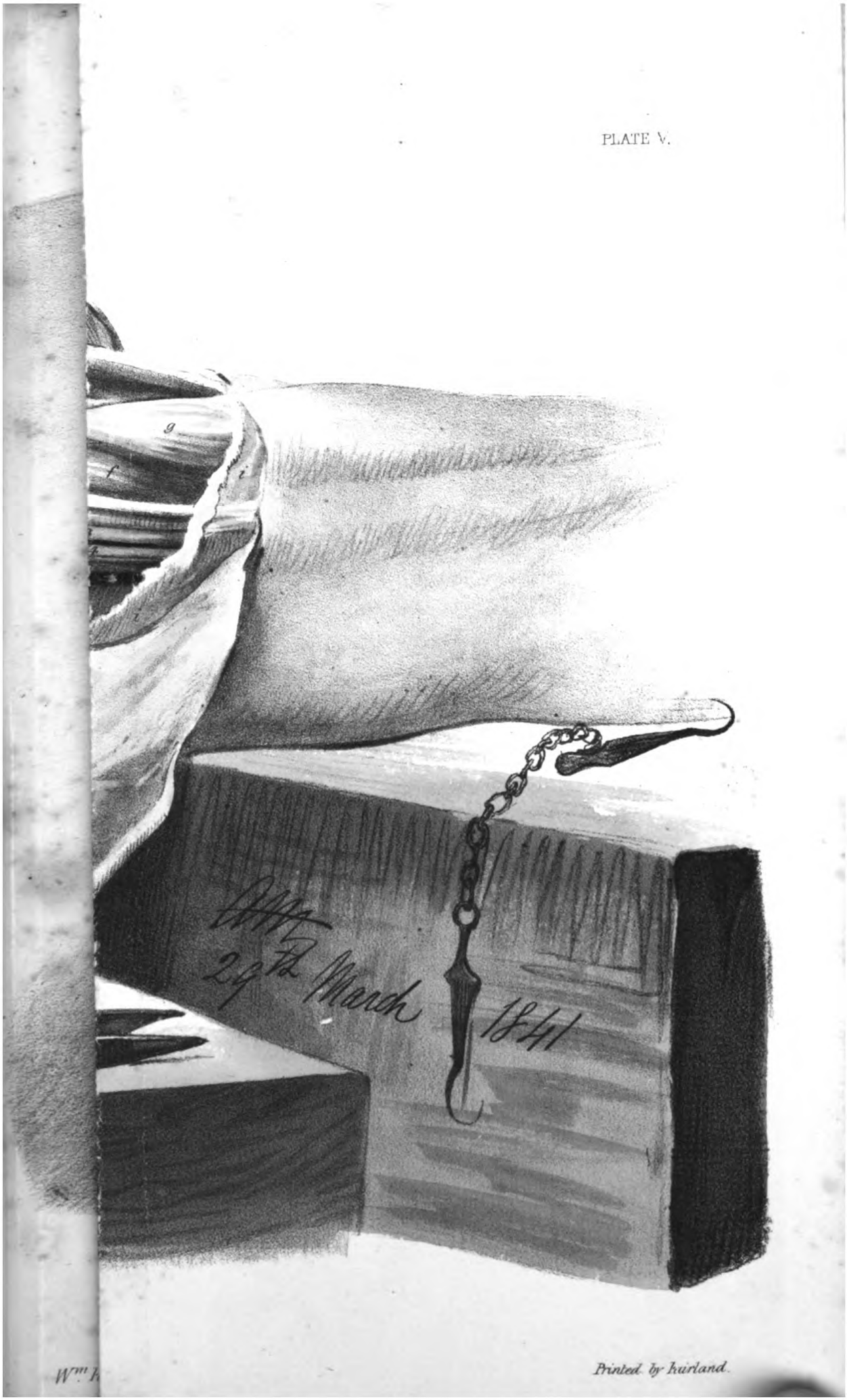
a. a. The lower border of the great pectoral muscle, forming the anterior fold of the axilla.

b. b. The anterior border of the latissimus dorsi muscle, which, with the teres major muscle (*c*), forms the posterior fold.

c. Part of the teres major muscle.

PLATE V.



Printed by Fairland.

d. d. d. d. d. The serratus magnus muscle, which arises by fleshy digitations from the first eight ribs and is inserted into the base of the scapula.

e. e. The subscapularis muscle.

f. The middle part of the coraco-brachialis muscle, which slightly overlaps the axillary artery in the lower part of its course.

g. The short head of the biceps flexor cubiti muscle.

h h. Part of the external oblique muscle of the abdomen.

i. i. The fascia of the arm which binds down the large vessels and nerves as they descend alongside of the coraco-brachialis and biceps muscles.

k. The fascia of the axilla, which, before the dissection was commenced, was stretched across the cavity included between the great pectoral and latissimus dorsi muscles, and concealed the vessels and nerves of the region.

l. l. Integuments of the axilla dissected from their connexions, and reflected in a similar manner.

ARTERIES AND VEINS.

1. The axillary artery in the lower part of its course. It rests at first upon the subscapularis muscle (*e*) near the shoulder-joint, and afterwards upon the tendons of the latissimus dorsi (*b*) and teres major (*c*) muscles.

2. The axillary vein. This large and important vessel covers the artery and plexus of nerves.

3. 4. The venæ comites of the brachial artery. They have been drawn a little downwards so as to expose the artery, which, naturally, they conceal.

5. The subscapular vein, which empties itself into the axillary vein.

6. A small artery, which, in this subject, took its origin from the axillary artery, underneath the pectoral muscle, and divided into two branches, one of which ran along the edge of that muscle to the mammary gland, while the other pursued an opposite course, towards the arm.

7. The long thoracic or external mammary artery. It usually runs along the lower border of the small pectoral muscle.

8. The subscapular artery. This vessel springs from the axillary artery near the articulation of the humerus with the scapula; it runs along the lower margin of the subscapular muscle as far as the inferior angle of the scapula, where it divides into many branches which are distributed to the serratus magnus, subscapularis, teres major, and latissimus dorsi muscles. Its principal branch, however, is the dorsal artery of the scapula; this turns backwards, passing round the lower edge of the subscapular muscle, to be distributed to the parts behind. It is seen in the drawing as the first branch of the artery.

There are other arteries in the axilla; some of which lie between the pectoral muscles—the thoracica acromialis and the thoracica suprema—and are not seen in this view of the region.

The posterior circumflex, a large artery, will be found close behind the neck of the humerus, between the subscapularis and latissimus dorsi muscles. Occasionally, however, it springs from the axillary artery lower down, below the tendons of the latissimus dorsi and teres major muscles.

The anterior circumflex is a small vessel, which, springing from the outer side of the artery, passes under the tendons of the coraco-brachialis and biceps muscles, running round the neck of the humerus.

NERVES.

9. The median nerve of the arm. In the lower part of the axilla it lies between the brachial artery and the coraco-brachialis muscle.

The other large nerves of the brachial plexus are concealed from view by the artery and its accompanying veins, which must be pulled asunder if we wish to see them.

10. The nerve of Wrisberg, a small branch from the brachial plexus which lies upon the axillary vein.

11. A branch of communication between the nerve of Wrisberg and the first intercosto-humeral nerve.

12. The first intercosto-humeral nerve.

13. The second intercosto-humeral nerve.

14. }
15. } The middle intercostal cutaneous nerves, branches of the 4th 5th
16. } 6th and 7th intercostal nerves.
17. }

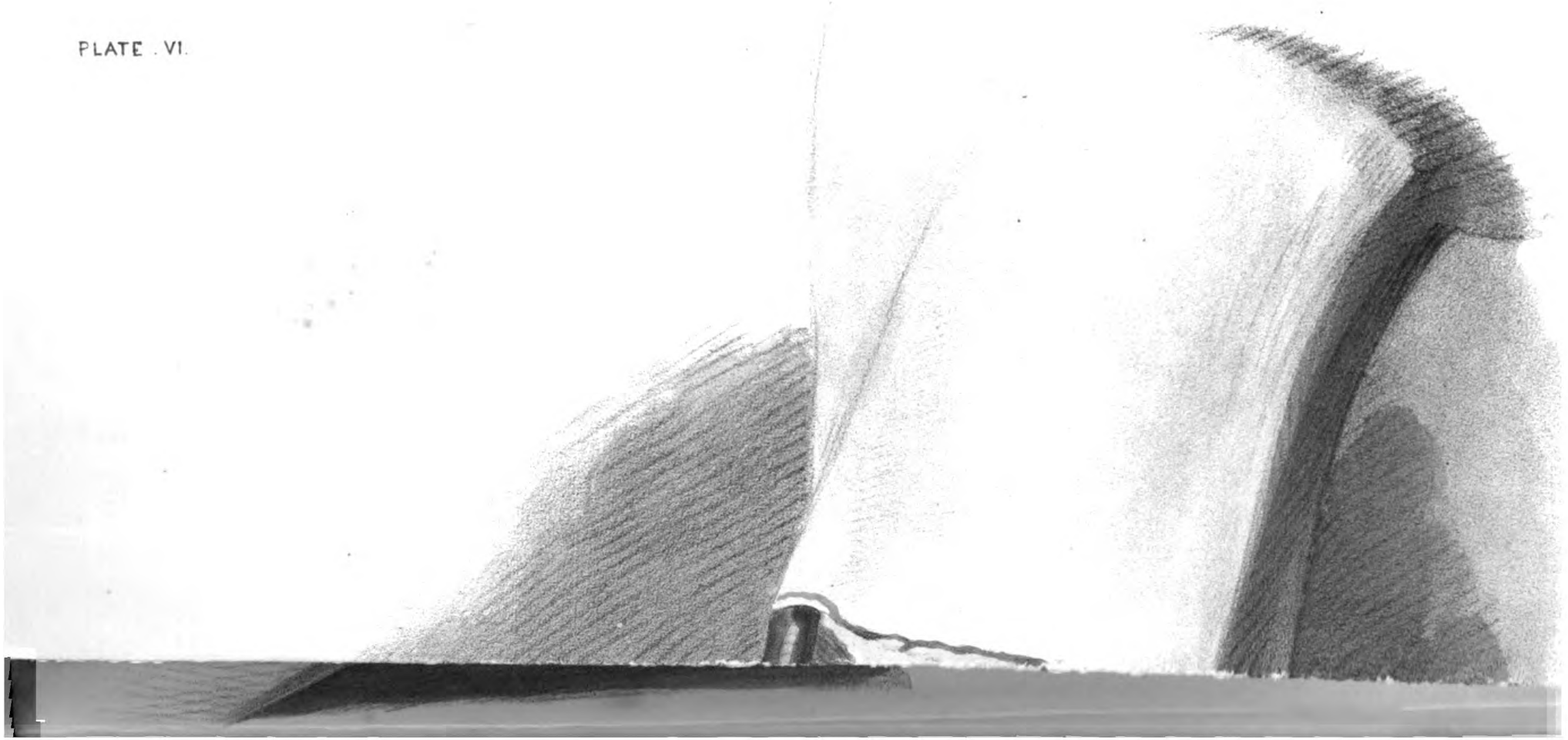
18. The long thoracic nerve, a branch of the brachial plexus, which is distributed to the serratus magnus muscle. It is sometimes called the external respiratory nerve of Bell.

19. The nerve to the subscapularis muscle.

20. The circumflex nerve.

21. The nerve to the latissimus dorsi muscle.

PLATE . VI.



EXPLANATION OF PLATE VI.

SURGICAL DISSECTION OF THE BEND OF THE ELBOW.

*First Dissection of the Bend of the Elbow.**—The arm should be extended and rotated outwards so as to bring the whole of the structures on the fore-part of the elbow-joint clearly into view. (See Plates VI. and VII.) The first incision should be made in a perpendicular direction along the outer border of the limb, commencing about four inches above the elbow-joint, and terminating three inches below it: from each extremity of this incision another cut is to be made at right angles to it, and extended across to the opposite border of the limb. (See Plate VI.) The true skin, which here is very delicate and thin, only should be raised at first, as the superficial vessels and nerves lie in the subjacent cellular membrane (the *superficial fascia*), which must therefore be removed with care so as to preserve them from injury.

A. The skin and part of the superficial fascia dissected from the other structures in front of the elbow, and thrown aside.

B. The fleshy belly of the biceps flexor muscles, covered by the fascia of the arm. *a. a.* The tendinous portion of the biceps muscle underneath the fascia.

C. The fascia of the arm where it covers the brachial artery and median nerve, and separates them from the median basilic vein. The fascia is here greatly strengthened by numerous fibres derived from the tendon of the biceps muscle. The direction of these fibres is downwards and inwards.

D. The fascia of the arm where it covers the flexor muscles of the hand and fore-arm, at their origin from the inner condyle of the humerus.

E. The same fascia covering the supinator radii longus muscle and other extensors of the wrist.

F. The fascia covering the flexor carpi radialis and flexor sublimis muscles.

G. The fascia covering the triceps extensor cubiti.

NERVES.

1. The external cutaneous nerve (Plate VI. fig. 7. and Plate VII. figs. 1. 2. 3. and 4.), after passing between the biceps and brachialis anticus

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* Previously to commencing this dissection, the veins in front of the elbow-joint may be injected with wax or tallow, by means of a pipe inserted into some of the smaller veins on the back of the hand, and at the root of the thumb.

EXPLANATION OF PLATE VII.

SECOND DISSECTION OF THE STRUCTURES IN FRONT OF THE ELBOW-JOINT.

To proceed with the dissection of the muscles, nerves, and blood-vessels of this region, we should divide the fascia of the arm by an incision carried along the inner border of the biceps muscle, and extended for some way over the muscles of the forearm, which take their origin from the internal condyle of the humerus. In doing this, we may preserve, if we choose, the fibrous expansion that is given off from the tendon of the biceps to strengthen the fascia of the forearm, and which serves to separate the brachial artery, in the latter part of its course, from the median basilic vein. On turning aside the fascia, and removing the condensed cellular membrane which forms the sheath of the vessels, we have the view of the parts as they are represented in Plate VII.

A. The internal condyle of the humerus, covered by the fascia of the arm.

B. B. The fascia covering the supinator radii longus muscle.

C. The fascia covering the fleshy belly of the biceps flexor cubiti muscle.

D. The fascia of the forearm, in front of the flexor muscles of the hand.

E. The fascia, covering the triceps extensor muscle.

b. b. b. The fascia of the arm slit open along the inner edge of the biceps muscle, so as to expose the brachial artery and its accompanying veins.

F. The biceps muscle. *c.* Its tendon.

G. The inner edge of the pronator radii teres muscle, partly exposed by reflecting the fascia of the arm.

ARTERIES.

H. H. The brachial artery, before it dips at the bend of the elbow between the muscles from the condyles of the humerus.

I. The artery lying more deeply between the supinator radii longus and pronator radii teres muscles.

a. a. a. Small arteries given to the biceps muscle.

VEINS.

K. K. The basilic vein.

L. The median basilic vein.

M. The median cephalic vein.

Wm. Fairland, lith.

London, Taylor & Walton, Upper Gower Street.

Printed by Fairland.

N. The median vein of the forearm.

O. The communicating branch, connecting the superficial with the deep-seated veins of the forearm.

P. The radial vein.

Q. The cephalic vein.

R. R. } Venæ comites of the brachial artery.
S. S. }

T. U. V. Ulnar veins of the forearm.

W. A vein which comes from the back of the elbow.

NERVES.

1. The external cutaneous nerve.

2. 3. 4. Branches of the same nerve.

5. The internal cutaneous nerve.

6. 7. Branches of the internal cutaneous nerve.

8. 9. Filaments of the internal cutaneous nerve distributed on the front of the forearm.

10. 11. 12. Other filaments of the same nerve which descend on the inner side of the limb.

13. 14. The median nerve, which lies in the sheath of the brachial vessels, and on their inner side.

EXPLANATION OF PLATE VIII.

SURGICAL DISSECTION OF THE RADIAL AND ULNAR ARTERIES AT THE WRIST.

The hand and fore-arm should be extended in the supine position, as they are represented in the engraving. The skin and subjacent adipose membrane are then to be raised from the fascia of the fore-arm, leaving, however, the superficial veins and terminal filaments of the cutaneous nerves of the arm which lie upon it. For this purpose, two incisions should be made across the limb; one about the middle of the fore-arm, and the other over the origins of the small muscles of the thumb and little finger. These incisions should be united by a vertical cut, extending downwards along the outer border of the arm. The flap, when raised, is to be reflected over the ulna. (See Plate VIII. fig. A.)

Numerous veins ramify in the subcutaneous adipose tissue; those on the outer side of the limb take their origin from the small veins at the root of the thumb and forefinger, and ascend to join the radial veins already noticed in the dissection of the bend of the elbow. On the ulnar side they ascend in a similar manner, gradually increasing in size, and contribute to the formation of the ulnar veins of the fore-arm. In the centre they unite and form the median vein. All these veins freely inosculate with one another, and with those which are placed underneath the fascia.

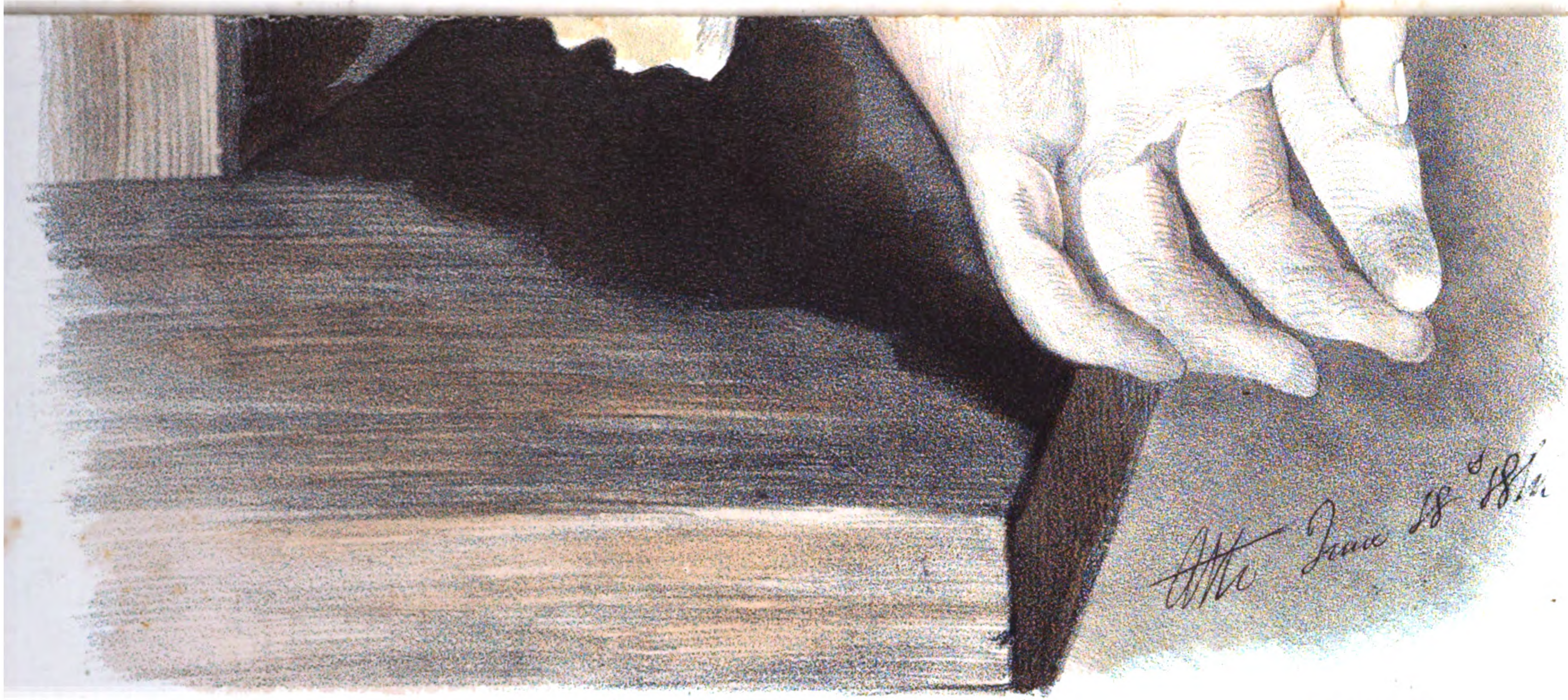
The fascia of the fore-arm is, in this region, dense and firm in its structure. It covers the flexor muscles, and the radial and ulnar arteries. It is attached, on the inner side, to the border of the ulna and pisiform bone; on the outer side, to the styloid process of the radius and to the scaphoid bone; it is continuous inferiorly with the anterior annular ligament and palmar fascia. From its inner surface several processes are detached, which invest the various tendons in front of the wrist. One of these is particularly deserving of attention, as it passes horizontally between the superficial and deep flexor muscles, separating them from each other, and binds down the ulnar artery and nerve as they run alongside the tendon of the flexor carpi ulnaris muscle.

A. The skin and subcutaneous adipose layer raised from the fascia of the fore-arm, and thrown to one side.

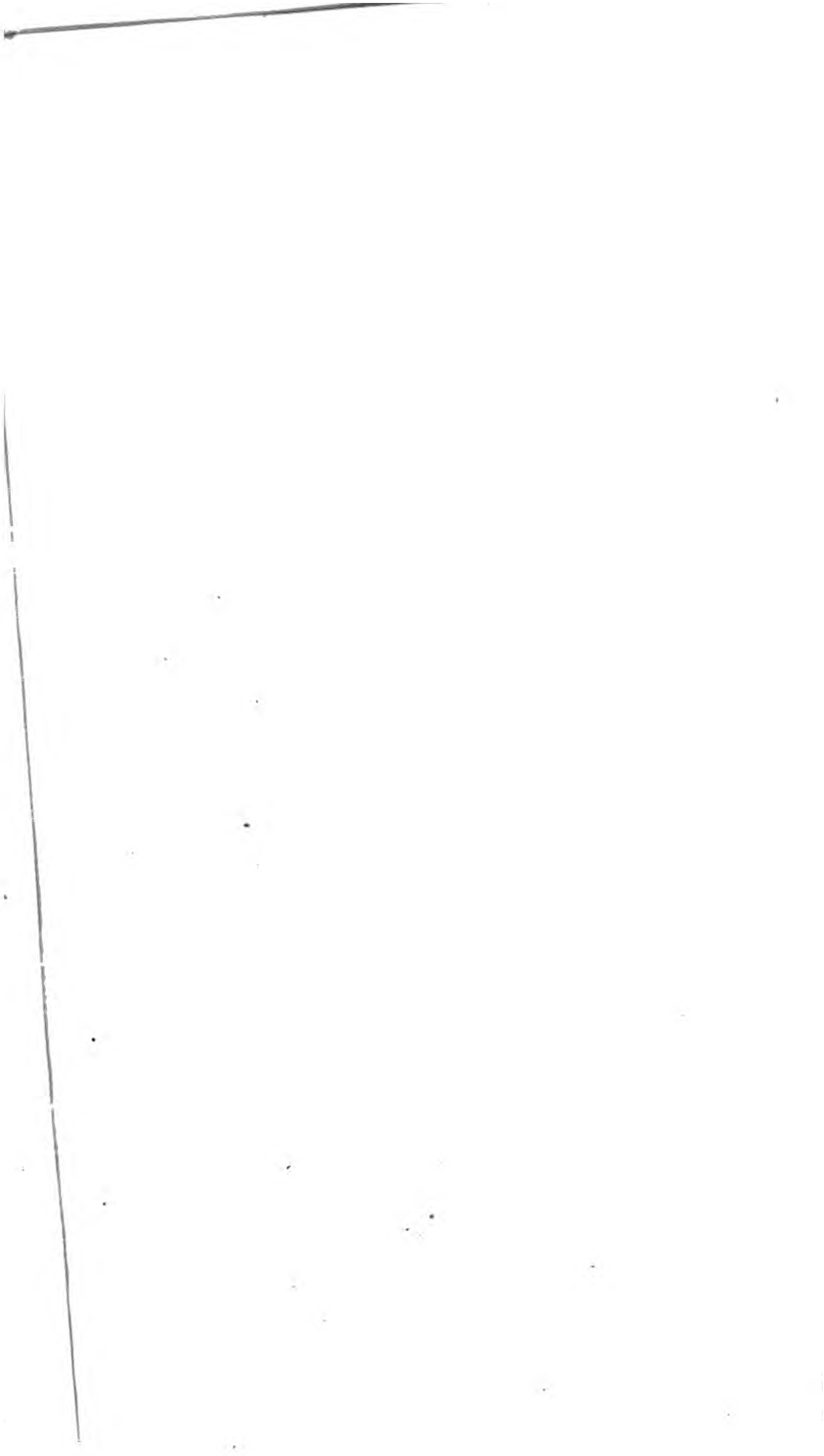
B. B. B. Part of the fascia of the fore-arm, covering the flexor muscles of the wrist-joint and fingers.

C. The palmar fascia.

D. The broad flat surface of the lower part of the radius. The radial artery lies upon it, before turning over the external lateral ligament of the wrist-joint to reach the interval between the first and second metacarpal bones. It is easily compressed in this situation.



W. Farland litho. London. Taylor & Walton. Upper Gower Street. Printed by Farland



E. ***f.*** **The tendon of the supinator radii longus muscle. It lies on the outer side of the radial artery.**

F. *g.* The flexor carpi radialis muscle. Its tendon (*g*) is placed along the ulnar side of the radial artery.

G. G. *h.* The palmaris longus muscle. Its tendon (*h.*) is inserted into palmar fascia.

H. H. The fleshy fibres of the flexor carpi ulnaris muscle. *i.* The attachment of its tendon to the pisiform bone. The ulnar artery and nerve lie under cover of the tendon of this muscle.

I. K. *k.* The flexor longus pollicis muscle. K. The fleshy fibres of the muscle. I. *k.* Its tendon.

L. *l. l.* The flexor sublimis muscle. L. The fleshy portion of the muscle, supporting (G) the palmaris longus and (F) the flexor carpi radialis. ***l. l.*** Some of its tendons passing under the anterior annular ligament of the wrist, which is marked (*c*, *c*).

M. The tendons of the extensores ossis metacarpi and primi internodii pollicis muscles. They cross over the radial artery, as it turns round the external lateral ligament of the wrist to join the interval between the heads of the abductor muscle of the fore-finger.

N. Origin of the abducens pollicis muscle.

O. Origin of the flexor brevis minimi digiti muscle.

P. The pronator quadratus muscle.

a. **The scaphoid bone.**

b. **The pisiform bone.**

c. c. **The anterior annular ligament of the wrist.**

VEINS.

e. e. The superficial radial veins of the fore-arm.

ARTERIES.

1. 1. The radial artery, in the lower part of the fore-arm. Its accompanying veins have been removed to show the vessel more distinctly.

In this part of its course the artery is covered by the skin, subcutaneous adipose tissue, and fascia of the fore-arm ; it rests upon, at first, the flexor profundus pollicis and pronator quadratus muscles, and, latterly, the flat surface of the radius. The tendon of the supinator radii longus is on its outer side, and that of the flexor carpi radialis lies internally to it. It is accompanied by two veins. The radial nerve lies at some distance externally.

2. The radial artery turning over the external lateral ligament of the wrist-joint, to join the back of the hand. Here it lies deeply, under cover of the extensor tendons of the thumb (M).

3. The anterior carpal artery, a small branch of the radial, which runs along the lower border of the pronator quadratus muscle, and anastomoses with a similar branch from the ulnar artery.

4. The superficialis volæ artery. This is the principal branch of the radial artery, and is frequently of large size. It passes into the palm of the hand, where it joins with the ulnar artery, forming with it the superficial palmar arch.

5. A small branch of the radial artery distributed to the muscles of the thumb.

6. 6. The ulnar artery in the lower third of the fore-arm.

In this part of its course, the ulnar artery rests upon the flexor profundus digitorum muscle, to which it is bound down by the deep fascia. The tendon of the flexor carpi ulnaris muscle slightly overlaps it. The ulnar nerve (10, 10) lies on its inner side, and it is accompanied by two veins, which were removed in the dissection from which the drawing was made.

7. The ulnar artery where it lies on the anterior annular ligament of the wrist-joint, by the side of the pisiform bone. It is bound down, in this situation, by a very dense and thick fascia.

NERVES.

8. 9. The radial nerve, after it has passed underneath the tendon of the supinator radii longus muscle, in its course to the back of the hand.

10. 10. The ulnar nerve, which lies on the inner side of the artery.

11. The cutaneous branch of the ulnar nerve, which, passing backwards underneath the tendon of the flexor carpi ulnaris muscle, a little above the styloid process of the ulna, is distributed upon the integuments of the little and ring fingers.

THE END.

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