The prostate gland and its enlargement in old age / by Decimus Hodgson, M.D., Edin., M.R.C.S. Engl.

THE PROSTATE GLAND, &c.

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AND

ITS ENLARGEMENT IN OLD AGE;

BY

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Dedicated

TO

JOHN GOODSIR, ESQUIRE, F.R.S.,

PROFESSOR OF ANATOMY IN THE UNIVERSITY OF EDINBURGH,

In acknowledgment of many acts of kindness and encouragement received from him, by

His faithful and obedient servant,

DECIMUS HODGSON.

PREFACE.

THE following monograph is principally founded upon my inaugural dissertation on Graduation, to which a gold medal was awarded by the University of Edinburgh in the year 1855.

I have endeavoured to lay before the reader in some detail an account of the healthy anatomy of the prostate, and the morbid changes which it undergoes in old age.

The illustrations have been carefully selected from a considerable number of specimens, and will, I trust, contribute materially to the elucidation of the subject, especially as regards the surgical treatment of the disease.

Dr. Allen Thomson has assisted me with several valuable suggestions, bearing upon the publication of the work and its illustration.

I have to thank the Council of the Royal College of Surgeons of England, and the Council of King's College, London, for permission to make use of the preparations in their Collections.

Mr. Goodsir kindly placed at my disposal the preparation from which Plate 11 has been made; and I am indebted to Mr. Robert Brown, of the Cumberland Infirmary, for the specimen delineated in Plate 12.

UNIVERSITY OF GLASGOW,
Nov., 1856.

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ERRATUM—page 12; line 30; for "*convexity*" read "*concavity*."

ANATOMY AND PHYSIOLOGY OF THE PROSTATE.

INTRODUCTION.

THE Prostate is a firm glandular body which surrounds the neck of the bladder, and the first inch and a quarter of the urethra in the adult male. Its relation to these parts is of the most intimate nature, and indeed it cannot be disconnected from them without destroying their integrity. Of itself it does not seem to be a very important organ; at least little has been satisfactorily proved as to its function beyond its being a gland which furnishes a fluid accessory to the secretion of the testicle; and the remark made by John Hunter* holds good with regard to our present knowledge of its office, "The use of this gland is not sufficiently known to enable us to judge of the bad consequences that attend its diseased state, abstracted from swelling." Many circumstances, however, combine to prove this to be an accessory gland of reproduction; it discharges its secretion into that portion of the urethra where the ducts of the testicles open; in certain animals, such as the mole, which have stated periods of sexual intercourse, the prostate is diminished in size during the intervals; in persons who have been castrated it dwindles down almost to a rudimentary condition; and it is the seat of certain disorders, especially chronic inflammation and undue secretion, arising from over-indulgence in sexual pleasures quite apart from any specific infection. I lately had the opportunity of dissecting the organs of generation in a man about 35 years old, whose penis had been removed apparently by an operation some years before his death; the prostate, in common with the testes, vesiculæ seminales and the dilated terminal portion of the vasa deferentia, was much reduced in size.

The part which the prostatic secretion takes in the perfection of the reproductive fluid is uncertain; that the gland is absent in many ruminating animals would seem to indicate that it is not indispensable to fecundation. It is stated, as an argument to

* Hunter on the Venereal Disease, page 181. Edit. 1810.

prove that the gland is not absolutely necessary to generation, that persons have been known to retain the power of impregnating the female although labouring under serious disease of the prostate; it must be admitted, however, that in estimating the value of such evidence, many circumstances, such as the nature of the disease and the complete or partial implication of the glandular structure, ought to be carefully weighed; thus there is no reason to suppose that hypertrophy, or a low form of inflammation, incapacitate the gland from performing its functions, and considerable disorganization may take place in it from the formation of abscess without destruction of the whole secreting tissue. On the other hand, it would be equally injudicious to conclude that it is indispensably requisite to reproduction because disease in it may be attended by impotence; the very nature of its connection with other and important portions of the generative apparatus, the ejaculatory ducts for instance, renders an extensive organic disease of the prostate very probably dangerous to the integrity of essential parts. Mr. Adams suggests that its chemical re-action may perform some duty in relation with the seminal fluid; "In connection with this obscure and difficult subject, I think the fact of the prostatic secretion being naturally, as I believe, acid, is a circumstance of some interest. The secretion of the testes is well known to be alkaline. Is it not probable that the re-action of the prostatic on the seminal fluid may be of use in the maintenance of the fluidity of the latter? The idea is somewhat confirmed by the fact, that in women the acid secretion of the vagina prevents the coagulation of the menstrual blood, and thus favours its discharge. This has been proved by Mr. Whitehead, who found that, if the menstrual fluid was received directly from the os uteri into a speculum, it coagulated like ordinary blood."*

The difficulties which attend on attempts to define the particular functions of the accessory reproductive glands in man are very great; the amount of fluid which can be obtained from them after death is small, and perhaps, when obtained, it is altered, through the agency of previous disease or subsequent chemical changes, from the healthy standard. With regard to the Prostate, however, Mr. Adams' researches appear to have fully established the acidity of its secretion; and comparison with other instances in the animal economy, in which glandular secretions of alternate alkaline and acid tendencies have peculiar functions of the highest importance, and evidently due in a great measure to their chemical composition, as in digestion and nutrition, renders it more than probable that similar purposes are served by the same

* Adams on the Anatomy and Diseases of the Prostate, page 25. Lond. 1851.

conditions in the reproductive fluids; in other words, the accessory secretions may aid in perfecting and preserving the fecundating power of the seminal particles. In addition, the prostatic secretion is undoubtedly useful in diluting the semen to such a bulk as may render its expulsion from the urethra and transmission to the female organs effectual.

The relations of the Prostate to the neighbouring parts, and especially the neck of the bladder, render it an object of great interest to the surgeon. It is known to be liable to almost all forms of disease which usually attack glandular structures and produce enlargement; and is, moreover, subject in old age to a swelling, or Hypertrophy, of a unique nature, concerning which I propose to treat in the following pages. These swellings produce alterations in the prostatic urethra and neck of the bladder, which impede free micturition and induce dangerous affections of the whole urinary apparatus. An essential part of their treatment is the use of the Catheter, whereby alone a complete evacuation of the urine can be obtained. Much stress will therefore be laid on the introduction of the catheter in the subsequent parts of this volume. To facilitate the description of that and other operations, as well as for the purpose of establishing a healthy standard to which variations in disease may be referred, I propose to give an account of the natural Anatomy and connections of the Prostate; and I trust this arrangement will not be unacceptable to my younger readers or those gentlemen who may desire to refresh their memory on this subject.

GENERAL RELATIONS OF THE PROSTATE.

THE following dissection, performed on a male pelvis, in which the abdomen and lower extremities have already been dissected, will bring into view the prostate gland and viscera of the pelvis as seen from the side.

Separate with the fingers the peritoneum from the iliac fossa and side of the pelvis to be examined, and lay it towards the middle line. The pelvic fascia will now be exposed and may be traced in its connections with the bladder at the sides and in front; detach this fascia from the brim of the pelvis and obturator muscle, and lay it also towards the middle line, leaving uninjured the white band which stretches across from the back part of the pubis to the spine of the

ischium, and marks the origin of the levator ani muscle. In front, separate the corpus covernosum from the rami of the pubis and ischium, and saw through the former bone one inch external to its symphysis. Remove the spine of the ischium with the bone-nippers, without injuring the fascia attached to it. Cut through the muscular and other tissues which leave the pelvis by the great sciatic foramen, if not already severed in the dissection of the leg. Divide the ilio-lumbar, and, if necessary, the great sacro-sciatic ligaments. And, lastly, either saw through the lateral part of the sacrum behind, or forcibly separate the os innominatum from that bone at the sacro-iliac synchondrosis. The portion of bone detached from the rest of the pelvis may now be laid aside. To facilitate further proceedings, the bladder ought to be moderately distended with air and the rectum with tow or cotton, and a piece of the same material placed in the pouch of peritoneum between the two viscera. After placing the pelvis in a convenient position by means of a small block, and fixing the spine of the ischium (which is free) with hooks, the levatores ani et prostatæ may be cleaned on their outer aspect. The white band of fascia, stretching from the back of the pubis to the spine of the ischium, may be cut through about an inch from the middle line, and laid down, after the continuity of the fascia with the anterior true ligaments of the bladder has been observed. The prostate may now be felt as a firm body encircling the neck of the bladder. A longitudinal incision through the upper surface of the fascia, close to the prostate and bladder, will disclose the venous plexus, and show how the superior division of fascia passes over those vessels to the gland and viscus; on removing the veins, the middle layer may be observed to pass between the bladder and prostate on the one hand, and the rectum on the other, amalgamating with the capsule of the gland in front and posterially ensheathing the vasa and vesiculæ; the lowest division of the fascia may be shewn by removing the levator ani carefully from the external surface of the flap. It will be found convenient at this stage to pass a metal sound or catheter into the bladder, and retain it there during the further steps of the dissection.

The removal of the vesical and prostatic plexus of veins and the processes of fascia from the side of the bladder and gland, and a slight cleaning of the muscular coat of the rectum will expose the relations of the prostate to the bladder, rectum and vesiculæ seminales on one side. It may not be amiss to state that if the perineum have been deeply dissected previously, the relations of the third part of the rectum will have been disturbed; it is therefore advisable to leave the perineum undissected if a lateral view of the pelvis be specially desired. To complete the dissection, the peritoneal pouch may be examined and traced forwards between the bladder and rectum; a gradual injection of the bladder with water will shew the rising and falling of this pouch in accordance with a greater or less amount of distension of the viscus; after which, so much of the membrane as may be redundant may be cut away, and the muscular coat of the side of the bladder with the ureter and vas deferens cleaned. In front the anterior true ligament of the bladder, the two layers of the deep perineal fascia with the dorsal vein of the penis, piercing them a little below the pubic arch, the membranous portion of the urethra with the thin muscular covering of Guthrie's Muscles, the bulb, and the cellular interval between the apex of the prostate and membranous urethra on the one part, and the rectum on the other, should be examined and defined. Cowper's gland will be found as a small hard whitish body by the side of the bulb, and enclosed in the triangular ligament below the urethra; its duct may be traced forward to the bulbous portion of the urethra, by drawing the body of the gland downwards, and putting the duct on the stretch.

Should an entire body be used in making this dissection, some modification in the mode of proceeding is necessary. In such a case, supposing the dissection to be performed on the left side, one incision should be made from the pubes to the umbilicus a little to the left of the middle line, the knife being carried through the integuments and other tissues down to the transversalis fascia; a second should then be directed from the termination of the first cut at the umbilicus, and at right angles to it, to the lumbar vertebræ; and the flap so made

should be laid down towards the thigh without injury of the transversalis fascia or peritoneum. The relations of the peritoneum to the bladder and anterior wall of the abdomen, in connexion with puncture of the bladder above the pubes, may be examined before the parts have been much disturbed; for this purpose the viscus should be injected to a varying extent with tepid water, and the rising and falling of the reflection of peritoneum, according to the amount of fluid contained in the bladder, observed. The transversalis fascia being removed, the peritoneum may be separated from the iliac fossa and side of the pelvis as before. The subsequent steps of the dissection need not be repeated; it will be sufficient to point out that an incision, through the soft tissues down to the bone, must be made over the left pubis before that bone can be sawn through; that the spine of the ischium must be nipped off with the bone-nippers from the interior of the pelvis; and that the soft tissues must be severed while the side of the pelvis with the leg attached is being removed from the rest of the body, care being taken to cut to the left of the middle line so as to avoid injuring the viscera of the pelvis. The preparation and examination of the viscera are already sufficiently described.

The removal of a longitudinal slip from the side of the rectum, so as to expose the mucous membrane of the gut for the last four or five inches of its extent, adds to the completeness of the view to be obtained.

The Prostate occupies the middle line of the body in the front part of the pelvic cavity; it is placed behind the pubic arch, and half an inch, on the average, intervenes between the upper surface of the gland and the lower border of the pubic bones at their symphysis; the distance varies however somewhat according to the dimensions of the pelvis, the size of the gland, and the extent to which the bladder may be distended. In children and boys it is placed almost vertically in the pelvis, and gradually obtains its oblique position as life advances. The anterior true ligaments of the bladder, consisting of the strong anterior portion of the pelvic fascia, are attached to the lower margin of the pubic bones on their posterior aspect, and pass backward on the upper surface of the prostate to the neck of the bladder; they are separated from each other by a median interval or depression, which corres-

ponds to the position of the dorsal vein of the penis, after it has passed into the pelvis, and is about to sub-divide to form the prostatic plexus of veins; the ligaments cover in this plexus and send processes between the individual veins to join the capsule immediately surrounding the prostate; at the neck of the bladder the anterior true ligaments become united to the fibrous tissue of that part, and give origin to the middle longitudinal fibres of the muscular coat, or, as some have more correctly expressed it, the ligaments serve as a medium of insertion of those fibres to the pubic bones. The levatores prostatæ are a pair of muscles, which arise on each side from an oblique line on the posterior aspect of the pubic bones, and proceed downwards to expand on the sides and lower surface of the gland in the manner of a sling. The deep layer of the triangular ligament of the pelvis is one of the divisions of the pelvic fascia; it is attached to the arch of the pubes above, and to the rami of those bones and a portion of the rami of the ischia laterally; below, it degenerates into a layer of cellular tissue which expands over the external surface of the levator ani muscle; this fascia, although connected with the bones above mentioned, is not intimately united to the periosteum covering them, as is the case with the anterior layer, but is continuous with the obturator division of the pelvic fascia; it is pierced immediately below the pubic arch by the dorsal vein of the penis; the prostate lies behind it, and receives from it, about an inch below the pubic arch, a prolongation, which is continued backwards and amalgamates with the capsule of the gland; this layer may be said to form the deep division of the prostatic capsule, above which the plexus of veins are placed; this prolongation of the fascia over the prostate as the urethra leaves the gland, is an arrangement, whereby the canal passes through a firm membrane without the disadvantage of having a defined edge surrounding it at that part. The lower surface of the prostate lies on the anterior surface of the middle third of the rectum, its apex being found on examination from the gut, to be an inch and a half or three-quarters from the anterior margin of the anus, and its base about two and a half inches from the same point; the apex of the gland is separated from the rectum by a slight cellular interval as the gut turns downwards and backwards to reach the anus. If the bladder be empty, or nearly so, the position of the gland and its relation to the rest of the urethra may be ascertained in the living body by passing a catheter into the bladder, and examining the parts by means of the fore finger in the rectum; the finger will detect in front the course of the instrument, covered, but not masked, by the bulb of the urethra; beyond that the catheter may be felt somewhat more distinctly in the membranous

portion of the urethra; and behind this the prostate will be discernible as a slightly prominent body, merging in front and behind into the neighbouring structures; if the bladder be full of urine, the prostate is masked by the distension.

To obtain a correct knowledge of the urethra as it exists in the erect posture of the living body, the dissected pelvis ought to be supported by blocks in such a manner that the tip of the coccyx may be on a plane half-an-inch or so higher than the lower margin of the pubic arch, and the internal surface of the pubic bones look upwards as well as backwards. If the dissection have been made on an entire subject, a just idea of the relations of the parts, in connexion with the passage of the catheter in the horizontal posture of the body, may be formed without any further arrangement. In each case the staff or catheter ought to be removed from the canal, since it alters by its weight the natural course of the urethra.

As it lies embedded in the prostate, the urethra has a direction from the neck of the bladder downwards and forwards; this direction obtains in the immediately succeeding part of the membranous portion, while more anteriorly the membranous portion ascends a little; after passing the anterior layer of the triangular ligament, the urethra takes on a more confirmed ascending direction, being maintained for a short distance in that position by firm attachment of the bulb to the triangular ligament; more anteriorly the urethra continues to ascend in front of the symphysis pubis, and finally droops down with the penis, in the flaccid state of that organ. In this manner the whole course of the healthy urethra forms two curves; the one commencing at the neck of the bladder and terminating at the bulbous portion, having its concavity opposite the pubic arch; the other commencing with the bulbous portion and terminating at the external orifice, with the convexity directed towards the perineum. By raising the penis parallel with the abdomen, the whole canal forms one curve, having the concavity upwards. In catheterism, when the tip enters the perineum, it is necessary to raise the handle of the instrument to the abdomen, its concavity being uppermost, so that its axis may be adapted to the direction of the urethra as it exists at the fixed bulbous portion. When the urethra has passed forward through the anterior layer of the triangular ligament, it dilates into a small

pouch, the sinus of the bulb, placed below and a little behind the level of the membranous portion immediately continuous with it, and about an inch below the inferior border of the pubic arch at its symphysis; this pouching of the canal is caused partly by its dilatation, and partly by the rising up of the triangular ligament at that part, in such a manner as to constrict the urethra a little as the membrane is being reflected forwards. To evade the obstacle which this dilatation and natural constriction entail, it is necessary to lower the handle of the instrument to a right angle with the axis of the body before passing it on; should it, however, fail to pass, (being entangled in the sinus, and pressing against the margin of the ligament) it must be withdrawn a little, and then passed on with the tip gently pressed against the upper wall of the canal; this again failing, pressure, on the perineum over the urethra and the instrument, will elevate the tip and guide it into the membranous portion. Should the instrument be *forced* onwards with the handle depressed at this stage, the mucous fold laid over the projection of the triangular ligament will be lacerated; if pushed on without depression of the handle, the instrument will be thrust through the fold into the perineum. The catheter, if lightly guided by the hand, will pass freely along the membranous portion; unless the compressor urethræ muscle be in a state of spasm, this part of the canal offers no natural obstacles; owing, however, to its firm connection at both of its extremities with the layers of the triangular ligament, it has, unless braced up by the compressor muscle, a tendency to gravitate downwards towards the middle, thus forming part of the curve already described as having its concavity looking towards the pubic arch; it is consequently necessary to continue the lowering of the handle of the catheter as it is being passed forwards, to adapt the curve of the instrument to this condition of the membranous urethra. Where the posterior layer of the triangular ligament is reflected backwards on the prostate, a slight narrowing of the urethra obtains; this constriction may present a little impediment to the catheter; if so, a slight retraction of the instrument, before passing it on further, will suffice to clear the difficulty. From the apex of the prostate to the neck of the bladder, the urethra gradually ascends; it is therefore necessary to depress the handle of the catheter to a level with the patient's thighs, or a little lower, to guide it into the viscus; other points connected with the passage of the catheter through the prostatic urethra and neck of the bladder, will come into consideration subsequently. Owing to the connection of the prostate to the triangular ligament and anterior true ligaments of the bladder, the gland with the urethra passing through it, and the neck of the bladder, are very firmly

connected to the pubic bones, so that no movement which could interfere with the patency of the urethra can take place.

Although I have described the connections of the urethra, as regards the passage of an ordinary curved instrument only, it is proper to state that a straight instrument, the lithotrite for example, can easily be passed into the bladder by a dexterous hand acquainted with the natural obstacles and the mode of evading them.

The peritoneum, passing continuously from the abdominal walls and iliac fossæ, adheres to the superior fundus and sides of the bladder; the lateral reflections of this membrane do not require any particular notice here. Examining the course of the membrane from the internal aspect of the abdominal walls, it passes backwards over the umbilical ligament to the upper surface of the bladder, and thence along the posterior surface to the free extremities of the vesiculæ seminales, where it adheres to the bladder laterally, being, however, continued forwards in the form of a pouch between those bodies as far as the base of the prostate in the contracted bladder; the lateral attachments at this part, form two elevations or folds, called the posterior false ligaments of the bladder; the forefinger placed in the pouch ascertains that the concavity of the bag looks towards the rectum, the convexity or external surface towards the prostate, and that the peritoneum is reflected from the base of the bladder to the anterior surface of the rectum. In the dissection, I have recommended injection of the bladder, for the purpose of shewing the effect of the rising and falling of that viscus on the reflections of the peritoneum passing from the abdominal walls to the bladder, and from the bladder to the rectum. When the bladder is empty, the reflection of peritoneum from it to the abdominal walls falls with the contracted viscus into the pelvis; when fully distended, the bladder rises from the pelvis into the abdomen, and carries up with it the reflection of the membrane, a portion of the anterior surface of the viscus, uncovered by peritoneum, presenting itself opposite the abdominal walls, just above the upper margin of the pubic bones; the extent to which this rising of the peritoneum takes place varies, being entirely dependent on the quantity of fluid in the bladder; the greatest height to which the reflection is elevated above the upper margin of the pubic bones, by extreme distension of a healthy bladder, appears to amount to two inches or a trifle more, leaving a space of the front wall of the bladder uncovered by peritoneum to the same extent, and adapted for puncture above the pubes. When the neck of the bladder has been elevated from the rectum by an enlarged prostate, and the viscus itself is dilated and much

distended, this space becomes much larger. It is commonly stated that the recto-vesical pouch of peritoneum approaches *very nearly* to the base of the prostate in the highly contracted state of the bladder—in fact, it is said, it may approach within half-an-inch of that point. I have myself seen it several times so near the base of the prostate, that no interval could be said to exist; this is probably of little moment, since puncture of the bladder by the rectum is only performed when the bladder is distended to the utmost with retention of urine, and the pouch removed upwards by the overloaded viscus; nevertheless, it deserves to be mentioned, as all facts relating to the position of the serous membrane to the bladder are of importance. I have not seen any instance, in which the utmost distension of a moderately sized bladder removed this pouch more than an inch-and-a-half from the base of the prostate; still there can be no doubt, that it is further removed in the case of larger bladders, enormously overloaded—the only conditions under which puncture by the rectum can be required. The space between the vesiculæ will be described with the base of the bladder. It has been proposed to tap the recto-vesical pouch of peritoneum from the rectum, in those rare cases where the bladder has been ruptured and the urine extravasated into the serous sac; it would appear to be a very feasible operation, but I am not aware that it has ever been done.

The pelvic fascia of each side is marked by a thickening in the shape of a dense white line running from the lower and posterior part of the pubic bones to the spine of the ischium. This line indicates the division of the fascia into two layers, one of which covers the internal aspect of the obturator muscle, and is thence called "obturator" fascia; the other is laid over the inner surface of the levator ani, and is called "recto-vesical" on account of its furnishing coverings to the bladder and rectum. From the contiguous surfaces of these two divisions the levator ani arises, and causes by its attachment there the aponeurotic thickening. The recto-vesical fascia, after lining the inner surface of the levator ani, divides into three processes. The superior of these passes over the vesical and prostatic plexus of veins to the prostate and bladder; in the former it is continuous with the anterior true ligaments, and is lost in the capsule of the gland; in the latter it passes upwards and degenerates into cellular tissue. The middle layer passes below the venous plexus; anteriorly it amalgamates with the capsule of the gland; posteriorly it furnishes a process, strong and aponeurotic in front, but weaker behind, which invests the vesiculæ seminales and terminal portions of the vasa deferentia; this investment of the vesiculæ

and vasa separates those bodies from the rectum, and is continued into a similar process derived from the other side. A third division of the recto-vesical fascia passes upon the rectum, which it ensheaths.

The connections of the posterior layer of the triangular ligament, and the anterior true ligaments of the bladder, have been previously mentioned.

ANATOMY OF THE PROSTATE.

It is necessary to remove the prostate, with the bladder, vasa and vesiculæ, from the body, in order to obtain a knowledge of the particular connections of the gland with those organs.

The most common mode in use at post-mortem examinations, where the prostate and bladder alone may be required, has been to cut the urethra through, close to the posterior layer of the triangular ligament within the pelvis, and then to separate the prostate, &c., from the surrounding parts, as much as possible with the fingers, and by the knife where necessary. This method saves a good deal of external mutilation about the pubes and perineum, but cuts the urethra off rather short. It is, therefore, better to remove a portion of the pubic bones (say an inch on each side of the symphysis) along with the parts desired ; this may pretty easily be done by sawing vertically through the pubic bones, cutting through the spongy portion of the urethra and vascular bodies at the root of the penis, passing a knife through the cut margins of the bone downwards, to sever the connections of the triangular ligament, and carrying it transversely between the urethra and the rectum ; the front part of the portion to be removed from the body being stretched upwards and backwards by the hand, it may now be partly cut and partly separated by the fingers from the rest of its attachments. The parts connected to the pubic arch may again be examined, and then dissected off for convenience sake. An incision may be made into the bladder at its superior fundus, the viscus stuffed with hair or tow and the opening sewn up. On the upper surface the anterior true ligaments may be dissected off and

the prostatic plexus of veins examined; the connexion of the gland to the muscles of the bladder should be observed. The base of the bladder, with the vesiculæ and vasa, and their relation to the prostate may be shewn by removal of a quantity of dense tissue, derived from the recto-vesical fascia. To discover the third lobe as it is seen on this aspect, it is necessary to dissect the vasa and vesiculæ from the base of the bladder. and throw them forwards; the third lobe, if present, will appear as a round hard and white body placed between the posterior extremities of the lateral lobes, and below (in this position) the commencement of the ejaculatory ducts. The other relations of the third lobe will be seen afterwards.

The form of the prostate has been compared to that of a Spanish chesnut, which indeed it very much resembles. It is triangular in shape, the base of the triangle being attached to the neck of the bladder, from which the two sides converge to the apex anteriorly. (Pl. I.) It presents for examination two surfaces, one anterior looking towards the arch of the pubes, the other posterior resting on the rectum; two sides; a base and an apex. The base is rounded and rather thick, having a notch (or interval between the lateral lobes) in the middle line, whence it has been compared to the heart of the playing card; this notch exists both on the upper and lower surface; above, it is filled up by submucous tissue and part of the muscular apparatus of the bladder; below, it is bridged over by the capsule and receives the seminal ducts. (Pl. I. D.D.) The sides, (Plates 1. 3. A.A.) consisting of the lateral lobes, are rounded and prominent, thicker opposite the interval between the neck of the bladder and the openings of the ejaculatory ducts in the urethra, terminating posteriorly in a rounded extremity, and anteriorly gradually thinning off towards the apex of the gland. The upper surface is smooth and slightly convex; in young persons it is impressed with a central longitudinal furrow corresponding to the urethra. The lower surface (Pl. I.) is also smooth, but flat; it is marked in front by a central depression, (E.) indicating the course of the urethra, and behind by two smaller secondary furrows (D.D.) which merge into the principal one about the middle of the gland; the latter pair of furrows correspond to the course of the ejaculatory ducts, and define the extent of the lateral lobes on their inner aspect. All these depressions are more or less obliterated in enlarged specimens of the gland.

The lobes of the prostate are usually described as three in number; two lateral and one middle lobe. Not that there is any particular lobulation to be observed in the general contour of the adult gland, but partly because in the fœtus and certain animals there are observed two distinct lateral lobes, which in man are joined together in the middle line, and completed by the growth between their posterior extremities of the third lobe; and partly because the enlarged gland presents, in many cases, a lobulated appearance on its urethral aspect, having the character of two lateral lobes and a middle lobe intermediate between them at the neck of the bladder. In the adult the lateral lobes are joined by a process of glandular substance crossing the urethra, and called the isthmus of the prostate. (Pl. I. E.) Since the external characters of the gland are entirely due to the lateral lobes and the isthmus connecting them to each other, any description of them beyond that of the general form of the gland would be superfluous.

The third or middle lobe (Plate 2, fig. I. A., fig. II. C.) deserves, on many accounts, a particular consideration. It performs the part of the "isthmus" in connecting the posterior extremities of the lateral lobes together, in the space contained between the neck of the bladder and the termination of the ejaculatory ducts. Above, it is bounded by the neck of the bladder and contiguous portion of the urethra; below, and in front, it lies on the ejaculatory ducts and utricle; laterally and anteriorly it is inseparably connected to the lateral lobes and their isthmus; and, posteriorly, it bulges out between the lateral lobes in the form of a white rounded mass, (Fig. II. at M.) when it is of unusually large size. In persons under 20 years of age with healthy prostates, the middle lobe is not usually found to protrude between the extremities of the lateral lobes.

In the subsequent pages I shall have to shew how this portion of the prostate swells up at the neck of the bladder and prevents complete evacuation of that viscus; indeed, had it not been that it was subject to an enlargement of a most dangerous nature on account of its connection with the neck of the bladder, the middle lobe would never have been thought worthy of special mention, and would have been looked upon merely as the posterior portion of the isthmus.

So far as I can ascertain, John Hunter first drew attention to it in this country as "a small portion (of the gland) which lies behind the very beginning of the urethra, (and) swells forward like a point into the bladder."* Morgagni was evidently well acquainted with the anatomy and pathology of the part; he

* Hunter on the venereal disease. Page 182.

describes the third lobe as a smooth roundish body, lying prominent between the bladder and the ejaculatory ducts;* and mentions cases in which he shewed the continuity of valvular protuberances at the neck of the bladder with the substance of the prostate.† More lately, and more completely, Sir E. Home drew attention to this lobe and the results of its enlargement; pointing out the mode of dissecting off the vesiculæ and vasa so as to shew its rounded lobular appearance at the base of the bladder. Undoubtedly, the credit of giving a more particular account of these parts in health and disease, than had previously appeared, is due to Sir Everard Home.

In all cases which I have examined, the part of the third lobe, which is seen by throwing forwards the vesiculæ and vasa, has been rounded, hard and white, differing in no essential point from the rest of the gland in its external appearance; if it be developed from mucous follicles, embedded in dense submucous tissue, as I shall afterwards endeavour to shew, its firm external character is sufficiently accounted for, while the intimate connection of the fibrous tissue of the neck of the bladder with the capsule of the prostate renders the inseparable connection, which obtains between the middle and lateral lobes, a matter of no wonder. In fact, the denseness of its external surface is due to its being covered by a sort of capsule, derived from the fibrous tissue of the neck of the bladder. The difference between this lobe and the rest of the gland is, that the lateral lobes are visible at an early period of fœtal life, while the middle one does not come prominently forward, except in adults and older persons.

When the middle lobe is small, its ducts and their orifices are scarcely visible to the naked eye; but if this part of the gland be large, and especially if the enlargement be due to glandular Hypertrophy, the ducts are proportionately increased in size, and may be seen to pass forwards to discharge themselves by two or three large orifices, behind the posterior extremity of the verumontanum.

Behind the prostate, and on the under surface of the bladder, lie the vesiculæ seminales and the terminal portions of the vasa deferentia,—(Plate I.) These bodies are enclosed in a process of the recto-vesical fascia, and connected to the bladder by a quantity of tenacious cellular tissue. The pair of vesiculæ (B.B.) lie on the outer side of the vasa (C.C.), which are closely connected to the former bodies, each vas deferens to its corresponding vesicula. Each vesicula consists of a tube, about

* Adversaria Anatomica. Animadv. XV.

† Seats and causes of disease. By Cooke. Lond. 1822.

five inches in length, coiled up in such a manner as to form a body about two and a half inches long, by half or three-quarters of an inch broad; this body is not, however, equally broad throughout its extent, but gradually diminishes in diameter from its posterior to its anterior extremity; this narrowing of the vesicula in front is due to the actual diminution in diameter of the tube and the subsidence of its convolutions anteriorly. Behind, the vesiculæ in their natural state terminate in a round free extremity; in front, they join with the vasa deferentia to form a single pair of ejaculatory ducts. The vasa deferentia at the base of the bladder become dilated and convoluted, but again diminish in diameter as they approach the notch of the prostate and are about to join with the vesiculæ to terminate in the ejaculatory ducts; throughout this part of their course they are closely applied to the inner side of the vesiculæ. Posteriorly, the pair of vasa and vesiculæ lie at some distance from each other; anteriorly, they converge to the notch of the prostate; in this manner they bound a triangular space at the base of the bladder, which is interesting on account of being the part of the viscus, which is pierced in puncturing the bladder from the rectum; the third side of this triangle is formed, in a surgical point of view, by the reflection of the peritoneum from the bladder to the rectum. Generally, but not always, this space is free from fat. A knowledge of the dimensions of this triangle is of great importance to the surgeon, and more especially so, since it varies at different times in the same subject. At the broadest part, opposite the free extremities of the vesiculæ, the space measures from one inch to an inch and three-quarters; in front, it gradually diminishes, so that the vasa lie as nearly parallel as possible just behind the prostate; the peritoneal pouch, formerly described, encroaches, to a varying extent, on this space from behind forwards. When the bladder is empty and contracted, the triangle is obliterated, or almost so, for all surgical purposes. Fortunately, puncture of the bladder is only called for in circumstances the most favourable to its success; I mean extreme distension of the viscus. Distension of the bladder causes that viscus to rise from the pelvis and draw up the peritoneal pouch, leaving the anterior part of the space uncovered by serous membrane; moreover, the dilated bladder separates the vasa and vesiculæ a little, and increases the lateral dimensions of the space. The apex of this triangle is about 2½ inches from the anterior margin of the anus.

The vasa deferentia consist of three coats. The external covering consists of fibrous tissue derived from the recto-vesical fascia. The middle one is muscular and elastic, being composed of longi-

tudinal fibres with an intermediate circular and oblique layer. The internal coat is the mucous lining; this membrane, throughout the greatest part of the tube, is marked by longitudinal folds; where the tube becomes dilated and convoluted at the base of the bladder, the mucous membrane takes on a reticulated character, assimilating itself to the nature of the vesiculæ.

The vesiculæ seminales are composed of the same elements as the contiguous portions of the vasa, viz.: an external fibrous investment, which supports the convolutions; a middle muscular and elastic "proper" coat; and an internal brownish mucous membrane, highly reticulated and vascular, presenting the same honeycomb appearance as is found in the gall-bladder.

As was already mentioned, the vasa deferentia unite with their corresponding vesiculæ to form a pair of ejaculatory ducts.

To trace the ejaculatory duct through the substance of the gland, it will be found advantageous to select a specimen which has been for some time hardened in spirit. The first step is to make an incision through the upper surface of the gland and neck of the bladder, to expose the prostatic urethra (Pl. 3); about three-quarters of an inch in front of the neck of the bladder, the opening of the utricle (a structure which will be described subsequently) presents itself (E); this ought to be carefully stuffed with a little fine cotton. A small (Pl. 2, fig. II) opening should be made into the vas deferens and vesicula of the side to be dissected, and a bristle or very small wire passed through it and along the ejaculatory duct to protrude in the urethra by the side of the utricle. The lateral lobe should now be carefully dissected away from the side of the duct, commencing at the base of the prostate where the duct enters the gland, and following it upwards and forwards to the urethra. The duct crosses the utricle near the urethra. The utricle ought to be defined. That part of the prostate which lies above the utricle and ejaculatory duct is the third lobe.

At the notch of the prostate, each pair of vesiculæ and vasa, having lost their convolutions and a good deal of the thickness of their coats, unite at an acute angle to form an ejaculatory duct, (Pl. I.) In this manner two ducts are formed. They pass forwards and upwards (Pl. 2, fig. II.) between the middle (C)

and lateral (B) lobes of the prostate to reach the sides of the utricle (above G), are connected to the walls of that body as they lie along it, and finally discharge themselves by a pair of slit-like orifices on the floor of the urethra, (Pl. 3, E.) They gradually approach each other in this course, and their orifices are placed on each side of the mouth of the utricle; occasionally, but rarely, the openings of the ejaculatory ducts discharge themselves into the cavity of that body. As they advance towards their termination, the calibre of the ducts diminishes in a marked manner. They differ essentially in many respects from the vasa: their mucous lining is much smoother; they are quite free from convolutions; and their external coat is so thin as to be inappreciable to the naked eye; in fact they are true ducts, while the vesiculæ and contiguous portions of the vasa serve more important purposes. Kolliker* and Mr. Henry Hancock† have shewn that the ejaculatory ducts are surrounded by muscular and elastic fibres, continued from the vasa.

That portion of the urethra which is surrounded by the prostate gland (Pl. 3) extends from the neck of the bladder to the posterior layer of the triangular ligament, where the membranous portion commences. In the adult, this part of the canal is fifteen lines in length and four in breadth on the average. Its diameter, however, is greater in the middle opposite the prostatic and ejaculatory orifices; less at the neck of the bladder and triangular ligament, being constricted in the former place by a quantity of dense and comparatively inelastic tissue disposed around the vesical orifice, in the latter, by the posterior layer of the triangular ligament as it is reflected backwards to form the prostatic capsule. It is generally stated, that the urethra lies at a distance of two lines from the upper and four lines from the lower surface of the gland. These measurements are by no means constant; according to my observation, they are pretty regular in the prostates of young persons of 18 to 22 years of age, while in older individuals the amount of glandular tissue above the urethra equals, and occasionally rather exceeds, that below the canal.

If the gland be cut through transversely at its front part, the urethra is found to present a triangular form, the apex of the triangle being below, the base above.

This is the most dilatable portion of the urethra; if a bladder be opened at its fundus, the little finger can, with some facility, be passed through the vesical orifice into the urethra; by doing so

* Kolliker's Human Histology, Vol. ii., page 232. (Sydenham Soc. Edit.)

† Hancock on Stricture, page 12. Lond. 1852.

it may be noticed that the neck of the bladder is more contracted and less dilatable than the urethra in front. The firm capsule of the prostate does not at all participate in this capacity for dilatation; it would appear that the dilating medium compresses the glandular structure against the internal aspect of the capsule. The mucous coat is abundant, and thrown into longitudinal folds when the canal is collapsed; moreover, a large quantity of yellow elastic and other tissues, adapted to permit dilatation and contraction of the canal, is laid beneath the mucous lining. There is, of course, a limit to this property, which is a matter of great interest to lithotomists; experiments on the dead body shew that attempts at extensive dilatation after a slight incision in the gland merely tend to split up the prostate in the direction of the cut; nevertheless, it has become an established practice to make a slight incision first, and extend the wound in the gland with the forefinger afterwards, as being less likely to injure the recto-vesical fascia, and favour infiltration of urine, than a free use of the knife.

On laying open the bladder and prostatic urethra by an incision along their upper surface, the general and particular characters of the mucous membrane lining them may be observed:

The membrane lining the bladder is of a pale pink hue, and loosely attached to the tissues below, over the greater part of the viscus: it is continued along the ureters backwards to the kidneys, and along the urethra forwards to the external meatus where it merges into the skin. The mucous coat of the prostatic urethra is of a pale tint; it is continuous with the vesical layer and with the membrane lining the reproductive glands. When the bladder and urethra are contracted the mucous lining is thrown into folds; in the former the folds are sinuous, velvety and numerous, in the latter they run longitudinally from the neck of the bladder forwards. A quantity of mucous follicles, numerous at the neck of the bladder, more sparing at other parts, permeate this coat.

Owing to peculiarities in the disposition of the submucous tissues at the floor of the bladder and prostatic urethra, and to the inversion of the mucous coat along some ducts and lacunæ, certain structures of remarkable interest are found at this part. Taken in order from behind forwards, the trigone (Pl. 3. C.C.–B.) comes first into consideration.

The trigone is a triangular space at the base of the bladder remarkable for the uniform smoothness and firm attachment of the

mucous membrane laid over it, and denseness of the subjacent tissues. One angle is anterior and placed at the neck of the bladder behind the uvula; the others are posterior and lateral, corresponding to the ureteric orifices. The distance between the angles is about an inch-and-a-half, so that it pretty nearly represents an equilateral triangle. Its dimensions, however, are in some measure dependent on muscular action, and are consequently found to vary a little. The mucous membrane covering it is never found to be thrown into folds like the rest of the bladder; when the trigone is diminished in size by muscular action, it is merely thrown into a series of very fine wrinkles, converging in front to the neck of the bladder. The orifices of the ureters are oval or slit-like, their long axes being directed inwards and forwards. The sides of the trigone are defined by a pair of muscular bands passing from these orifices to the neck of the bladder; the base is formed by a transverse band connecting them together. It forms with the neck of the bladder the most sensitive portion of the viscus. The triangular space between the vesiculæ, previously mentioned (page 20), corresponds to it.

The uvula is a small eminence situated at the mouth of the bladder, immediately in front of the anterior angle of the trigone (Pl. 3. B). It is smooth, roundish, and of a varying size. Below, it corresponds to the insertion of the muscles of the ureters, the dense fibrous tissue of the neck of the bladder and the middle lobe of the prostate; in the healthy bladder it appears to be more or less marked according to the degree to which Bell's muscles are contracted; in disease it may be the seat of fibrous hardening and enlargement, as shewn by Mr. Guthrie; or it may be encroached on by a growth from the middle lobe of the prostate. It represents the boundary line between the bladder and the urethra.

Third in order, counting from the bladder forwards, appears the eminence of the verumontanum, placed on the floor of the prostatic urethra. (Pl. 3. B.D.E.) It consists of a longitudinal crest or ridge rising gradually at the neck of the bladder, and expanding about three-quarters of an inch in advance of the uvula into a small bulbous eminence, in the middle of which is the opening of the utricle with the orifices of the ejaculatory ducts on each side of it; in front of this it again subsides into a central longitudinal fold, which is continued as far as the membranous portion of the urethra, where it terminates by a bifurcation. At its most prominent point it measures a line and a half or three-quarters in height.

On each side of the verumontanum is a deep concave depression or gutter, on which the greater part of the prostatic ducts open. This is the sinus prostaticus. The mouths of the ducts

may be shewn by squeezing the recent gland, so as to make the prostatic secretion exude from them. They are fifteen or sixteen in number, more or less according to the development of the glandular tissue; in the same way they vary in size, the largest of them in the healthy gland being merely visible to the naked eye; when the gland is hypertrophied, the diameter of the orifices and the ducts leading to them becomes remarkably increased. For the most part, they open on each side of the most prominent part of the verumontanum; those from the middle lobe, however, are found behind that point, completing a horse-shoe form in which they are arranged.

The utricle is a small cavity, which opens on the most prominent part of the verumontanum by an orifice compressed from side to side, and consisting of a pair of lateral lips; the orifices of the ejaculatory ducts are placed on each side of it. (Pl. 3, E.) The body of this organ is exposed in the lateral dissection of the prostate made in following the ejaculatory ducts to their termination. (Pl. 2, fig. II. G.) It is usually found as an oval or rounded sacculus, averaging four lines in length by two in breadth, placed below the middle and between the lateral lobes of the prostate; its axis is directed from behind, forwards and upwards to the urethra; towards the orifice it is constricted a little in the form of a neck; a No. 4 catheter, and sometimes a No. 6, can be insinuated through the mouth and neck into its cavity. It consists of an inversion of mucous membrane, (interspersed with numerous minute follicles, said to secrete a matter like cerumen,) and of a subjacent layer of thin but tough fibrous tissue, stronger at the neck than in the body of the organ; the ejaculatory ducts are connected to its sides for a short distance previous to their termination; I have observed a thin muscular band from the central fibres of the detrusor urinæ pass below the middle lobe to be inserted into the fibrous coat. It is commonly stated that a small catheter, if improperly introduced, may be arrested by the utricle and cause serious injury to the patient, should sufficient force to produce laceration be used; if the instrument to be introduced be of the usual kind and passed in the ordinary manner, its tip will be guided to the bladder along the upper surface of the urethra, and consequently, escape the remote chance of being implicated in the orifice; I am not aware of any instance on record of such a mishap occuring to the utricle.

In a physiological point of view, the utricle is one of the most interesting structures in the body. It has been shewn by E. H. Weber* and others, to be the analogue in the

* Muller's Archives, 1846.

male of the uterus; the ejaculatory ducts, corresponding to the Fallopian tubes, opening on the margins of its lips and sometimes even into its cavity.* In man the utricle merely remains as the vestige of a previous rudimentary organ, and it does not appear to serve any particular purpose. Although not generally more than four lines in length by two in breadth, it varies much in size; it has been observed in some instances to reach three-quarters of an inch or an inch in length, and on the other hand to be so small as to be barely perceptible.

The prostate is connected to the neck of the bladder by muscular and fibrous tissues, and mucous membrane. The continuity of the mucous coat of the bladder with that of the urethra has already been shewn. The arrangement of the muscular and fibrous tissues remain to be described.

The external layer of the muscular coat of the bladder consists of longitudinal and oblique fibres; the former, from their strength and attachment, are usually accounted a separate muscle, under the name of "detrusor urinæ", which consists of the central fibres of the external layer; above, it takes origin from the anterior true ligaments of the bladder, and by means of them from the posterior aspect of the pubic bones (page 10), from the urachus, the upper surface of the prostate and the neighbouring submucous tissue; coursing backwards over the superior fundus to the base of the bladder, it is attached to the submucous tissue of the organ behind the prostate, to the prostatic capsule in part, and to those accumulations of tissue which elevate the mucous membrane into the uvula and verumontanum. Mr. Guthrie first described the attachment of certain fibres of the detrusor to the structures composing the uvula and verumontanum. In a well marked specimen there is no difficulty in shewing, by a lateral dissection, the attachment of a small band to the fibrous coat of the utricle. The lateral fibres of the external coat run an oblique course, being connected to the submucous tissue and capsule at the base of the prostate.

The arrangement of the circular fibres of the muscular coat, which Sir C. Bell considered to act as a sphincter around the vesical orifice, may be seen by making an incision into the fundus of a bladder, inverting it and dissecting the mucous membrane carefully away from around the urethral aperture.

* The development and comparative anatomy of the utricle will be found fully described in the articles "Prostate," by Mr. Adams, and "Vesicula prostatica," by Leuckhardt, in the Cyclopædia of Anatomy and Physiology.

On the upper surface of an undissected prostate the continuation of these fibres around the urethra may be shewn by careful removal of the anterior true ligaments and detrusor urinæ, commencing at the neck of the bladder and following the circular fibres forwards. If the urethra be opened they may be followed by delicate removal of the mucous membrane, and a longitudinal layer of tissue prolonged from the trigone and muscles of the ureters along the urethra. In front of the opening of the ejaculatory ducts it is necessary to use minute examination to trace them on.

At the neck of the bladder the circular muscular fibres become aggregated together into two crescentic layers, placed respectively above and below the vesical aperture. Sir Charles Bell described them as performing the part of a sphincter.* At present, however, this opinion is not commonly received. Kolliker and Mr. Henry Hancock have traced these fibres forward encircling the prostatic urethra. Mr. Hancock† states that the internal layer of the muscular coat of the bladder is continued forwards through the prostatic urethra; that the outer layer "passes forwards on the outside of the prostate gland, and laterally and inferiorly joins the fibres derived from the inner coat in front of the prostate gland, to assist in forming the organic muscular covering of the membranous portion of the urethra;" the longitudinal fibres on the upper surface being attached to the pubic bones, as mentioned previously; after investing the membranous portion of the urethra (distinct from the compressor urethræ), Mr. Hancock represents them as dividing into two layers, one of which lies beneath the mucous membrane of the urethra and some areolar tissue, while the other is placed between the vascular tissue and fibrous investment of the corpus spongiosum; at the extremity of the urethra the two layers again unite, to form the dense tissue surrounding the external urinary meatus. I must admit that I have been unable to trace the external layer of the muscular coat of the bladder on the outside of the prostate, in the manner mentioned by Mr. Hancock; it appears to me that they terminate on the under surface of the bladder in the submucous tissue as already described.

The ureters, outside the bladder, are covered by an external longitudinal coat, particularly well seen in cases of hypertrophied

* Sir C. Bell on Diseases of the Urethra, &c. Lond. 1822. Page 9.

† Hancock on Stricture. Lond. 1852. Page 14.

bladder; these external fibres are inserted variously, one set being attached to the submucous vesical tissue around the orifice; another are lost among the general muscular coat of the bladder; while a third set are prolonged forwards, reinforced by additional fibres, and terminate at the neck of the bladder by a kind of tendinous attachment connected to the uvula; the muscles of the ureters within the bladder were first particularly described by Sir Charles Bell, and are still called Bell's muscles. They are particularly well marked in certain cases of hypertrophied bladder. (Pl. 4, M.M.) They define the sides of the trigonum vesicæ. From the uvula a thin stratum of longitudinal fibres, continuous with the tissues of the trigone, and composed of elastic and muscular fibres, pass forwards along the urethra, between the mucous coat and circular muscular fibres derived from the bladder.

Immediately beneath the mucous membrane of the prostatic urethra, and mixed up with the tissues already described as found there, is a longitudinal plexus of veins; these, when injected, form a pair of columns, one on each side of the urethra, and having a sort of groove between them; at the utricle they are continuous with a similar vascular layer, mixed up with the submucous tissue of the verumontanum in the middle line; anteriorly they form a pair of columns throughout nearly the whole of the urethra; behind, the columns with the vascular element of the verumontanum are continuous with the veins of the base of the bladder. It is supposed that congestion of this erectile tissue, prominent in all directions behind the utricle, and having a groove anteriorly, favours the onward flow of the reproductive fluids, and shuts up the neck of the bladder behind.

The verumontanum, at its most prominent part, is elevated by the mouths of the ejaculatory ducts and utricle. The tissues below its mucous membrane consist of elastic and muscular fibres with erectile tissue, already mentioned, and prostatic glandular structure.

Below the longitudinal and circular fibres of the prostatic urethra comes the substance of the gland itself.

Binding together the muscles of the bladder is a fibro-elastic submucous tissue; this element is rather delicate and very elastic at other parts of the organ, but at the neck of the bladder it becomes much stronger and less capable of undergoing dilatation; it is here firmly united to the capsule of the prostate and its interglandular processes.

Thus, tracing the connection of the gland with the neck of the bladder from without inwards, we have, first the longitudinal muscular coat of the bladder, inserted in part into the capsule of the prostate; next, the submucous tissue of the bladder intimately

united to the same; afterwards the circular muscular coat continued forwards through the prostatic urethra; then a longitudinal layer of musculo-elastic tissue continued from the trigone along the urethra; and most internally, the mucous membrane of the bladder continuous with that of the urethra. Finally, the ducts of the prostate pass through these various tissues, as they are found on the floor of the urethra, to terminate on the mucous coat.

Externally, the prostate presents remarkable firmness and consistency, owing to the strength of its capsule; if this covering be removed, the internal surface can be easily lacerated. The capsule of the prostate is usually described as being furnished to the gland from the fasciæ of the pelvis, (page 15); it consists of two layers, an external and internal, between which, on the upper surface and sides of the gland, the prostatic plexus of veins lies; from the internal aspect of the capsule processes pass around the glandular follicles and ducts, and are connected to the submucous tissues of the urethra; these processes consist of unstriped muscular fibres, with white fibrous and yellow elastic tissues, and sometimes constitute the greater part of the substance of the gland.

On section, the cut surface of the prostate presents either a cribriform, or shining vesicular appearance; the former appearance is seen when a longitudinal vertical section is made through a lateral lobe, the ducts of the gland being principally cut across; the latter is best seen by a cut carried obliquely downwards and outwards from the urethra, when some of the glandular structure, with the ducts belonging to it passing inwards to the urethra, may be observed. Many of the ducts run obliquely under the mucous membrane for a short way, in their course to the verumontanum; other pass directly to their destination. An opaque whitish fluid may be squeezed from the cut surface. It will be noticed that the substance of the prostate is made up of two structures, a soft yellowish series of vesicles and their ducts, and a more or less firm tissue laid between the glandular matter and connecting it together; a satisfactory examination may be made by taking a piece of a young prostate, and delicately unravelling the interglandular tissue from one or more vesicles with a pair of needles, when the minute appearance of each element may be observed. Mr. Quekett has injected the glandular substance and described the arrangement which it follows; the minute structure has also been described by Weber, Muller, Kolliker, and Dr. C. H. Jones. The orifices of the ducts have already been seen to open on the floor of the urethra (Pl. 3); these ducts are 14 or 15 in number, and average from $\frac{1}{8}$ to $\frac{1}{4}$ of a line in diameter; each of them branches into smaller tubes

which radiate in the body of the gland and terminate in ultimate vesicular expansions; these vesicles are fifty or sixty in number; they are said to average from $\frac{1}{170}$ to $\frac{1}{100}$ of an inch in diameter, but are liable to great variety in this respect from morbid changes; each vesicle has a general spheroidal form, and presents on its external surface a series of diminutive globular elevations, corresponding to internal cup-like depressions, which are doubtless calculated to increase the secreting surface. The vesicles are lined by a flat, the ducts by a columnar epithelium; the capillary blood-vessels form a network around the vesicles and ducts, being supported by the internal processes of the capsule and their intervesicular continuations. The vesicles and tubes, which are connected with any one principal duct, do not communicate with those belonging to another.

NERVES AND VESSELS.

The prostate is supplied with nerves from the inferior hypogastric plexus of the sympathetic system; these plexuses receiving white filaments from the second, third, and fourth anterior sacral nerves of the spinal system, but chiefly from the third. The prostatic filaments lie between the gland and the levatores ani et prostatæ in their passage forwards; in addition to the prostate these nerves supply the vesiculæ seminales in part, and the corpora cavernosa of the penis. The bladder also derives its nerves from the same source, the white filaments, which are mixed with the sympathetic branches and arise from the anterior divisions of the sacral nerves, being principally distributed to the neck of that organ and the prostatic portion of the urethra; this arrangement accounts for the increased sensitiveness of those parts, and also, in virtue of reflex action, for the sympathetic pains felt in the loins, testicles, and at the end of the penis in certain diseases, whose seat is at the neck of the bladder or its immediate vicinity. The minute distribution of the nerves is not known.

The arteries are supplied from the internal iliac trunk. The principal artery of the prostate is the vesico-prostatic or lowest vesical; it arises from the anterior division of the internal iliac, and passes forwards to the lower part of the sides of the bladder; here it gives off vesical branches, and passes forwards on the prostate dividing into branches, which supply the gland and anastomose with twigs from the opposite side above the prostate; in rare cases communicating branches of some size have been observed to pass below the prostate; in front it is generally

found to communicate with the arteries of the bulb derived from the internal pudic. Mr. Spence* has observed several cases in which the prostatic artery passed to the apex of the gland without dividing into minute branches; I have seen one case of this kind in which the artery was of comparatively large size; unfortunately, it did not come under my notice until the subject had been too far dissected to trace its ultimate distribution. Mr. Quain† mentions an instance in which extensive hœmorrhage after lithotomy arose from the smaller arteries of the prostate, the larger branches being untouched and the veins not enlarged; this occurrence was probably due to peculiar diathesis in the patient. Rare cases have been observed, in which the artery of the corpus cavernosum, of the bulb, or even all those ordinarily supplied by the internal pudic to the penis have been furnished by an enlarged branch of the vesico-prostatic; fortunately, such a branch most commonly lies on the upper surface of the gland, otherwise, it might be injured in the lateral operation of lithotomy. Other branches supplying the prostate or anastomosing with its arteries, arise from the internal pudic and middle hœmorrhoidal. The terminal branches which supply the gland, pass through the capsule and divide into twigs which ramify among the glandular vesicles and tubes, supported by the interglandular tissue.

The prostate is covered on its upper surface and sides by a plexus of veins, consisting of several large and a few smaller vessels. The dorsal vein of the penis, after passing beneath the pubic arch, divides at the apex of the prostate into two branches, which again subdivide and form the chief part of the plexus; other smaller veins from the substance of the prostate, and from the coats of the bladder, empty themselves into it. These veins are covered by the anterior true ligaments of the bladder and upper layer of the recto-vesical fascia, which send processes between them to the deeper layer of the capsule, and enclose them in fibrous sheaths From the prostate these vessels pass backwards and form the vesical plexus at the side of the bladder, and ultimately empty themselves into the internal iliac trunk. Those veins, which ramify in the prostate itself around the glandular vesicles, unite to form a smaller number of vessels which join the hœmorrhoidal veins and prostatic plexus. On account of the peculiar arrangement of the internal and common iliac veins, which lie for the most part below their corresponding arteries, have an ascending direction, and are devoid of valves, the prostatic plexus is very liable to congestion in common with

* On the Sources of Hœmorrhage after Lithotomy. I. Vol. Edin. Med. Journal, 1841.

† Anatomy of the Arteries. Lond. 1844.

the veins of the other pelvic viscera; they are, therefore, frequently found to be much larger than they should be, especially in old men. The horizontal posture is always necessary in inflammatory affections of the pelvic organs that the return of blood from them, already liable to be retarded by the natural relations of the iliac veins, may be facilitated. The lymphatics consist of a deep and superficial series; the former ramify with the vessels in the tissue supporting the glandular structure; the latter lie between the layers of the capsule. The deep join the superficial series, which terminates in the lymphatics, corresponding to the internal iliac vessels.

DEVELOPMENT, GROWTH AND SIZE.

THERE can be no doubt that the prostate is developed from mucous glands of the urethra and neck of the bladder. The simple nature of the gland, the termination of its secreting surface in the prostatic urethra by several orifices, and the growth of fresh glandular tissue with ducts and orifices proper to itself, (in the case, especially, of the third lobe) quite establish, in my opinion, this hypothesis; moreover, women have a rudimentary prostate, consisting of mucous follicles which are subject to the formation of calculi, identical with those found in the male prostate.* As in other glandular structures so no doubt in the prostate, the system of vesicles and ducts are formed from simple inversions of mucous membrane, (as follicles,) by lengthening of the simple tubes in the first place; afterwards by the growth of secondary tubes from each principal one; and lastly by expansion of the terminal portions of the tubes into vesicles, smooth and small at first, afterwards racemose and larger. Such being the case, the great comparative muscularity of the interglandular tissue ceases to be an object of wonder; the glandular structure, in fact, growing in the walls of the urethra, receives muscular investments from it as it lies between the mucous membrane of the urethra and the external covering of the gland, derived from the recto-vesical fascia. I am aware that the circular muscular fibres of the prostatic urethra are generally considered to be distinct from the

* "It has been alleged by Leuckhart (see his article on Weber's organ, in Illustr. Med. Ztg. I. 2.) that in women there exists a true rudimentary prostate, consisting principally of mucous follicles and situated between the beginning of the urethra and the reflexion of the vagina. Virchow also admits the existence of this body, and says that he has often found at the neck of the bladder, especially in old women, when the internal orifice is thickened, round grayish-yellow enlargements in which there are gradually formed firm dark-coloured bodies lying embedded in the mucous membrane. These bodies he considers identical with or analogous to the concretions found in the prostatic portion of the urethra. Virchow's Archives, V. 3., 1853." From Edin. Monthly Journal, July, 1854.

muscular structure of the prostate; my own view is that this distinction is made by dissection, and does not exist in the natural condition of the parts; that the lateral and inferior portions of the capsule may be looked on as an aponeurosis of insertion, for part of the external muscular coat of the bladder, combined with the fascia of the pelvis at this part; and that the muscular structures, from the mucous membrane of the urethra to the capsule of the prostate, may be considered as the general muscular coat of the urethra, interspersed with glandular tissue, and somewhat altered in arrangement and form to adapt it to this condition.*

Before the fourth month of fœtal existence the prostate is composed of two distinct lateral lobes; at or about the fifth month the isthmus and middle lobe are developed and the gland becomes one body. In the child it is somewhat round, and rather softer in structure than in the adult; it is also in earlier years placed almost perpendicularly in the pelvis. Up to the fourteenth or fifteenth year, the growth of the gland is much slower than at the period immediately succeeding; after thirty-five or forty the size of the healthy prostate appears to be almost stationary for some time, and sometimes even decreases; and, lastly, in old age it is subject to a remarkable increase in size. Thus, the growth of the prostate corresponds with that of the other reproductive glands up to a certain period; after which it enlarges even to a greater extent than they diminish; it remains to be seen whether its hypertrophy in old age is a natural occurrence or the result of disease.

Mr. H. Bell after careful researches on more than forty subjects, of ages varying from two to fifteen years, arranged in four categories, has found the measurements of the prostate to be as follows:†

* I understand that Mr. Ellis lately read a paper before one of the London Societies on the Muscularity of the Prostate; and have to regret that I am unable to compare that gentleman's opinion with my own, on account of the paper not having been published at the time of this going to press.

† Malgaigne Traité d' anatomie chirurgicale. Paris, 1838.

In Dr. F. Brittan's translation of Malgaigne's Operative Surgery, Lond. 1846, these measurements are stated somewhat differently:

From 2 to 4 years.		*From 5 to 10 years.*	
Transverse diameter, . .	6 to 6½ lines.	Transverse diameter, .	6½ to 8½ lines.
Posterior oblique radius,	2 to 2½ "	Posterior oblique radius,	2½ to 3½ "
Anterior oblique radius, .	1 line.	Posterior direct radius,	2 to 2½ "
Anterior direct line, . .	½ "		

From 10 to 12 years.		*From 12 to 15 years.*	
Transverse diameter, .	8 to 9½ lines.	Transverse diameter, .	9½ to 11 lines.
Posterior oblique radius,	3 to 4 "	Posterior oblique radius,	4
Posterior direct radius, .	2 to 2½ "	Posterior direct radius,	2 to 2½ "
Anterior direct radius, .	1 to 1½ "	Anterior direct radius,	1½

Age.	Transverse Diameter.	Posterior Oblique Radius.	Posterior Direct Radius.	Anterior Direct Radius.
2 to 4 years.	5½ to 6 lines.	2 to 2¼ lines.	1 line.	½ line.
5 - 10 "	6 - 7 "	2½ - 3 "	2 to 2½ lines.	½ line.
10 - 12 "	7 - 8 "	2¾ - 3½ "	2 - 2½ "	1 to 1½ line.
12 - 15 "	8½ - 10 "	3½	2 - 2½ "	1½ line.

I have found the measurements of a moderate sized prostate, taken from a person between 25 and 30 years of age, to be:

Length, along the lateral lobe, from base to apex, -	1 inch 6 lines.
Length, along the middle line, - - -	1 " 3 "
Breadth, most posteriorly, - - - -	1 " 2 "
Breadth, at the broadest part, - - -	1 " 6 "
Breadth, at apex, - - - - -	5½ "
Greatest depth above the urethra, - -	5 "
Greatest depth below the urethra, - - -	4 "
Greatest depth below the neck of the bladder, -	4½ "
Greatest thickness from the urethra directly outwards,	6 "

Another gland, which I should consider to be of full normal size, measured—

Transverse diameter at broadest part, - -	1 inch 8 lines.
Do. do. at apex, - - -	5½ "
Do. do. midway between base and apex,	1 inch 4 lines.
Length from base to apex in middle line, - -	1 " 4 "
Radius from urethra to upper surface, - -	6 "
Do. do. the sides, - - -	7 "
Do. do. lower surface, - -	5 "

These two glands correspond so closely in size with many others which I have examined, that it would be superfluous to append an account of the rest.

The average weight of an adult prostate is from 4½ to 5 drachms.*

* I have not myself examined sufficient prostates of young subjects to be able to give an account of its weight and size in earlier years. Mr. H. Bell's researches (from Malgaigne) have already been noticed. Further information on this subject may be found in Dr. S. D. Gross, on Diseases of the Bladder, &c. Philadelphia, 1851.

Reference may be made to the following works, on the subject of the size of the prostate in connexion with lithotomy:

Deschamps. Traité Historique et dogmatique de l' operation de la Taille, 1796.
Dupuytren. Memoire sur l' operation de la Pierre, 1836.
Velpeau. Traité complet d' Anatomie Chirurgicale, 2nd Vol, 1837.
Malgaigne. Op. cit.

FUNCTIONS OF THE PROSTATE AND ACCESSORY GLANDS.

THE prostatic secretion, as it is seen in the dead subject, is of an opaque milky appearance, and more or less viscid in different specimens. It consists of a serous fluid, holding in suspension molecules, granular globules and epithelial particles of the squamous and columnar varieties; indeed, its minute character presents nothing peculiar.

Haller says, "Therefore, that this fluid (*i. e.* the semen) might be projected with a greater force, and to a greater distance, nature has joined another humour, which is generated by the Prostate ....."* Nothing has since been added to our information on this point, excepting the observation made by Mr. Adams (page 6, ante) that the fluid is uniformly acid after death; and the suggestion that this acidity may aid to preserve the fluidity of the alkaline semen.

John Hunter,† observing that the fluid contents of the vesiculæ were different from the semen contained in the vasa deferentia, that in several instances where one testicle had been removed the corresponding vesicula remained full, and that in one case the vesiculæ were full notwithstanding that the vasa were imperfect, as well as from corroborative evidence furnished by comparative anatomy, concluded that the vesiculæ were not receptacles for the semen, but simply secreting organs providing an accessory fluid. More lately, improved means of investigation, afforded by the microscope, have enabled observers to prove the presence of seminal filaments in the vesiculæ; some have argued that these were a mere accidental admixture with the fluid of the vesiculæ, since they were much fewer in number in that body than in the adjoining vasa; this supposition does not appear to carry much weight with it. I am inclined to think that, in man, the vesiculæ not only receive the semen, but are the means by which it may be absorbed into the system, if not employed in reproduction; the seminal filaments are constantly found in these bodies, but usually in small numbers; their invariable occurrence at this part shews that their presence is not accidental; the paucity in which they are found indicates that they pass slowly or lose their characteristics as soon as they enter the seminal vesicles.

* Haller's Physiology. London, 1754. 2nd Vol.

† Hunter's Works, by Palmer. 4th Vol.

My opinion, however, that the vesiculæ dissolve the seminal particles and prepare them for absorption is mere hypothesis; it is principally founded upon the apparent want of some large vascular surface adapted to absorb the semen formed during the intervals of sexual intercourse, and the evident convenience by position and fitness from its structure of the mucous membrane of the vesiculæ, and also of the contiguous vasa, for this office.

Whatever other functions the vesiculæ may have, they certainly secrete a fluid which is used for reproduction; this is proved by John Hunter's cases, in which the vesiculæ were filled with fluid after loss of the corresponding testicles; in the case, previously mentioned, of the man who had had his penis removed some years before death, the vesiculæ shared in the atrophy of the other reproductive glands.* Doubtless, this fluid is secreted in greater quantity at the time of the venereal orgasm; and is expelled along with the previous contents of the vesiculæ.

Let us consider, with most observers of the present day, that the seminal fluid passes into the vesiculæ; it would appear that the seminal filaments, impelled forwards by fresh accumulations of fluid in the vasa, pass into the ejaculatory ducts in the first place, and that they then take a retrograde course into the vesiculæ; a small quantity may now and then pass into the urethra and be found in the urine, but this is an accidental occurrence; the great bulk of the fluid is prevented escaping into the urethra by the narrowness of the ejaculatory ducts near their termination, and by the closure of their orifices, which do not open unless distended by the seminal fluid under muscular action of the coats of the vasa and vesiculæ.

In sexual intercourse, the contents of the vesiculæ pass forwards under the muscular contraction of the coats of those bodies; being shut sacs in other directions, the fluid in them cannot take any other course than into the ejaculatory ducts. The semen in the vasa is also propelled into the ejaculatory ducts by contraction of the muscular coat of those tubes; it cannot pass backwards on account of the narrowness of the vasa posteriorly, and the accumulation of fluid behind. Thus, the secretions in the vesiculæ and vasa pass into the ejaculatory ducts under the influence of muscular action, dilate them, and escape into the prostatic portion of the urethra. Simultaneously, a quantity of prostatic secretion, which has been formed under the influence of the venereal excitement, is expelled by contraction of the muscular elements of the interglandular structure, and is mixed with the semen and contents of the vesiculæ; what-

* I have published a more extended account of this case, than could, with propriety, be inserted in this work, in the Glasgow Medical Journal for Oct., 1856.

ever effect the prostatic secretion may have on these fluids occurs at this juncture.

The venous plexus mixed up with the tissues of the prostatic urethra has already been mentioned (page 28). Under the venereal excitement, these veins become congested in common with the erectile tissue of the penis. It is probable that by their turgescence they raise up the orifices of the various ducts in the prostatic urethra, and so facilitate the discharge of their contents; in the same manner that closure of the eyelids favours the escape of the lachrymal secretion over the conjunctiva by putting the ducts on the stretch. In addition, by their congestion, in common with the venous tissue of the verumontanum, behind the utricle, and of the neck of the bladder, they are supposed to offer an impediment to backward flow of the reproductive fluids; while anteriorly, the turgid veins have a groove between them, in which the fluids pass forwards to the membranous portion of the urethra; it is possible that the circular muscular fibres, which surround the prostatic urethra in greater quantity near the neck of the bladder than anteriorly, also help to restrain the semen from passing backwards. The general muscular coat of the bladder is, of course, perfectly at rest while the reproductive fluids pass into the prostatic urethra, otherwise, the urine would pass forwards and mix with them; the urine is, further, retained by the same means which prevent the fluids passing into the bladder.

Having accumulated in the prostatic urethra, the reproductive fluids are thence propelled forwards through the membranous urethra into the sinus of the bulb, either by pressure of the fluids from behind or by contraction of the muscular elements of the prostatic and membranous urethra; in the bulbous portion of the urethra, the secretion of Cowper's glands, of which the use is not known, is mixed up with them. It is uncertain whether or not Guthrie's muscles, surrounding the membranous portion of the urethra, contract, after the fluids have arrived in the sinus of the bulb, and cut them off from the prostatic urethra; for my own part I do not think that they do, the constant arrival of fresh fluid in the prostatic urethra, as that in front of it is ejected, would appear to be sufficient to prevent regurgitation. The first portion of the fluid, having distended the sinus of the bulb, is thrown forwards by the action of the ejaculator seminis, and allied muscles in the perineum, on the penis; this fluid is immediately followed up by a fresh supply, provided by continuous action of the muscular tissue on the contents of the vesiculæ, vasa and prostatic vesicles, the sinus of the bulb is successively distended, and the ejaculatory action is repeated until the great

bulk of the fluid is expelled. Ultimately, the last portions are extruded from the urethra, perhaps by contraction of its organic muscular coat.

From the foregoing account it is seen, that the prostatic urethra has particular functions in regard to the act of sexual intercourse; that the great bulk of the productive fluids is, in the first instance, poured into it, and that they then pass forwards along the urethra, their falling back into the bladder being guarded against by congestion of the erectile tissue behind the utricle; whether the neck of the bladder and posterior part of the prostatic urethra is blocked up purely by congestion of the erectile tissue, or by those means in conjunction with contraction of the circular fibres of the prostatic urethra, it is difficult to say.

HEALTHY MICTURITION.

THE part which the prostatic urethra takes in the act of micturition comes next under consideration. So far as regards the healthy retention of urine in the bladder, or its evacuation, this portion of the urethra may be looked upon as a prolongation of the neck of the bladder; here, for the first time, in the passage of the catheter, is any peculiar sensation felt; Mr. Guthrie has shewn that the instrument excites, on its arrival at the prostatic urethra, a peculiar uneasy pain, and a desire to micturate; the former may probably be referred to the sensitiveness with which it is endowed in virtue of the orifices of the ejaculatory ducts opening into it; the latter, to the dilatation of the urethra by the catheter.

In the distended condition of the bladder, its walls are kept in constant apposition with the retained urine, by means of the elastic cellular tissue which binds together the muscles, and connects them to the mucous lining; the muscles having nothing to do with the adaptation of the bladder to its contents in a state of rest. When the urine has accumulated to a pint and a half, or thereabouts, it excites the desire for micturition; the general muscular coat of the bladder commences an active contraction, and propels the fluid towards the vesical orifice, the longitudinal fibres principally effecting this object, while the circular and reticular bands at once aid in the expulsion of the urine, and serve to maintain uniformity in the shape of the viscus as it becomes contracted; the orifice of the bladder is dilated by the urine under the influence of the contracting muscles, and the stream, once established, flows uninterruptedly along the urethra. There can be no doubt, that those fibres of the longitudinal coat, which are attached to the uvula and verumontanum, draw those

bodies downwards, while the neck of the bladder is being distended by the urine, and dilate the canal. If the utricle have any office at all in man, it may be that of affording a secretion to smear the orifices of the ejaculatory ducts, and protect them from the urine; those who have paid particular attention to the anatomy of this body, state that it secretes a yellowish fluid, or cerumen; it is possible that the band of muscular tissue, previously described as being prolonged from the detrusor urinæ to the fibrous coat of the utricle (page 25), may compress it, during micturition, draw its lips with the orifices of the ejaculatory ducts towards each other, and at the same time squeeze out a portion of the secretion from its cavity to be spread over them. When the general muscular coat of the bladder is expelling the urine, the muscles of the ureters draw down the orifices of those ducts, preserve the obliquity of their course through the vesical coats, and prevent the regurgitation of urine towards the kidneys; in fact, they contract simultaneously with, and in the same proportion as, the other muscles of the bladder; and are hypertrophied to the same extent as the general muscular coat in cases of obstruction to free micturition (see M.M., Pl. 4). As the urine escapes and the capacity of the bladder is diminished by muscular action, the contiguous margins of the muscular fibres become approximated together, and push out the mucous membrane into the form of folds projecting into the bladder. At length, the whole of the urine having been evacuated from the viscus, the active contraction of the muscles of the bladder is continued in the fibres prolonged forwards under the mucous membrane of the urethra (page 27), and the last drops of urine are ejected from the canal.

The muscles of the bladder are now in their most contracted state; no longer, however, in a state of action, but merely (so to speak) in a state of collapse, retaining their last form; the vesical muscles having no antagonists, the elastic tissue which binds them together is enabled to effect this. The same is the case with the prostatic urethra and neck of the bladder.

The urine again distils from the ureters into the bladder and gradually dilates it, the muscles being in a state of rest and offering no opposition, while the elastic nature of the submucous and inter-muscular tissue is particularly adapted to permit it, and to keep the vesical walls in perfect apposition with the urine, whatever may be its amount. In post-mortem examinations I have sometimes seen a sort of cup-like depression around the ureteric orifices of bladders which contained a few ounces of urine; this has led me to believe, that the longitudinal muscular fibres, (which have been already described as surrounding the ureters

outside the bladder, and as being inserted in part into the vesical coats opposite the terminations of the tubes, page 28,) draw up the ureteric orifices and facilitate the discharge of urine into the bladder; acting in some measure as antagonists of Bell's muscles; should they do so, it will be a partial exception to the general fact of the muscles of the bladder having no antagonists. The urine now goes on accumulating till a sufficient quantity is contained to excite the desire for micturition again.

The means by which the urine is prevented from oozing out of the urethral aperture during the quiescent state of the bladder, has long been a matter of dispute. Sir Charles Bell considered that the circular fibres of the viscus, behind the prostate, kept the mouth of the bladder closed, and prevented the falling back of the reproductive fluids during sexual intercourse; and accounted those fibres as the sphincter of the bladder. More recently it has been shewn that these fibres are not retentive but expulsive. Mr. Guthrie and others have, since, regarded the elastic tissue of the neck of the bladder and prostatic urethra as the true medium of healthy retention of urine; this appears to be the correct explanation. Mr. Hancock believes that "it is the contraction of this circle of fibres, (around the prostatic urethra,) which is not, recollect, a distinct sphincter, but part and a continuation of the inner coat of the bladder, acting upon the pad of the elastic and non-elastic tissue which surrounds the neck of the bladder, combined with the consent of the other muscular fibres of the bladder to remain quiescent, which retains the urine under ordinary and healthy circumstances."* My own view is, that these particular fibres and those of the rest of the urethra are perfectly quiescent during the intervals of micturition, in the same manner as those of the bladder itself; that the prostatic urethra and the neck of the bladder, with the rest of the canal, are kept closed, during the intervals of micturition, by means of the elastic tissue in their walls, quite in the same manner as the bladder is kept in apposition with its contained urine; and that the muscular fibres of the bladder and urethra are simply employed in expelling the urine at intervals. There can be no doubt that the longitudinal mucous folds of the prostatic urethra, with the verumontanum, fit into each other in such a manner as to render the escape of urine through the urethra impossible.

Excepting on one point, my own opinion regarding the functions of the muscular tissue of the urethra is the same as Mr. Hancock's. That gentleman, for the first time, shewed that "Ordinary micturition may be considered to be performed by the

* Op. Cit., page 49.

bladder and urethra combined, not by the bladder alone, or by the urethra alone, but by the two together, assisted, to a certain extent, by the abdominal muscles."* Nevertheless, he thinks that certain of the circular fibres of the neck of the bladder and prostatic urethra act on the submucous tissues there, and close the vesical aperture. This does not appear to me to be the case; if it were, then in paralysis of the bladder the urine would constantly dribble away when the surface of the fluid reached the level of the neck of the bladder, because, the circular fibres there being paralysed, in common with the general muscular coat of the viscus, there would be no obstacle to its escape; on the contrary, the urine accumulates to a very great amount before dribbling occurs, and the fluid only comes involuntarily away when it is in such quantity as to become amenable to the action of the abdominal walls.

* Op. Cit., page 37.

HYPERTROPHY OF THE PROSTATE.

THERE are two principal varieties of increase in the quantity of the natural constituents of the prostate; the one consists of hypertrophy of the parenchymatous, the other of the glandular structure. The former is a pretty common occurrence in younger persons who have suffered for a long time from irritation of the urinary organs; the latter, with which we have principally to do, arises without any very apparent cause in men of advanced age.

Parenchymatous Hypertrophy. This affection is usually traceable to stricture or inflammation of the urethra of long standing, stone in the bladder, or some such source of irritation acting on the neck of the bladder and prostatic urethra, and setting up chronic inflammation of the gland. The disease is not of such a nature as to enlarge the prostate to the same extent as is found in glandular hypertrophy; the prostatic urethra is not distorted or altered to any very remarkable degree, although the bulk of the gland may be increased to twice its usual volume or more.

On section, the substance of the prostate is found to be condensed and fibrous; the cut surface being dotted with numerous minute yellowish granulations, the glandular vesicles, embedded in the thickened interglandular tissue; each of these is attached by a sort of pedicle consisting of its duct and vessels.

Dr. C. H. Jones* has remarked, that enlargement of the prostate may be due to increase of the interglandular tissue, and especially of its muscular elements. In this variety it is common to find an abundance of organic muscular fibres; I am not, however, at present able to say whether condensation of the prostate is due to hypertrophy of this tissue alone, or of it combined with proportionate increase in the white fibrous and yellow elastic tissues. It certainly is a remarkable circumstance, that vascu-

* Medical Gazette, 20th Aug., 1847.

lar excitement or chronic inflammation of the prostate should induce hypertrophy of its muscular tissue, and does not admit of any explanation, that I am aware of at present.

The principal alteration in the urinary passages in these cases is found in an indurated condition of the neck of the bladder, which is raised into a firm transverse band, forming a bar between the urethra and viscus. In cases of urethral stricture, the prostatic portion of the canal, behind the original obstruction, is dilated to a greater or less degree; this condition is well seen in Pl. 4, where the thickening of the neck of the bladder (A) is also remarkably developed; in such an instance, it might become a question whether the muscles of the ureters (M.M.), attached in part to the uvula vesicæ, had not acted on the neck of the bladder and helped to form this elevation by dragging up the part every time the viscus was emptied, and these hypertrophied muscles brought into play in conjunction with the general muscular coat of the bladder; however this may be, the formation of this bar at the neck of the bladder acts beneficially at first, in stricture cases, by presenting an obstruction behind the original disease, which relieves the stricture from pressure of the urine, and renders it, therefore, less liable to spasm and more amenable to treatment.*

Mr. Guthrie has described a similar fibrous bar which is formed at the neck of the bladder in persons advanced in age, and gives rise to the same symptoms which are observed in true enlargement of the prostate; this disease requires much the same treatment as enlargement of the gland.†

Induration of the prostate and thickening of the neck of the bladder is not always found in stricture cases; it only comes on after a long continuance of such a disease. In strictures the prostatic ducts are sometimes dilated and afford on pressure a puriform fluid; this enlargement of the ducts is apparently due to the action of the bladder on the urine, which, meeting an obstruction at or near the bulb, dilates the urethra behind, and, in some measure, the prostatic ducts also.

This hardened state of the prostate is much more liable to be the seat of abscess, than the next variety; such might naturally be expected from the causes which give rise to it, viz.:—chronic inflammation or vascular excitement, originating in some source of irritation near the gland or acting indirectly upon it. Nevertheless, Tubercle of the Prostate (which also gives rise to

* Sir B. Brodie on Diseases of the Urinary Organs. Lond. 1842.

† Guthrie on the Anatomy and Diseases of the Bladder, &c. Lond. 1836.

hardening followed by abscess) must not be confounded with this disease; it may be usually recognized by the previous history of the case, and the existence of similar deposits in the lungs and other parts of the body; moreover, a scrofulous state of the prostate is commonly found in persons under twenty-five years of age, while simple hard enlargement of the gland takes place in older persons who have been subject to urinary diseases.

Although there is reason to believe that disease of the prostate, accompanying stricture of the urethra, is almost always confined to a hardening of the gland and the formation of a bar at the neck of the bladder, I am not prepared to say that glandular hypertrophy may not occur under the same conditions. For the most part it may be laid down as a rule that pressure of urine, which always takes place, in urethral stricture, on the prostatic urethra, keeps down, as it were, any tendency to enlargement of the gland; further, the very hardening of the interglandular substance will, doubtless, impede any increased growth in the secreting structure itself.

This hardening very commonly subsides on the cure of the disease which induced it. Mr. Stafford has published a number of cases of diseased prostate, which appear, from their history, to have been of this variety, and in which the enlargement readily yielded to the local application and internal use of iodine, in conjunction with the appropriate remedies for the primary disease.*

Glandular Hypertrophy. This form of enlarged prostate is so common in persons of advanced age, that some of the best authorities have classed it among the signs of bodily decay; thus, Sir B. Brodie says, "When the hair becomes grey and scanty, when specks of earthy matter begin to be deposited in the tunics of the arteries, and when a white zone is formed at the margin of the cornea, at this same period the prostate gland usually, I might perhaps say invariably, becomes increased in size." It is quite true that the gland is found to be enlarged in almost every person beyond fifty-five or sixty years of age; of two or more persons, however, of any stated age it may be much larger in one than in another; or the form of the enlargement, on its urethral aspect, may be of such a nature as to give rise to difficulty in micturition at an earlier period in one case than in a second; in some instances, while the enlargement has been great, the difficulty in emptying the bladder has been comparatively small; while in others, a very small increase of size, in a par-

* Stafford on the treatment of some affections of the Prostate Gland. Lond. 1840.

ticular direction, has presented an insuperable obstacle to free escape of the urine. It does not, therefore, follow that disease of the prostate should not exist because it may not give rise to formidable symptoms; of those persons who reach their eightieth year few escape an obstruction in passing their water from this cause; of those few who die between their fifty-fifth and sixtieth or seventieth year without having suffered from impeded micturition, it is very rare to find the prostate otherwise than enlarged to some degree, and presenting every appearance of being likely to become formidable at a still later period of life.

On section, this form of disease presents a more or less firm cut surface, having a decidedly glandular appearance. The ducts leading to the glandular structure are enlarged to three or four times their natural diameter; with care they may be traced onwards and found to divide into secondary branches which are lost in lobules of various sizes. These lobules are more or less aggregated together and form the protuberances which appear on the prostatic urethra and neck of the bladder; when several of them form one mass, a large rounded portion of the gland projects into the urethra; a single one sometimes projects here and there and gives the urinary passage a remarkable nodulated aspect; they vary from the natural size of the glandular vesicles up to the magnitude of a small hazel nut. The nodules are severally contained in a more or less strong fibrous capsule, formed from the interglandular processes; they may be enucleated from this tissue and shewn to be attached by a stalk, consisting of their ducts and vessels, to the substance of the gland. These are the general characters of the lateral and middle lobes; in some instances they vary a little; so far as I have observed, the flat and more moveable tumours, which project from the middle lobe into the bladder (Pl. 10, 12, A.), are composed principally of a firm stroma in which are scattered rather smaller glandular vesicles, the connecting tissue forming the great bulk of the valvular process; where the projection of the middle lobe rises as a firm lobulated mass, embedded between the lateral lobes at the neck of the bladder, and terminated by a more or less rounded free process, the substance of the projection is made up of larger glandular bodies (Pl. 5, D.B., Pl. 9, A.A′). In some instances the substance of the irregular mass is hard and resistent, in others, soft and elastic; these varieties, in consistency, appear to be due rather to the previous amount of irritation which the gland may have undergone, than to any peculiarity in the structure of the enlargement; thus it might naturally be expected that an inflammation would produce a similar tendency to hardening in a prostate, which had undergone glandular hyper-

trophy, that it does in a healthy gland in the case of stricture and other diseases.

Minute anatomy does not disclose any thing peculiar in the character of these enlargements; the condition of the glandular structure appears to be even less altered, as seen under the microscope, than it does to the naked eye. More extended observation may detect greater changes than we are as yet acquainted with; for the present it is sufficient to state that the most experienced pathologists have failed to notice anything whereby the structure of the hypertrophied tissue may be distinguished with certainty from the normal gland.*

So far as I have observed, the number of ducts proper to the gland is not increased; neither is the number of terminal vesicles. Whatever may be the definite number of mucous follicles in the prostatic urethra or glandular vesicles in a full-grown prostate, it appears that they never become more in the enlarged gland. The most evident changes are the increase in size of the vesicles and the enlargement of their ducts; these changes are seen whatever part of the gland undergoes hypertrophy to any great extent. If the lateral lobes are hypertrophied, then its ducts are enlarged; if the middle lobe, a similar change is observed. It is to be noticed, however, that in the flattened tumours of the middle lobe, which have a comparatively small amount of glandular element, the ducts are not so obvious and do not shew themselves until the flattened tumour has grown into a rounded firm mass with well-developed nodules of glandular matter.

By this enlargement a remarkable change is wrought in the character of the gland; the terminal vesicles, previously so small in comparison with their ducts (page 29), now become enlarged in a proportion much greater than the ducts themselves.

From these facts it would appear to be a property of the prostate, that its glandular structure can, and does in old age, become hypertrophied to almost any extent, and somewhat altered in its general nature in consequence.

The secreting surface of the prostate is by these means increased; and herein lies the safety of the gland from danger of abscess. In the case of parenchymatous enlargement, a continuance of the chronic inflammation which has originated the disease, after setting up the formation of puriform fluid in the glandular structure, is apt to induce the formation of general or circumscribed abscess in the substance of the gland; in glandular hypertrophy, however, abscess is very rare; inflammation or vas-

* On this subject see Paget's Pathology. Lond. 1853. 2d Vol. Wedl's Pathological Histology, by Busk. Sydenham Soc. Edit., 1855.

cular excitement has a tendency rather to expend itself in increased secretion from the mucous surface of the gland without extending to its interglandular substance; this discharge is freely poured from the glandular vesicles through the dilated ducts into the prostatic urethra in the form of a more or less viscid, or purulent fluid; thus, the extensive secreting surface spread over the vesicles, and its free communication with the urethra by the ducts, constitute the safety valve of the prostate in this form of its enlargement.

The cause of this enlargement of the prostate is involved in much obscurity; so much so, that, taking into consideration its common occurrence and the age of the persons in whom it is found, many have attributed it to senile degeneration. It might naturally be expected that in elderly persons, addicted to sexual pleasures, the prostate would become enlarged; and more especially so, since the other glands of reproduction at an advanced period of life cease from their functions, and the office of providing a fluid for frequent sexual intercourse at this time may, with some reason, be thought to devolve on the prostate, and so induce an increase of its glandular elements. There are yet other circumstances in the habits of life of persons, which may in some degree tend to bring on the disease by producing an increased flow of blood to the sexual organs and exciting the venereal desire; exposure to cold, for instance, an habitually constipated state of the bowels, or indulgence in high living; I do not, however, think that any of these could of themselves cause an enlargement of the gland having the peculiar characters of senile hypertrophy, although they may secondarily favour it by rendering the desire for sexual intercourse uncontrollable. Still it must be acknowledged that certain persons who have led irreproachable lives have suffered from enlargement of the prostate, and that these speculations as to its cause are by such facts rendered of doubtful value. Indeed, it might become a question in those very cases, which would seem to shew that hypertrophy of the gland resulted from excessive addiction to venery in elderly men, whether the enlargement has not given rise to that vice by irritating the orifices of the ejaculatory ducts, and been the cause, instead of the result, of this perversion of the sexual passion. On the whole, the latter is the most charitable, and by no means the most unreasonable view; if it be adopted, some other theory, than uncontrolled sexual indulgence, remains to be found as an explanation of the cause of this disease.

Hypertrophy of the prostate is very slow in its growth, or at least is found to be a long time before it produces serious effects on the bladder, if its progress be traced from the earliest period

at which some slight difficulty of micturition has first been noticed. The delicacy of the subject and the want of accurate observation in the patients, have made it a matter of considerable difficulty either to discover the cause of the disease, or to follow its progress; most probably, however, the rate at which the tumour grows varies in different persons, and advances more or less slowly from fifty years of age onwards.

Although the middle lobe has, from its position and the remarkable changes which it undergoes, been an object of much greater attention than the lateral lobes, careful examination of numerous specimens shew that, as a general rule, it neither increases at an earlier period or in a greater degree than the other portions of the gland.

The lateral lobes first begin to enlarge at the sides of the gland and after a certain time, being restrained from increased extension outwards by the capsule, protrude in the form of rounded bodies on the sides of the urethra; by this means the urethra is flattened from side to side, (Pl. 6, B.C. Pl. 12, B.B.) and presents the appearance of a vertical slit if the gland be cut through transversely. In the meantime, the middle lobe has been encroaching on the neck of the bladder in the form of a central nipple-shaped eminence (Pl. 6. A.); as it extends, it becomes a kind of valvular growth, flattened from behind forwards, attached below to the neck of the bladder and terminated above by a convex free border (Plates 10, 11, 12, A.); at this stage it is more or less marked in its natural state as if the sides were brought forwards and folded on themselves (Pl. 10); on each side this process is connected to the lateral lobes by an elevation of the mucous membrane, more or less prominent in accordance with the stage of the enlargement (Pl. 12).

In certain cases, the middle lobe, instead of progressing from the first as a valvular and independent tumour, goes on increasing in unison with, and connected to, a consentaneous hypertrophy of the lateral lobes on each side of it, and the result is that the neck of the bladder is elevated by an immoveable growth formed from those parts of the prostate (Pl. 5); this eminence is commonly surmounted by a free valvular process of the middle lobe (B).

The lateral lobes, progressing further, generally become unequally enlarged (Plates 7, 8, A. B.); the anterior part of one encroaching in a greater degree on the urethra, and the posterior part of the other; in this way the urethra becomes tortuous. The middle lobe now becomes still further altered; previously, an excrescence flattened from behind forwards, convex above, and attached by a base of some size, the glandular

vesicles begin to grow still further and a rounded tumour is formed (Plates 5, B. 9. A. A.); this body becomes larger towards its free extremity, and the consequence is that its attached portion takes on, in a great measure, the form of a stalk, and is the smallest part of the tumour; at the same time, the prominent tumour elevates the portion of mucous membrane lying between itself and the lateral lobes, and the obstruction at the neck of the bladder is completed.

In a further stage, the posterior portions of the lateral lobes may be unequally enlarged, and the middle lobe pushed to one side or the other, according as the right or left lateral lobe may be greater at that part (Pl. 8).

This is the general course which the hypertrophy may follow. In many instances, it is found to vary a good deal. Thus, the three portions of the gland may become enlarged to a great degree without any one of them preponderating to such an excess over the other as to produce very much deviation of the urethra (Pl. 9); or the lateral lobes may be hypertrophied, one more than the other, and both of them to a degree much out of proportion to the growth of the middle lobe, and so produce great tortuosity of the canal, without the existence of a corresponding amount of alteration at the neck of the bladder (Pl. 7). Indeed, the varieties which the prostatic urethra and neck of the bladder present, in cases of enlargement of the gland, is almost infinite; I trust, however, that the appended illustrations will give a sufficiently good idea of the forms which may prevail, whether for practical or other purposes.

The bulging of the hypertrophied tissue on the urethra and neck of the bladder is easily accounted for; the capsule of the gland is stronger than the mucous and submucous tissues of the urethra, and the enlarged parts encroach most where least resistence is offered.

On its external surface the hypertrophied gland is generally rounded (Pl. 11, C.); the lateral lobes, which naturally constitute the greater portion of the prostate, are principally enlarged. For the most part, the amount of tissue immediately above and below the urethra is not enlarged to any very great extent, although the depth of the gland at its sides may be much increased; this can easily be understood when it is remembered that hypertrophy of the lateral lobes flattens the urethra from side to side, and causes it to assume the form of a slit, placed vertically in the substance of the gland; the great exception to this fact is in the case of the middle lobe, which is always enlarged below the neck of the bladder, and elevates that part to a greater or less degree.

This enlargement of the prostate is not attended by any pain or particular uneasiness in the gland itself; it goes on for years without giving the person affected any cause to suspect the progress of the disease. Attacks of inflammation, from cold, horse-back exercise, or other sources of irritation, now and then come on, and originate a considerable degree of pain, with difficulty in the evacuation of fæces or urine.

The circumference of the prostate being more or less increased in cases of its enlargement, the altered condition of the gland makes it encroach to some extent on the rectum; there need not however, be any proportion between the inconvenience produced on the bladder and on the gut by the enlarged body; in the case of the rectum, it is the bulk of the gland on its external aspect which gives rise to inconvenience; as regards the bladder, it is not so much the actual size of the gland as the manner in which it presents itself to the urethra, that produces dangerous effects; a very small valvular enlargement of the middle lobe may be fraught with the most pernicious consequences to the urinary apparatus, while the rectum shall be little affected; on the contrary, a largely hypertrophied prostate may not present so much obstruction to the evacuation of urine as to the passage of fæces along the rectum. Altogether, it may seem, at first sight, remarkable how little the functions of the rectum are disturbed by this disease; there is in most cases simply a moulding of the fæces by the gland as it impinges on the gut, and even this impression may be subsequently obliterated by the sphincter ani. The immunity of the rectum from retention of its contents is, however, easily accounted for; the circumference of the enlarged gland is not usually so much increased as to affect the capacious rectum sufficiently, to offer an obstruction to the evacuation of the fæces; its growth to any very great extent externally is restrained by the strong investing capsule of the gland, while hypertrophied nodular bodies projecting into the bladder or urethra may present an insuperable obstacle to perfect evacuation of the urine; there are no irregular growths on the exterior of the prostate adapted to arrest the passage of the fæces through the rectum; and, lastly, the connexion which the gland bears to the rectum is not of that intimate nature, which it has to the bladder, and consequently it is not prevented from being in some measure moved upwards along with the superior wall of the gut, on which it rests, by the passing fæces.

When the enlarged gland receives a sudden accession of size and becomes tender from an attack of inflammation, whether caused by cold or other circumstances, difficulty and pain may be experienced in defæcation; these inconveniences are, however,

rather to be referred to the increased sensitiveness of the gland itself than to any obstruction arising from its bulk.

It is pretty common to find prolapse of the mucous membrane of the rectum from straining in micturition in cases of enlarged prostate; and the bulky gland may retard the return of venous blood from the gut and cause hæmorrhoids. Apart from these affections, or accompanying them, there is sometimes considerable soreness about the anus with some difficulty in defæcation; and often the rectum suffers from an unnatural sense of fullness arising from bulging of the enlarged gland upon it. In these cases, the size of the gland and the nature of its encroachment on the rectum may be ascertained by introducing the finger, well oiled, and moving it about from side to side and from before backwards on the upper part of the gut.

Sir E. Home* mentions two cases in which an unequal enlargement of the lateral lobe encroached on the rectum, and gave rise to much uneasiness on going to stool, with intense griping pain during the expulsion of the fæces; this was followed by an aching pain of some hours duration. There was also great distress if the patients walked much. These symptoms took place in patients of 36 years of age, and could not of course be referred to the senile form of enlargement. Similar pains, to those which accompanied defæcation, took place on pressure of the gland from the gut; during the intervals of emptying the bowels there was more or less ease. It would appear that the sensitiveness in these cases lay in the mucous membrane of the rectum; probably the enlargement depended on a circumscribed vascular excitement or inflammation of the gland. Both patients recovered under the application of opium and hemlock suppositories with warm glysters, to the rectum in the situation of the enlarged gland.

Although the prostatic urethra is flattened from side to side by the enlarged lateral lobes, its capacity is not diminished and is even in many cases much increased; nevertheless its elasticity is impaired, and the alteration of its form, especially if nodular growths project into it (Plates 5, E.—7, A.B.—8, A.B.—9, H.B. —12, B.), renders the passage of urine along it much less free, opposing the muscular power of the bladder and making the stream slow. A very large catheter can, however, in all cases of this description be made to pass along it with a little management.

This part of the urethra, considered along with the neck of the bladder, is always lengthened in consequence of hypertrophy of the prostate; a longer catheter than is commonly used is therefore

* On the Diseases of the Prostate. Lond, 1811.

required in drawing off the urine. This lengthening of the canal depends on several conditions of the enlarged gland; thus the neck of the bladder may be much elevated (as in Pl. 5) from the urethra; the middle lobe may present itself as a central tumour, on each side of which a tributary channel is prolonged from the urethra to the base of the bladder (Plates 9, 12); or the lateral lobes may be unequally enlarged (Plates 7, 8), rendering the canal tortuous, and so add to its length, in addition to the greater or less increase in the same, caused by elevation of the neck of the bladder.

The neck of the bladder is always elevated in this disease. The general increase in size of the gland raises the urethra and adjacent portion of the bladder from the rectum (Pl. 11, H.H′. H″. shewn by the catheter); in consequence, that natural curve in the canal, which was formerly described as commencing at the neck of the bladder and terminating at the bulb (page 12), is lengthened and becomes sharper; further, the middle lobe becomes more or less prominent in the bladder, whether as a valvular (Pl. 10, A.) or more immoveable tumour (Pl. 5, E.B.), and if it be desired to introduce a catheter into the viscus without lacerating this part, the instrument must be made to ride over it in the generality of cases; these conditions, therefore, necessitate the use of a more curved instrument than is generally employed.

By the growth of the middle lobe beneath the neck of the bladder, and its projection into the viscus, either as a central and moveable tumour connected to the lateral lobes by an elevated fold of mucous membrane, or as a growth intimately united to them by integrity of structure, the free communication between the cavity of the bladder and the urethra is interrupted. A reservoir is formed behind the elevated tumour, and a quantity of urine is constantly retained in it; at first the tumour is small and the reservoir of a limited capacity, holding an ounce or two of water; in course of time the projecting mass becomes larger and larger, and the reservoir behind it is capable of retaining from one to two pints of liquid, and sometimes even more. Whatever may be the amount of liquid which the bladder can hold, so much only is evacuated at each micturition as may be in excess over the quantity which the reservoir can retain. In consequence, the bladder is dilated, at the same time that its muscular coat is hypertrophied in order to cope with the opposition in front. It does not, however, dilate to such an extent as to be able to retain, in addition to the residue urine, a quantity of fluid equal to what a healthy bladder can hold; it, therefore, follows that, as the residue urine increases, the quantity which

can be expelled must be evacuated at shorter intervals, in order that the usual amount to be passed in the twenty-four hours may be made up. Frequency of micturition is present at all stages of this disease; earlier on, it is less marked, and merely attended by a feeling of urgency to empty the bladder; in the advanced stages, when the bladder is inflamed, it is accompanied and followed by great pain.

The dilatation of the bladder and the increase in the amount of residue urine progress so slowly, and are extended over so considerable a length of time, that the change in his condition is imperceptible to the patient, and he becomes gradually habituated to it.

In the meantime, the valvular process at the neck of the bladder, and the transverse folds connecting it to the lateral lobes, "Are pushed forwards before the urine in every attempt, that is made to void it, acting like a valve, and closing up the opening, till the cavity of the bladder is much distended, when the anterior part of the bladder being pushed forwards, and the tumour being drawn back in consequence of the membrane of the posterior part of the bladder being put on the stretch, the valve is opened, so that a certain quantity of water is allowed to escape, but the bladder is not completely emptied."* When a moveable tumour of one of the lateral lobes (Pl. 7) projects into the bladder, the mechanism is no doubt allied to that of the preceding variety; in these cases, however, the reservoir is less marked and the disease on the whole less dangerous, because the obstructing mass is not exactly in the middle line but leaves a rather free passage on one side of it. In certain cases, where the valvular tumour is of considerable size and weight, the patient is able to make water with comparative facility when lying down, because in that position a large pedunculate mass falls back and is not so easily pushed against the vesical orifice by the urine; in the same way dribbling of urine frequently occurs when the bladder is much distended, and (as at night in bed) no efforts are made to expel it.

It has already been stated that the muscular fibres of the healthy bladder become closely approximated together, as the viscus is contracted on the last drops of urine, and that the mucous membrane is pushed out into folds which project into the cavity of the organ (page 39). In the case of enlargement of the prostate, the residue urine prevents the muscular bands from becoming perfectly approximated to each other; the larger the amount of residue urine, the greater is the interval between the individual bands. When the bladder is dilated to the utmost, the

* Sir E. Home on Diseases of the Prostate, Vol. I.

muscular fibres are spread pretty equally over it and the mucous membrane is not marked by any particular inequalities; as the urine escapes, these fibres become aggregated together into separate bundles between which the mucous membrane is stretched; in the unavailing efforts to empty the bladder, the general muscular coat causes the residue urine to protrude the lining membrane through the margins of the contiguous bundles; in this manner the bladder becomes sacculated. This condition always accompanies long standing impediments to micturition; and may even take place, without the existence of obstruction, in persons who are great drinkers and habitually retain a large quantity of urine for a considerable length of time, whereby their bladders become weakened.

When newly formed, the little protrusions have thin fibrous walls, lined with mucous membrane; the small and recent pouch may be further covered by a layer of the more external muscular coat of the bladder; it opens into the viscus by a more or less constricted neck, which is bounded on all sides by the internal muscular bundles through which the protrusion has taken place; as the pouch becomes larger the external muscular layer is pushed aside and becomes part of the boundaries of its neck. The pouches vary in size and number. The size depends, of course, on the duration of those causes which have originated them. The number appears to depend on the size; one or more large pouches put the mucous membrane on the stretch and prevent the formation of many others. They do not protrude at the trigone at all; this is accounted for by the denseness of the submucous tissue at that part and the firm attachment of the mucous membrane to it; the strong uniform character of the detrusor urinæ generally prevents much pouching in the middle line; with these exceptions, they occur in pretty equal proportions over the surface of the bladder.

If the pouches are formed over those parts of the bladder which are invested by peritoneum, they are covered by that membrane, in addition to their other tunics. As they increase in size their fibrous coat becomes strong and resistent. It occasionally, but very rarely, happens that one or more isolated muscular bands become fixed to the pouch by an inflammatory process, and that the body of the protrusion, during its gradual enlargement, is constricted and divided by one or more imperfect septa.

For the most part the pouches have rounded bodies and constricted necks (Pl. 10. B.B′). The neck, however, being bounded by muscular bands, is found to vary in many instances; it is, however, subject to a permanent contraction, the result of inflammation and induration of the tissues around it.

Dr. Baillie* relates a case in which the bladder was divided into two chambers which communicated with each other. The upper chamber was generally much distended, so that a round tumour could be easily distinguished by the touch above the pubes. When a catheter was introduced into the bladder, a few ounces only of urine came away, and the tumour above the pubes continued distended. When the patient stood up, a quart of water sometimes passed away involuntarily and the tumour subsided for the time. After death the aperture of communication was found almost obliterated. Mr. Wilson† had seen three cases of this discription.

Supposing no organic stricture to have taken place, the state of the neck of a vesical pouch depends on the muscular fibres which bound it; thus in the highly distended bladder the mouth of the protrusion is pretty open, and in very recent cases is so much widened that a pouch cannot be said to exist under these conditions; the reason is that the muscular bands of the neck are separated and spread out over the bladder when the viscus is much distended. As the general muscular coat contracts on the urine, and some of it escapes along the urethra, the muscular bundles which surround the neck of the pouch become gathered together, and at the same time a certain quantity of the urine enters the protruded membrane which lies between them; thus there are simultaneously going on two processes—the dilatation of the pouch and the closure of its mouth. Should the catheter be used and the bladder entirely emptied, the muscular boundaries of the neck become quite approximated together, and a portion of urine is incarcerated in the pouch; it is thus rendered a solid body and is brought down on the tip of the instrument towards the termination of the flow of urine, producing the characteristic "fluttering blow;" this blow is of greater or less force according to circumstances, and may be repeated more than once with its power diminished at each repetition; the active contraction of the muscular coat of the bladder now ceases, and, on the patient changing his posture, the intercluded urine is enabled to ooze out of the pouch; if the bladder be at all irritable, as is commonly the case, a fresh desire to micturate immediately ensues.

The "fluttering blow," and the renewed desire to micturate immediately after the bladder had been completely emptied, were first identified with the existence of vesical pouches by Mr. Guthrie.

Vesical pouches generally contain urine. Not uncommonly their lining membrane is found covered with shreds of lymph or

* Morbid Anatomy. London, 1807.

† Wilson on the Male Genital and Urinary Organs. Lond. 1821.

encrusted with a calcareous deposit. Sir B. Brodie and other surgeons relate cases in which, after a large quantity of urine had been drawn off by the catheter, as much as half a pint of pus has come away, the tip of the catheter having probably accidentally entered a pouch containing that matter; in Sir B. Brodie's case there were three pouches, one of which, containing half a pint of pus, was situated between the rectum and bladder, and had given rise during life to a sensation like the crawling of a worm at that part. This pus is secreted by the mucous membrane. Inflammation of the mucous lining sometimes extends to the fibrous coat of a pouch and glues it to the neighbouring parts; or it may affect the peritoneum, if the protrusion be in its neighbourhood. In other cases the pouch may become the seat of sloughy ulceration (Adams).

The circumstances attending the occupation of a vesical pouch by a calculus, will be mentioned afterwards.

During the advanced stages of enlargement of the prostate, the bladder is always filled with a certain quantity of urine, and is very frequently much distended; on this account the urine which is secreted by the kidney cannot at all times find free ingress into the bladder; this urine, therefore, remains for some time in the ureters, and these ducts become gradually dilated and serve as auxiliary reservoirs. Sometimes the ureters are large enough to admit a fore-finger, and in rarer cases, are even much larger than this; their orifices, however, are never dilated; the action of Bell's muscles (page 39), the obliquity of their course through the vesical coats, and the existence of a valvular arrangement of the mucous membrane at their orifices, preserve the ureters from regurgitation of the urine which may be in the bladder. On the whole, the retention of urine under such circumstances in the ureters is a fortunate occurrence, although it is ultimately the source of dangerous affections in the kidneys; when the bladder is immoderately distended, the urine in these ducts accumulates and presses on the papillæ of the kidneys, arresting for a time the secretion of more fluid; were the secretion of urine to proceed, and were it poured continuously into the already over-distended bladder, rupture of that viscus would undoubtedly take place more frequently than it does.

In the same manner the pelves and infundibula of the kidneys become dilated; the constant pressure of urine then causes the secreting structure of these glands to become atrophied. If they have suffered from inflammation, extending upwards to them from the bladder, they will be found larger and more vascular than usual, but unnaturally soft. The same may be found in cases of inflammation of the kidney which has not been preceded by

inflammation of the bladder. In more advanced stages of the inflamed kidney it is found contracted and smaller than usual.

The formation of an obstruction at the neck of the bladder, and a reservoir behind it, in which a portion of urine is always retained, renders the bladder peculiarly liable to stone in cases of enlarged prostate.

For the most part, those, who are affected with enlarged prostate and stone in the bladder simultaneously, suffer less than other persons; this is to be attributed to the elevation of the neck of the bladder and the retention, under ordinary circumstances, of the stone in the reservoir at the base of the viscus. Excepting for this mitigation, in certain instances, the symptoms of vesical calculus are the same in these as in other cases. If, as occurs but rarely, the neck of the bladder is ulcerated in the situation of the prostate symptoms of unusual severity ensue.

It occasionally happens that a calculus is found embedded in a vesical pouch; should a small stone be in the neighbourhood of the mouth of a pouch during micturition it may be driven into it by the urine, and incarcerated as the neck of the protrusion is closed by approximation of the muscular bands; it may again escape when the muscular bands are separated by distension of the bladder, and be implicated in the pouch a second time in the same manner as the first; ultimately, should it remain a considerable time, it sets up inflammation of the pouch, the neck becomes permanently contracted, and the calculus, if of sufficient size, cannot easily escape. It is probable that in other cases a stone may from the first be formed in a vesical pouch. The incarceration of a calculus, previously free, in a vesical pouch accounts for the cessation of symptoms which has occasionally been observed in certain cases, and for the difficulty experienced in some rare instances in detecting the concretion.

It is often a matter of great difficulty to prove the presence of a stone in cases of enlargement of the prostate with ordinary instruments; Sir E. Home has pointed out the fact that in these cases an equally good diagnosis can be made with the elastic catheter; this instrument can, in almost all cases, be introduced with a little management; as the urine flows away the stone is brought against its tip with some force and produces a blow quite characteristic of the nature of the substance; and the concretion can be pushed away before the catheter, giving the patient much ease. In some cases of disease of the prostate the urethra at that part is indurated and gives the idea that the catheter is passing over a rough surface; this condition may be known from vesical calculus, by the fact, that the peculiar sensation ceases as the instrument enters the bladder. The "fluttering blow" of a

vesical pouch is too characteristic to be mistaken for the impulse produced by a stone, even if the elastic catheter be used.

A protrusion of a portion of the bladder through the abdominal walls in the situation of ordinary hernia is at all times an unusual occurrence; nevertheless it does occasionally take place in company with diseases of the urethra and bladder, and more especially so in old persons, in whom the viscus is large and flabby and who have been in the habit of using forcible straining efforts in micturition. The hernia may occupy various sites either in the male or female; in the former it is more common in the inguinal region than at any other part. To render such a protrusion possible, it is necessary that the bladder should rise out of the pelvis, and be expanded laterally to an extent sufficient to place a portion of it in contact with the internal opening of the inguinal or femoral canal; that it should be so weakened by previous disease as to be unable to empty itself by its own contraction; and that forcible efforts should constantly be made by the abdominal muscles in the act of micturition. When the viscus is highly distended it is incapable of protrusion into the hernial canals; when a greater or less quantity of urine has been evacuated, (the bladder, however, not having contracted closely on the residue as it would do in health,) and violent straining is exercised by the abdominal muscles in attempts to expel the remainder, a portion of the anterior or lateral part of the viscus may be forced into the hernial canal; the relations of the peritoneum to the bladder and its elevation when the viscus rises out of the pelvis are such, that the protrusion passes underneath the reflected edge of the membrane, and therefore is not contained in a hernial sac, but connected by cellular tissue to the neighbouring parts, and, of course, not returnable. It is probable that those cases are most favourable for the formation of this affection, in which the viscus is never entirely emptied and a portion of it is brought, under the influence of the abdominal muscles, to act as a *bag of water* in dilating the hernial canals. This kind of hernia may take place, in a similar manner, by rupture or dilatation of the combined tendon of the internal oblique and transversalis, and so be of the direct variety. In a further stage, the displaced portion of bladder continues to be gradually dilated, and may drag down a piece (nearer the superior fundus) to which the peritoneum is attached, so that a small sac of that membrane is placed in front of the hernia; this bag of peritoneum may subsequently receive a herina of intestine or omentum, and mask the protruded portion of bladder. At last the hernia of the bladder becomes greatly dilated, and forms a tumour marked by a neck at that point where it escaped from the abdominal walls; by this neck it communicates with the rest of the viscus.

A cystocele varies in size according to its stage and the amount of fluid contained in the displaced portion of bladder. In cases where the natural efforts do not suffice to discharge the fluid of the tumour into the cavity of the bladder, it is more or less soft and fluctuating; if the bladder be emptied, the urine in the hernia may be made to flow into the viscus by moderate compression, and the patient in consequence experiences a fresh desire to micturate. When emptied, the tumour subsides and nothing but a soft membranous substance is perceptible to the touch, unless indeed a calculus is contained in it as has sometimes happened. The tumour is free from pain and does not appear to be very liable to strangulation. Cystocele is usually, but not always, accompanied by difficulty in micturition and fits of retention of urine. If complicated with intestinal or omental hernia, they always lie in front of the cystocele; they may be distinguished with facility by the characters proper to each. The connexion of the protruded bladder to the surrounding structures by filamentous tissue prevents its reduction by manipulation, except at a very early stage before such attachment has become confirmed; Mr. Teale* states, that "a cystocele occurring at the inguinal or femoral apertures is irreducible, except in its earlier stages, when from the extensibility of the connecting tissue, it may be pushed within the abdomen. Even in the more advanced stages the irreducible condition may sometimes be gradually overcome by prolonged recumbency, and the judicious use of pressure. When, however, the bladder has reached the scrotum, replacement is not to be expected, and prolonged attempts by taxis or other means would be prejudicial."

Mr. Lawrence† has shown that a cystocele may be induced by a gradual increase in size of an ordinary hernia; "If the original hernia be neglected, its increase elongates the hernial sac, gradually drawing into the ring that portion of the peritoneum which is attached to the bladder, and the bladder itself, if it be disposed to yield to this force." It thus follows, that hernia of the bladder need not in all cases be due to a dilatation and weakening of its own walls, although these conditions generally precede the disease.

The irreducible cystocele ought to be treated with moderate support, sufficient to prevent its becoming constantly filled with urine. Persistent stagnation of urine in it will undoubtedly end in inflammation, and perhaps the formation of calculus.

Course and Symptoms of the Disease. The patient, when fifty-five years of age or upwards, begins to be affected with some

* Teale on Hernia. Lond. 1846.

† Lawrence on Ruptures. Lond. 1816. 5th Edit.

difficulty in micturition. There is a want of power in the expulsion of urine, the stream is slower, and the time occupied in its evacuation is longer than natural. About this time, a small quantity of urine remains in the bladder after micturition; this residue increases gradually and the bladder becomes dilated; yet the patient is generally not aware that the viscus always contains a certain amount of urine. In consequence of the increasing residue urine, micturition is required oftener than usual, and the quantity passed at each micturition is smaller.

At this or a later period the prostate may become inflamed; this occurrence usually takes place during the autumn or winter, and is aggravated by high living or other excesses. Micturition is attended by increased difficulty, and a smarting pain situated along the whole course of the urethra or at the external orifice; there may also be an acute pain at the neck of the bladder. The urgency to empty the bladder is increased. Commonly a gleety or purulent matter flows from the urethra and stains the linen; undue bodily exertion gives rise to hæmorrhage and the discharge is tinged with blood.

Hæmorrhage from the prostate may be caused by inflammation, violence with the catheter, over exertion, or jolting as on horseback or in a carriage. The effused blood is usually of a bright colour and may come away without being mixed with the urine. If the blood be discharged from the surface of the prostate in the urethra, it comes away pure, or mixed with pus; it may either precede or follow the urine in micturition; if there be incontinence of urine, this fluid is tinged with the blood. Should the hæmorrhage take place from that portion of the gland which projects within the neck of the bladder, then there is no particular means of diagnosing the seat of lesion, excepting in so far as can be conjectured from the existence of disease in the prostate, and the likelihood of its having been injured by a catheter or otherwise. Hæmorrhage of the prostate into the bladder generally takes place in larger quantities, than into the urethra.

The inflamed prostate often renders defæcation painful, and causes it to be followed by intense tenesmus. But this occurrence is not invariable.

It is a remarkable circumstance, that a patient with inflamed prostate is occasionally found to aver that he is more easy when his body is bent forwards in sitting, or ascending a hill. Some persons notice a swelling in the perineum, others do not.

It is not usual for the inflammation of a hypertrophied gland to terminate in abscess. For the most part the patient gets better of the first attack or two by antiphlogistic treatment, usually of his own adoption.

Repeated attacks of inflammation harden the enlarged gland, and appear to render it more liable to be the seat of abscess on a fresh accession. The symptoms of abscess in these cases are by no means so distressing, as those which accompany the acute formation of pus in younger persons. It may or may not be accompanied by distinct rigors; generally, the patient suffers from low feverish symptoms of some weeks or months duration; the canal of the prostatic urethra is diminished by pressure of the matter, so that there is increased difficulty in micturition and obstruction to the introduction of the catheter. At length the abscess points in the urethra, perineum, or rectum, and discharges itself, unless it have been previously opened. If it should open behind the verumontanum or on the neck of the bladder, it is apt to be complicated with much subsequent pain from the lodgement of urine, and an ulcer may be formed, producing intensely painful symptoms; such a distressing result is far from common.

Retention of urine may supervene on an inflammation of the hypertrophied gland, and require an appropriate treatment.

Whether or not the patient may have suffered from inflammatory attacks of the prostate, the disease, if neglected, progresses gradually to its more severe forms.

After a longer or shorter duration of simple difficulty in micturition and accumulation of residue urine in the bladder, the fluid, from its long stagnation, becomes altered in its qualities and is a source of irritation to the mucous membrane. The desire to micturate often, becomes a feeling of necessity; and the symptom is more marked, because a small quantity of urine only passes at a time. At this or an earlier period a small quantity of urine generally dribbles away after micturition; this is a portion of fluid which has remained in the prostatic urethra after the contraction of the bladder has ceased, and which the canal, from the alteration which it has undergone in form, is enabled to retain for a few minutes; incontinence of urine, due to the valvular character of the third lobe, is also common (page 54).

Sooner or later the mucous lining of the bladder begins to inflame; at first the vessels are found injected with blood, principally at the neck and base of the bladder; this vascularity increases and the whole surface becomes red and highly congested; the inflamed membrane, continuing to be irritated by the acrid urine, becomes still more highly injected with blood, dark-coloured and pulpy. At the same time it secretes a mucus, varying in quantity and quality according to the severity of the disease. In the earlier stages this secretion is small in quantity and diffused in the urine, rendering it slightly turbid; when the urine cools it subsides in the form of a fleecy cloud, which at last sinks

and becomes a tenacious mucus. As the inflammation augments, the secretion is increased in amount and in tenacity; if the disease be severe, it almost equals the urine itself in quantity and is *very* adhesive; in still more aggravated cases the mucus is yellowish and has a tendency to a purulent nature; it is occasionally found tinged with blood of a dark-red or blackish colour. The mucus is very liable to decompose and render the urine ammoniacal and intensely acrid. In very exceptional cases, pure pus sinks in the urine in the form of a yellowish sediment; that pus is not commonly found in the urine, in advanced cases of diseased prostate, is probably due, as Sir B. Brodie suggests, to the alkalinity of the urine; Dr. Babington has shewn that alkaline solutions alter pus into a viscid tenacious matter.

This inflammation of the mucous membrane progresses slowly. For some time the symptoms are comparatively mild; the patient has a frequent desire to micturate, and the act is preceded and accompanied by pain at the neck of the bladder and along the urethra; at this stage it is probable that the neck of the bladder is principally affected.

The kidneys often begin to be affected in consequence of the disease of the bladder. At first, the irritation extends along the ureters and reaches the secreting surface of the kidney; a large amount of pale coloured urine is secreted, either for a length of time continuously, or merely at intervals when the irritation is greatest. On post-mortem examination there is generally no very marked alteration in their constitution, excepting what may have been caused by the dilatation of the infundibula and atrophy of the secreting tissue. The amount of urine secreted in the twenty-four hours may vary as much as from 35 or 40 to 80 ounces.

The inflammation of the bladder becomes by degrees more violent and general. The mucous secretion increases in amount, is streaked or coloured with blood, and commences to decompose. The urine is rendered ammoniacal and dark-coloured from decomposition and the admixture of blood. The acrid urine and mucus are a source of constant irritation to the sensitive mucous membrane; the patient is harassed by very frequent desire to micturate whenever a small quantity collects in the bladder; in the severest cases he may wish to empty his bladder every quarter of an hour or twenty minutes, and this the more especially when the irritating residue urine is allowed to remain, and a small quantity only can be passed each time. Simultaneously there is pain in the region of the inflamed viscus, and greatly increased torment and difficulty in the attempts made to pass water.

During this stage the kidneys may undergo a still more dangerous inflammation, leading, in the severest and most neglected

cases, to the secretion of a muco-purulent matter, or even abscess in those glands. In the first place, the alteration in them appears to depend on the constant pressure of urine which is collected in the pelves and ureters, and cannot pass into the highly distended bladder; the quantity of urine secreted in the twenty-four hours is diminished to eight or ten ounces. Inflammation attacks them, and the patient complains of uneasiness, deepening into actual pain, in the loins and across the abdomen. His bodily health is much weakened and his spirits depressed. The skin becomes hot, dry and feverish; the pulse quick, weak and irregular. Fits of shivering, more or less marked, with persistent nausea, and vomiting of everything taken into the stomach, indicate the formation of pus in the kidney. The mind becomes still further depressed and at length unconscious; and soon the patient succumbs to the disease.

Retention of urine may take place without there being any inflammation either of the prostate or bladder. Thus, when a large quantity of residuum remains habitually in the viscus, micturition is not performed at the proper time, and a considerable portion of freshly secreted urine passes down the ureters into the bladder, the vesical coats may be suddenly stretched and rendered unable to contract forcibly. Retention occurring in this way is not attended by much uneasiness or pain in the first instance. In most cases of this kind, the muscles of the bladder regain their power, if the urine be drawn off at proper intervals and not allowed to distend the viscus unduly; in other cases the use of the catheter is required ever after.

Or, retention may come on when the prostate has received some increase of size from inflammation, and presents a greater obstruction than usual to the flow of urine. I have sometimes found in enlarged prostates a delicate layer of lymph on the floor of the prostatic urethra, which may probably be referred to an inflammatory attack. In these cases there is generally a viscid or purulent matter from the prostate discharged by the urethra, and the gland is more sensitive than usual to the finger in the rectum. This form may or may not be accompanied by considerable inflammation of the bladder.

More frequently, the retention supervenes on an inflammation of the bladder. The inflammation of the mucous membrane extends to the muscular coat, already impaired by dilatation, and weakens it further; a large quantity of urine may be drawn off in this case. In other instances symptoms of retention came on when only a small quantity of fluid is in the viscus; the irritation has caused the bladder to expel all but the residue urine and to be highly contracted so long as that fluid

remains; the distress continues, and the contracted viscus is incapable of receiving the urine secreted by the kidneys and contained in the ureters. The patient makes violent straining efforts in every position he can devise to micturate; perhaps a few drops may escape when the straining subsides and the valvular third lobe is allowed to float back. The great bulk of the urine, however, remains. Should the retention not be relieved, the mucous membrane may slough away and be found after death floating in the bladder;* this occurrence is excessively uncommon. Other symptoms supervene if the retention be unrelieved; the bladder, either fully distended and containing a large quantity of urine, or spasmodically contracted and holding only a small amount, no longer admits any more from the ureters; the fluid accumulates in these ducts and the pelves of the kidneys, presses on the papillæ and prevents further secretion; the patient suffers intensely from anxiety and irritation; he becomes restless and feverish; the pulse is accelerated and intermittent; the tongue is covered with a brown fur; the memory fails and the mind wanders; at length convulsions ensue and are followed by coma and death.

Even after the occurrence of cerebral symptoms, the patient may recover if the bladder be emptied, and pressure on the kidneys removed; but "when the constitutional symptoms produced by a suppression of the secretion of urine, in consequence of the pressure on the mammæ, have gone a certain length, the drawing off of the urine is of no avail" (Home).

In certain cases the peritoneum is affected; either by extension of the inflammation of the bladder; or as a result of the diminished excretion of poisonous matter which ought to be eliminated by the kidney, but which nature endeavours to throw off by means of an increase and alteration in the fluid secreted by that membrane.

Some patients ultimately die from renal dropsy.

Ulceration of the enlarged prostate on its vesical aspect is one of the most disastrous events which take place in the course of the disease. Fortunately it is but a rare occurrence. It appears for the most part to be due to abrasion of the inflamed and softened mucous membrane by the catheter in the first instance, and afterwards to the irritation of the injured part by the urine. The ulcerated surface bleeds, and the urine is coloured dark-red or black. Whenever a sufficient quantity of urine is collected in the bladder to reach the ulcerated part, great distress is produced and the bladder contracts forcibly and with pain on the urine;

* See Brodie.

as the ulceration extends it takes less urine to reach it, and the pain and spasm of the bladder becomes more frequent; the more the fluid is spread over the raw surface the greater and more excruciating is the pain. The long continuance of these severe symptoms sooner or later exhaust the patient's strength, and he dies.

TREATMENT.

Inflammatory attacks which supervene on hypertrophy of the prostate, are usually amenable to simple treatment; it is almost unnecessary to say that all remedies should be carefully adapted to the strength of the patient. Leeches to the perineum or other forms of local depletion, with strict maintenance of the horizontal position during the attack, are most serviceable. The bowels ought to be kept gently open with laxative enemata or mild purgatives; in many cases a combination of sulphate of magnesia with tartarized antimony in small repeated doses will be found efficacious in subduing the inflammation. Dover's powder may be given internally to relieve pain; and five or six grains of extract of henbane, with a couple of ounces of starch solution in the form of an enema, are useful in allaying the irritability of the gland. During and after the accession, the patient should adhere to a light unstimulating diet, and keep out of the way of damp and cold.

When retention of urine occurs, or there is inflammation of the bladder caused by the presence of acrid residue urine, the use of the catheter is indispensable. To pass the instrument properly requires great care and delicacy; when it has once been introduced it is better to retain it in the bladder for a few days than to use it at short intervals; repeated passage of the instrument is apt to irritate the prostate and neck of the bladder; in some cases, however, retention of the catheter cannot be endured by the patient, and it thus becomes necessary to pass it at appropriate intervals. By means of the catheter retention of urine is relieved in the first place; the distress, under which the patient is suffering, is allayed; pressure is removed from the kidneys and urine is again freely secreted; the acrid urine and mucus are removed at regular intervals, and the irritation of the bladder subsides; at length, in favourable cases where the disease is not of very long standing, the muscular coat of the viscus recovers from its impairment, and

the patient can pass his water without artificial aid ; at the same time the amount of residue urine is very much diminished, most probably because the pressure of the catheter has caused some absorption of the prostate at the neck of the bladder, whereby a channel for the escape of the whole or greater part of the fluid is established.

The elastic catheter is preferred in the treatment of enlarged prostate. On account of its flexibility, it is not calculated to effect any damage during its introduction, and it can be retained in the bladder with comparative ease to the patient. Moreover, it can either be used without or with the stilet ; in the former case its pliability allows it to adapt itself to any tortuosity which the urethra may have undergone, it is not liable to cause spasm of the urethra, and the patient is not inconvenienced by the withdrawal of the stilet ; in the latter, the instrument is rendered sufficiently inflexible, and a most serviceable increase in its curvature can be effected by withdrawal of the wire. For use without the stilet, the elastic catheter should be kept on a strong well-curved wire and in a cool temperature for some length of time, until it has acquired a proper curvature and is able to retain its form ; new instruments, by being kept in salt water, are rendered capable of retaining their curvature better than by any other means ;* it is necessary to have a good collection of catheters always prepared for use, that another may be ready when one fails to pass and becomes soft.

The disadvantage of the elastic catheter, used without the stilet, is that it becomes soft on much manipulation, and must be replacd by a fresh one or furnished with a stilet. Sir E. Home recommends the use of a leaden stilet, but this not in the present day adopted.

Metallic instruments of the proper form and size are to be had at all surgical instrument makers under the name of "prostatic" catheters ; they are sometimes more easily introduced than the elastic catheters, but are more liable to excite spasm of the urethra and abrade the mucous membrane of the neck of the bladder ; further, they are not adapted for retention in the bladder. It is, therefore, preferable not to have recourse to them unless the elastic instruments fail to pass.

The prostatic catheter must be fourteen or sixteen inches in length ; it should be full sized, because a larger instrument is not apt to be entangled in the urethra, and (other things being equal,) is introduced with greater facility into the bladder than a smaller one ; the extremity should be blunt, rounded and smooth ; the

* Sir E. Home. Vol. ii. p. 117.

apertures near the end must be large that they may not be easily clogged by mucus or blood; and the curve of the instrument must be sharper than is the case with those in ordinary use, (pages 52, 53.)

If the silver catheter be used it must be warmed and oiled, preparatory to introduction; the elastic catheter must be oiled, but ought not to be warmed, since heat softens it and renders it too pliable for introduction without the stilet. Olive oil or lard is commonly used to smear the instrument; castor oil, however, is much to be preferred, as it adheres to the catheter, and smooths the way for it throughout the whole course of the urethra. Dr. Mantell* suggests that an ointment, composed of five grains of acetate of morphia to an ounce of spermaceti ointment, should be employed in cases where the urethra is very irritable; this appears to be very serviceable on such occasions, as is also belladonna ointment.

Probably the recumbent is the best position for the patient, on whom the catheter is to be passed, on account of enlargement of the prostate. He lies on his back, towards the left side of the bed, with the body a trifle raised, and the limbs a little separated from each other, and slightly bent on the trunk. In the recumbent posture a valvular process may fall back, and present less impediment to the catheter than when the patient is standing; some surgeons, however, prefer the latter position.

It is advisable to try first to effect an entrance into the bladder with the elastic catheter unsupported by the stilet, and especially in those cases where there is much irritation of the bladder and tendency to spasm in the urethra; if it passes in this way nothing more is required. Should it, however, fail, then the stilet may be passed into the catheter, (which remains in the urethra,) and the catheter passed over the neck of the bladder with its aid; the introduction of the stilet in this manner is of great service in cases where the catheter cannot be passed along the urethra, supported by its wire, on account of spasm; in its passage, the wire in this case merely acts on the inside of the catheter and need not distress the patient if properly managed. In many cases the catheter, supported by its stilet, may be introduced in the first instance without resorting to this proceeding; if, however, the greatest delicacy be not used in the operation, spasm of the urethra is apt to take place.

There are various modifications of the manner of passing the catheter employed by different surgeons; these need not be enumerated here. In cases of enlarged prostate, the best mode

* Coulson on the Bladder and Prostate. Lond 1852.

is to introduce it first with the concavity turned towards the left ilium, and with the handle in the horizontal line and parallel with the level of the body; to raise the handle gradually, as the beak advances in the perineum, almost to a right angle with the surface of the body, continuing at the same time to press it gently on; and lastly, to depress the handle between the patient's thighs as the beak approaches and passes along the prostatic urethra; during this proceeding it is well to keep the catheter well hooked round the pubic arch; this may suffice to effect an entrance into the bladder. But the beak may have been too far advanced before the handle has been depressed; in this case it may be arrested by a central valvular process, or the mucous fold connecting it to the lateral lobes; it will, therefore, be necessary to withdraw the catheter an inch or so, and to depress the handle a little earlier than in the former experiment. Should a still farther elevation of the beak be necessary than can be effected by simple depression of the handle, it can be obtained in two ways. The first is to insert the fore-finger into the rectum and press the extremity of the catheter upwards towards the pubic bones. The second is only applicable to the large elastic catheter used with a stilet; when the beak approaches the neck of the bladder, the stilet is retained by one hand while the catheter is passed on with the other; this increases the curvature of a large elastic catheter by which the extremity is enabled to ride over the elevated neck of the bladder; if a small-sized elastic catheter be used this proceeding is of no value, since withdrawal of the stilet straightens the smaller instruments instead of curving them.

During the operation, and especially if a metallic instrument be in use, the prostate may be examined and the nature of its enlargement ascertained; Mercier's instrument for this purpose is a modification of the ordinary calculus sound, and of much the same shape, but longer and larger than it; it can be moved about more freely in the bladder, but cannot be so easily introduced as the prostatic catheter; the left fore-finger is introduced into the rectum and pressed against the instrument; the degree and form of the enlargement of the middle and lateral lobes, and the condition of the urethra and neck of the bladder may be learned by tactile examination aided by the instrument.

The foregoing remarks on the passing of the catheter apply to all cases, whether the middle lobe alone be much enlarged or there be unequal enlargement of the lateral lobes; the elastic catheter without a stilet is particularly serviceable in those instances in which the lateral lobes protrude in the urethra and render it tortuous, because its pliability allows it to adapt itself to the altered course of the canal; the stilet may be introduced into the

instrument after it has arrived at the prostatic urethra, should it be required in order to elevate the beak of the catheter over the neck of the bladder.

In withdrawing the stilet, after the catheter has been introduced into the bladder, the handle of the wire must, of course, be brought upwards to the abdomen—the converse of the direction given to the instrument in its introduction.

It is observed that patients, who have long been subject to accumulation of urine in the bladder, from enlargement of the prostate, although at first greatly relieved by complete evacuation of the urine, frequently lose their health and die in a few weeks. Sir B. Brodie attributes the fatal result in such cases to the effect of the shock produced by the sudden withdrawal of a large quantity of fluid, which has for a length of time been stored up in the bladder; and considers that a slumbering disease of the kidneys is exacerbated in consequence of the removal of a wonted pressure on the secreting structure of those glands. That gentleman, therefore, recommends that in such instances the whole of the urine should not be drawn off at once; but that a portion only should be evacuated at first, and complete emptying of the viscus effected by degrees, in a period extending over several days; the patient's strength in the meantime being supported by the usual means. This has now become an established practice. There are, however, cases, in which the disease of the kidneys appears to have advanced too far, and the patient dies in spite of the most judicious treatment.

In most cases it will be advisable to retain the elastic catheter in the bladder; on removal of the pressure exercised on the kidneys, the secretion of urine is copious, and necessitates a fresh introduction of the instrument in a few hours, and passing the catheter at short intervals renders the treatment very harassing to the patient in difficult cases. It is obvious that the beak of the retained catheter must not project too much into the viscus; if it does so, then it will be a source of constant irritation to the vesical coats whenever they are sufficiently contracted to touch it; this is more especially to be guarded against in cases where there is a tendency to spasm of the bladder, whether arising from an ulcerated condition of the prostate, or from irritability of the organ coexistent with large vesical pouches; some care is required to arrange this; the catheter must be withdrawn to a sufficient extent without being allowed to escape entirely from the neck of the bladder; if the urine be not all evacuated, the position of the beak may be ascertained by withdrawing the instrument very gradually until urine ceases to flow; this shows that the apertures are out of the cavity of the bladder; pass it on again for about an

inch, and cut off all that projects from the external orifice of the urethra beyond an inch or thereabouts; refix the ivory mounting on the extremity which protrudes at the end of the penis. Probably the best mode of securing the catheter is the following; take an ordinary T bandage and tear the longitudinal band into two divisions; secure the horizontal band round the patient's abdomen, and pass the two longitudinal portions, one on each side of the scrotum, and round the perineum to be fastened to the opposite side of the horizontal one; pass an ivory ring, large enough not to produce inconvenience in case of erections, over the penis as far as its root; secure this ring to the contiguous parts of the bandage; and lastly, attach the catheter to the ring by means of four tapes; or what is better, by four longitudinal slips of elastic material. If the bands which pass from the extremity of the catheter to the ivory ring be made of elastic ribbon, the uneasiness produced by involuntary erections during the retention of the instrument is diminished. A plug of soft wood, adapted to the aperture of the catheter, prevents the urine from oozing out, and may be removed at appropriate intervals to empty the bladder.

The catheter, for the most part, should be retained in the bladder for some time. Some patients are not much inconvenienced by its retention for many weeks, while in others it sets up severe inflammation of the urethra and neck of the bladder, and renders it unbearable; however this may be, it should be changed every ten days or fortnight, and the progress which is made to voluntary micturition noted. In many instances, it is found more conducive to recovery to withdraw the catheter permanently after it has remained in the bladder for a week or two, and to pass it twice or thrice a day; for the most part it is advisable to retain the catheter rather than to be under the necessity of passing it more than every eight hours. Whatever modification of the plan of treatment may be required in different cases, the use of the catheter must never be abandoned until the patient can empty his bladder by his own unassisted powers; some persons regain the power to do so in a few weeks; and no further treatment is required upon this occasion; others never regain it, and are compelled to pass the catheter once or twice a day for the rest of their lives; in the latter case, the patient himself or an intelligent servant should be taught to perform this office. During the treatment and subsequently, the patient must be very careful not to use undue force in attempts at voluntary micturition; to do this retards recovery, and pushes a valvular tumour forwards into the vesical orifice.

Whenever, in a case which has already been treated or not, symptoms of irritation of the bladder come on, the measures previously related should be resorted to at the earliest period.

During the treatment the bowels ought to be kept gently open; owing to the confinement of the patient from his usual exercise this is sometimes not easily brought about; no purgative, however, of a violent nature is admissible. Should the lower bowels be principally constipated, then laxative enemata are most serviceable.

There are various remedies which are useful in allaying inflammation of the bladder, and subduing the secretion of viscid mucus.

Injection of the bladder is of little service in acute inflammation of that organ; in chronic inflammation, however, it frequently produces great benefit. It is necessary to exercise great caution in its use; not more than a couple of ounces of tepid water, or very slightly astringent solution, ought to be thrown into the viscus at one time. The usual injecting apparatus for the bladder may be employed; a more convenient method is to throw the liquid through an elastic catheter by means of an elastic caoutchouc bottle. The fluid may be retained in the bladder for a period varying from one to ten minutes, and the injection repeated once or twice, but not oftener, in the twenty-four hours. At first pure tepid water should be used to dilute and clear out the mucus; it may be found advantageous to retain a small quantity of tepid water for a longer period, in order that the urine may be diluted and rendered less acrid. Should an astringent solution be necessary, it must be very weak at first and may afterwards be strengthened a little. A solution of opium or morphia is frequently serviceable in allaying temporarily great irritability and spasm of the bladder. The injections ought to be abandoned for a time, if the bladder shows a tendency to increased irritability during their use.

There are certain medicines, which may be administered by the mouth, that are sometimes found to subdue chronic inflammation of the bladder and the secretion of viscid mucus. Most probably they pass through the kidneys and are dissolved in the urine, acting as a local application; they are, decoction of pareira brava, infusion of buchu, decoction of uva ursi, Chian turpentine, benzoic acid, small doses of cubebs and copaiba, tincture of muriate of iron, the mineral acids, and, in cases where the digestion is disordered, small doses of alkalies in conjunction with mild vegetable tonics; these medicines are, however, merely adjuvants to the use of the catheter, and are not to be too much relied on. Sir B. Brodie strongly recommends the use of a decoction of pareira; it is made by adding half an ounce of the root to three pints of water, and simmering it gently down to one pint; eight to twelve ounces are given daily; this decoction is apt in some cases to produce nausea, and in that event the extract of pareira may be substituted; the pareira is a most valuable remedy; the ordinary infusion, however, does not answer the purpose.

It is necessary to use anodynes to allay irritation; opium is the best and most certain remedy for this purpose; it does not, however, agree with all patients, and belladonna, conium, hyoscyamus or some allied medicine must be substituted; the remedy may be given by the mouth, or in the form of a suppository or enema; full doses are generally required. In some cases the patients rest as well without opiates.

Counter-irritation is often an excellent adjuvant in the treatment of inflamed bladder; it may be applied on the perineum or supra-pubic region. If there be symptoms of disease of the kidney, it may be of service to select the loins. If blisters of cantharides be employed, they should not be allowed to remain on too long, since absorption may take place and the symptoms be aggravated by the occurence of strangury; sprinkling the surface with raw morphia appears to prevent the cantharides from producing its specific action on the bladder. The seton is not at present generally used in this affection. If the disease can be made to yield to milder treatment, it is advisable to abstain from counter-irritation; to be of any real service, the discharge must be kept up for some time; and it is necessary to observe that the establishment and persistence for a length of time of so copious a drain, are attended by dangerous consequences to a patient debilitated by previous disease.

Considerable hæmorrhage sometimes takes place from the vesical aspect of an enlarged prostate; in certain instances the effusion of blood is truly formidable, the bladder being distended by it. The treatment consists, in the first place, of strict maintenance of the horizontal posture. Application of cold water to the perineum and supra-pubic region prove of the greatest service. Of internal remedies, acetate of lead with opium is in most instances successful in arresting the hæmorrhage; it may be given every two or three hours, in the proportion of three grains of the former to half a grain of the latter; ten grains of gallic acid, dissolved in water with a little alcohol, administered every few hours is also a good remedy; others, which are not to be relied on too much but which have occasionally been found to answer, are, tincture of matico, turpentine, small repeated doses of the bicarbonates of potass and soda, tincture of muriate of iron, and sulphuric acid. Local or even general blood letting may be necessary when the hæmorrhage is excessive; but the milder treatment mentioned above will usually suffice, without recourse to these measures being necessary. Injection of cold water into the rectum ought to be tried, should the application to the pubes and perineum fail to be efficacious. Removal of blood-clots from the bladder may be effected by injecting small quantities of tepid

water at intervals through a large catheter; Dr. Gross* states that a solution, consisting of one ounce of acetic acid to five ounces of tepid water, is particularly successful in dissolving coagulated blood; the broken up blood-clots may be drawn off by means of a syringe applied to the catheter. A better method than the latter is proposed by Mr. Adams; a large catheter is introduced into the bladder; a piece of wire, bent at the extremity, and furnished with a piece of lint, sufficiently large to fill the bore of the instrument, is passed along it as far as its visceral extremity; by withdrawing the wire, a considerable amount of suction power is produced, and portions of the coagulated blood are brought away. Injection of the bladder in this manner, and removal of coagula may be repeated once or twice in the twenty-four hours; the operation must be conducted with the greatest care, lest a fresh hæmorrhage be excited. I am not aware that these means have ever failed to remove the effused blood; should such a case occur, and the patient suffer great torment from its pressure, it would be necessary to open into the bladder by the perineal or supra-pubic operation to effect this object.

Should there be a pretty constant hæmorrhage of small amount, perseverance in the internal use of buchu generally suffices to arrest it.

It happens occasionally that the eye of the catheter becomes clogged up by blood-clots or mucus during its introduction, and the fluid contents of the bladder in consequence fail to escape; in this case the bore of the catheter ought to be occupied by a flexible metallic stilet, long enough to reach and protect the eye of the instrument, and sufficiently pliable to admit of its being withdrawn with facility; this form of stilet is particularly adapted for use with the silver catheter. When the large elastic catheter is employed, or when the leaden stilet is not at hand, a small elastic catheter will answer the same purpose;† it must of course, be of sufficient length and size; if it be used with the elastic catheter, it may be necessary to employ an iron stilet as well; the stilet is as well dispensed with, if the silver catheter be employed.

Although the more acute inflammations of the hypertrophied prostate rarely or never terminate in abscess, one or more collections of pus or muco-purulent fluid are sometimes found; there is reason to believe that these begin in the first place by obliteration of certain of the ducts of the gland, and interclusion of a small quantity of fluid in the vesicles from which they lead; it depends upon the existence or non-existence of chronic inflam-

* On Diseases of the Bladder, &c. Philadelphia, 1851.

† Dr. M. C. Bernard. Dublin Medical Press. June 16, 1847.

mation, whether the contained fluid partake more of a purulent or mucous character; these separate fluid collections may increase in size, and merge into each other so as to occupy a single cavity of some size; the latter is generally, if not always, accompanied or brought about by chronic inflammation. The purulent matter generally presses upon the prostatic urethra and increases the difficulty in micturition. Should there be any appearance indicating that the matter has a tendency to point in the perineum, an early opening should be made in that situation, that a free escape may be permitted. It sometimes happens that the finger in the rectum is able to detect a soft portion of the gland which is the seat of a muco-purulent fluid, and that aggravation of the urinary symptoms can be referred to it; if this be punctured, the matter escapes and the pressure on the urethra is removed; considerable relief may be obtained in this way; if the opening be made at an early period and before a suppurative action has been established, the wound may close immediately and no further inconvenience ensue. If an abscess unfortunately bursts into the urethra, the treatment is more difficult; the best plan is to pass a small elastic catheter into the bladder with the greatest care, keeping the beak gently pressed against the upper wall of the urethra during its introduction, and to retain it in the bladder by the usual means; the urine then flows through the instrument without entering the cavity of the abscess, while the small size of the catheter permits the matter to escape by its side. In some instances an abscess, which has burst into the urethra, reaches the rectal surface of the prostate and may be detected there by the finger; in such a case, a puncture should be made into it in that situation, in order that the fluid may more readily be discharged and the urethral opening allowed to heal; the entrance of urine into the cavity of the abscess and thence into the rectum, under these circumstances, may be prevented by retaining an elastic catheter in the bladder. In some cases there is so much irritation that retention of the catheter cannot be borne; it then becomes necessary to introduce it at intervals, as the case may require; the great point to be attended to, is to avoid implicating the beak of the instrument in the cavity of the abscess, which is always situated on the lower floor of the prostatic urethra. During the suppuration it is necessary to support the patient's strength; the use of quinine appears to check any tendency to profuse formation of matter; anodynes, hip baths of warm water, the administration of diluent mucilaginous solutions prove of great service in severe cases; the horizontal posture is, of course, to be insisted on as much as possible. After a few weeks, in favourable cases, the discharge of matter gradually ceases and the wounds heal.

Ulceration of the prostate may be palliated, but is rarely, if ever, cured. If the patient can lie on his abdomen the urine does not so easily reach the ulcerated surface, and considerable intervals of ease may be obtained by these means. It is advisable to retain the catheter in the bladder, when it can be borne; but this is not always the case; in some instances it is productive of great benefit by allowing the urine to be evacuated at short intervals, while in others its presence is intolerable; in the latter cases, all that can be done is to introduce it as often as the feelings of the patient demand. The bladder ought to be washed out with tepid water now and then; the water may either be pure, or medicated with opium. Local application of opium to the rectum, in the form of suppositories or injections, is to be employed regularly to allay pain. The patient's health and spirits must be supported as well as possible; and the urine diluted by the use of demulcent drinks.

In every stage of enlargement of the prostate, the general health of the patient ought to be carefully attended to. To that end a nutritious but unstimulating diet should be allowed; the use of wine or brandy must depend upon the previous habits of life of the patient and the particular circumstances of each case. So far as may be convenient, the horizontal posture should be maintained; when convalescence is established, gentle exercise on foot or in a carriage is beneficial, but horse exercise should be avoided.

For the cure of disease of the kidneys in these cases, reliance must chiefly be placed on the treatment calculated to allay the affection of the bladder. A slight disorder of the kidneys, depending on enlargement of the prostate, usually subsides on the employment of proper means to allay the primary disease.

M. Leroy d' Etoille has proposed the following modification of the use of the catheter. An ordinary elastic instrument is introduced into the bladder in the usual manner. A strong straight stilet is then passed along the catheter with the view of straightening that instrument, and by that means depressing forcibly the elevation at the neck of the bladder. The straightened catheter is retained for twenty minutes, and the proceeding is repeated once a day for a week or fortnight. Such an operation will, of course, be inadmissible in cases where there is ulceration or inflammation of the third lobe at the neck of the bladder. To obviate the difficulty which the stilet encounters, several complicated pieces of mechanism have been devised;* since the operation is not calculated to be of much service, these need not be described. The objections to the proceeding are: **1.** That the

* An account of these may be seen in Malgaigne's Surgery, by Brittan, Lond. 1846.

advocates of the operation do not claim for it any greater average success than can be obtained by simple use of the catheter: 2. That it may produce considerable injury to the neck of the bladder: 3. That a similar object can be equally well obtained by using an ordinary metallic catheter, (when such a one can be introduced into the bladder), because in this case the straight part of the instrument lies in the urethra while the curved portion is in the bladder, and in this manner depression of the neck of the bladder can be effected as well as by the more complicated proceeding.

Scarification of the prostate has been proposed by Mr. Costello* as a means of relieving turgidity of the vessels of the gland. That gentleman considers that four ounces of blood, obtained in this manner, would equal thirty leeches applied to the perineum; and speaks highly of the advantage of the operation. The instrument "consists of a silver catheter of the ordinary size, in the tube and extremity of which is fixed a small double-edged probe-pointed blade. When the catheter is introduced into the prostatic part of the urethra, this cutting part can be thrust out and drawn back by its attachment to the stilette of the catheter; the extent of the protrusion being regulated by a screw." Mr. Stafford also advocates this operation, and states that he has found it of service in encouraging absorption. The operation is not attended by much pain. I should think, however, that if it were not very cautiously performed, it might give rise to serious inconvenience from excessive hæmorrhage.

Means to be employed in case the Catheter cannot be introduced into the bladder to relieve retention of urine. In very rare cases it happens that the catheter cannot be introduced into the bladder; it then becomes necessary to create an artificial passage by which the urine may escape, otherwise the patient will undoubtedly die from the effects of the retention. All reasonable means having failed, puncture of the bladder should be resorted to without delay; if relief be not speedily procured in cases of retention of urine, the danger increases with the delay; in very many cases, in which it has been necessary to puncture the bladder, the subsequent fatal results may be attributed to the continuance of the retention rather than to the effects of the operation. It is, therefore, to be observed that, while on the one hand puncture of the bladder ought never to be rashly performed, on the other it ought never to be put off when it becomes evident that the catheter cannot be introduced.

The operations which are in use, or have been proposed under these circumstances, are, puncture above the pubes, perforation

* British Annals of Medicine. 10th Feb. and 3d March, 1837.

of the third lobe, and puncture of the perineum. The operation by the rectum is objectionable on account of the uncertainty which always exists as to the size and form of the tumour which projects into the bladder in the neighbourhood of the part where the puncture is made; if it were possible to introduce a catheter or sound to aid in the diagnosis of the case, then no further operation can be required; if the sound cannot be introduced, the state of the neck of the bladder and the trigone, which is more or less encroached on by the tumour, cannot be ascertained with sufficient accuracy to warrant the operation.

In describing the operation of *puncture of the bladder above the pubes*, it is sometimes recommended that an incision should be first be made through the skin and subjacent tissues, and that the proceeding should be completed by passing the trocar into the bladder at its lower part. It is obvious that a wound one inch, or thereabouts, in length will be but partially filled by the canula, and that there will, in consequence, be a greater risk of infiltration of urine than if the puncture be of the smallest possible size compatible with the dimensions of the tube to be retained. I should, therefore, feel inclined to pass the trocar into the bladder, in the manner described by Chelius* and others, without any preparatory use of the knife; a small incision through the skin alone, and no deeper, is, however, admissible and may facilitate the operation. The following are the steps of the operation; the hair is first shaved from the pubic region and the patient placed on the right side of the bed with his body slightly raised, and the knees a little inclined towards the abdomen; the skin of the supra-pubic region and the distended bladder are steadied by an assistant, or the left hand of the operator; a curved trocar, five inches in length and representing a portion of a circle six inches in diameter (Malgaigne), is then made to pierce the walls of the abdomen in the middle line, one inch or an inch-and-a-half above the superior margin of the pubic symphysis; it is then pushed into the bladder; in making the puncture, the instrument must be held with the concavity directed towards the pubic bones; the thickness of the abdominal walls at this part varies in different individuals, so that the trocar may have to traverse a distance of from two to four inches before the viscus is reached. The canula being steadied with the left hand, the trochar is withdrawn; the canula is then attached by its outer extremity to a T bandage, passed round the abdomen and perineum. The patient being laid on his side, the urine is evacuated. If the instrument used in this operation be too short, the

* Chelius' Surgery, by South. Lond. 1847.

contracted bladder is apt to slip away from it; it should, therefore, be at least five inches in length, and more if the patient be unusually fat. After the urine is withdrawn, a smaller silver tube, of sufficient size to fill the canula, and furnished with a rounded extremity and lateral apertures, should be inserted into the canula, in order that the sharp margins of the latter may not irritate the coats of the bladder; if not at hand, a piece of elastic catheter of an appropriate size may be used instead of the internal silver tube; the external extremity of the tube or piece of catheter must, of course, be attached securely to the canula and bandage, and be furnished with a plug of soft wood which may be removed when it is necessary to empty the bladder. John Hunter recommends that the convexity of the canula should be made to lie on the posterior part of the bladder, because in that position it will best adapt itself to the form of the viscus. The canula should be retained for eight or ten days; and then taken out to be cleaned. The mode to be pursued in removing it, is, first to withdraw the inner tube or piece of elastic catheter, and to pass a small curved instrument through the larger tube into the bladder; then to withdraw the canula, leaving the curved instrument in the bladder as a guide by which to introduce it again. After the canula has remained in the bladder for another 8 or 10 days, it may be expected that the viscus has become firmly adherent to the abdominal walls and that no risk of infiltration of urine need be dreaded. Should it be possible to restore the natural passage for the urine, the opening of the puncture may be covered with adhesive plaster and allowed to contract. It may, however, be deemed advisable to keep the wound open in the form of a permanent false passage; in this case a piece of elastic catheter may be substituted for the silver canula.

It is objected to the operation above the pubes that there is danger of infiltration of urine, and that the peritoneum may be wounded. To the first objection it may be answered that infiltration of urine need not occur if proper care be taken in performing the operation and conducting the after treatment. There is little or no danger of wounding the peritoneum in these cases; if the operation be required at all, it can only be in cases where the prostate is unusually large; a very bulky prostate elevates the bladder to a level with the lower part of the abdominal walls, and the peritoneum to a considerable distance above the upper margin of the pubic bones (Pl. 11. S.R.Q. and O.); further, the interval between the margin of the bone and the reflection of the peritoneum is increased by distension of the bladder; the peritoneum is therefore quite safe, and the bladder is in the most

favourable position, not only for this operation, but for the establishment of a convenient and permanent false passage. (Pl. 11. B.B′.) Moreover, the part of the bladder, which is wounded, is removed from the seat of disease; the retention of the canula, or catheter, does not inconvenience the patient or prevent him following his usual occupation; and the high elevation of the bladder ensures that it should be perfectly emptied at each micturition. It may be remarked that this operation is not applicable to such cases as stricture of the urethra.

Perforation of the third lobe may be performed with a metallic prostatic catheter, somewhat conical at the beak; the instrument is passed along the urethra until the beak is arrested by the attachment of the tumour to the neck of the bladder; the fore-finger of the left hand is introduced into the rectum to ascertain and direct the future movements of the instrument; and the beak is kept firmly pressed against the obstruction, while the handle is forcibly depressed and an artificial opening made into the bladder. Mr. Stafford has invented an instrument for this purpose, which may be employed instead of the pointed catheter. The subsequent treatment consists in leaving the catheter in the bladder for some days, until the new passage becomes lined by a false membrane, and in allaying any inflammation which may supervene; it will be necessary to pass the catheter at intervals of a week or so, after the convalescence of the patient, lest the new passage contract and close up.

Perforation of the third lobe has very frequently been done accidentally. Pl. 12 represents a specimen which was taken from a man in whom it had been done without design, and without any ill effects; up to the period of his death, which took place from some other disease, he passed his water through the false passages with considerable freedom. There are several cases of the same nature on record. It appears that the operation, if carefully performed in the cases adapted for it, is devoid of risk. Nevertheless, it is not without some disadvantages. It is not likely to prove successful in those cases where the middle lobe presents itself as a large solid tumour at the neck of the bladder; the amount of tissue to be penetrated is great, and there is a risk of the artificial opening becoming closed, or not being easily entered by the catheter in subsequent introductions of the instrument. Before determining, in extreme cases, whether this or the operation above the pubes is to be preferred, the prostate should be carefully examined from the rectum; if the gland be very large, the operation above the pubes is, for reasons mentioned formerly, to be selected; should the gland appear to be smaller, renewed and careful attempts may succeed in introducing the catheter without

an operation; if this does not follow, the third lobe may be perforated. There can be little doubt that a false passage has been made in this manner more often than absolutely necessary; and that in many of these cases the catheter might have been elevated over the tumour by the exertion of some pains.

Dr. J. A. Lawrie of Glasgow proposes to introduce *puncture by the perineum*, in cases where it is requisite to relieve the bladder by an operation in consequence of enlargement of the prostate. The operation is founded on the fact that the neck of the bladder is elevated in these cases, and that an instrument can easily be passed from the wound in the perineum, over the elevation and into the bladder. The operation is thus described:* "The patient being placed and tied as for lithotomy, the Staff is introduced and held as for lithotomy, *i. e.* pushed down upon the rectum, and the angle† made to project towards the perineum. The point of the staff ought merely to reach the apex of the gland, or pass about half-an-inch into it. Hence the necessity for having the under portion of the staff short. The urethra is now to be opened by thrusting the knife into the groove of the staff, not deeper than merely to make sure that the canal has been opened, and, immediately withdrawing it, making an incision just large enough to admit the finger. The finger being placed in the wound, a straight metallic catheter is introduced into the urethra, and lodged in its membranous and pervious prostatic portions. The staff is now withdrawn, and we have a straight catheter in a short straight canal, which a little gentle manipulation enables us to lodge in the bladder and relieve our patient. As it is of importance to have a thorough command of the catheter, I use one twelve inches long, slightly curved and perforated at the point; the slight curve enables us to glide it under the arch of the pubes, and over a projecting third lobe, while the perforation at the point allows us to withdraw it over the probed wire, and to lodge and retain in its place a short elastic tube."

The late Mr. Guthrie‡ observed that a patient, on whom he operated for stone in the bladder, was at the same time relieved of an enlargement of the prostate. That gentleman in consequence raised the question whether some operation, by the perineum, might not be advantageous in cases of enlargement of the prostate. So far as I can ascertain, it has not been established that a senile enlargement of the gland subsides after incision; and the general opinion of Surgeons is, that operations by the perineum are not admissible in these cases.

* Glasgow Medical Journal. July, 1854.

† Dr. Buchanan's rectangular staff is supposed to be employed.

‡ Op. cit.

On the use and administration of certain remedies, stated to be of service in reducing enlargement of the prostate. Hydrochlorate of Ammonia has not been employed in this country for the purpose of subduing enlargement of the prostate. It has, however, been used in Germany, and is held in great esteem by many surgeons in that country. It appears to have been first brought into notice by M. Fischer of Dresden* in 1831. M. Vanoye has followed up the administration of this medicine, and states that it is attended by great success; the gland undergoing by degrees a considerable diminution in size. The mode of administering it, is, to begin with 15 grains every two hours and to increase the amount gradually until nearly half an ounce is taken in the day. These are very large doses and are apt to affect the patient's health; should they do so, this medicine must be laid aside for the time, and recourse had to tonics. It is to be observed that this remedy should not be administered in any case, in which there is any chance of the general health of the patient being impaired by it.

Mr. Stafford† speaks highly of the beneficial effects produced by Iodine and its compounds in subduing an enlargement of the prostate, especially in its early stages. That gentleman charges the point of a bougie with Iodine or Iodide of Potassium, and dips it into tallow so that a coating is formed over it; the bougie is then passed up to the prostatic urethra and allowed to remain till the tallow melts; the bougie is then brought gently backwards and forwards, so that the Iodine is smeared over the enlarged part. This application is not made until any irritation, under which the gland may be labouring, is subdued by the usual means. The application consists of an ointment, composed of a grain of Iodide of Potassium to a drachm of unguentum Cetacei; the amount of Iodide is increased by degrees up to a drachm, and after that half a grain up to four or more grains of pure Iodine is added to strengthen the preparation. The Iodine or Iodide of Potassium may also be applied in the form of suppositories, along with Extract of Henbane; or administered by the mouth. Burnt sponge, which contains Iodide of Sodium, is mentioned by John Hunter as having effected a considerable reduction in the size of an enlarged gland; it is not stated whether it was in the case of a young or elderly person. It is to be observed that Mr. Stafford employs the catheter, and other appropriate means in the treatment of his cases; and it is probable that his success may in a great measure be attributed to this. Other surgeons have not been so

* Medico-Chirurgical Review. Oct., 1852.

† On the treatment of some affections of the Prostate. Lond. 1840.

successful, as Mr. Stafford, with Iodine; perhaps this may be attributed to the peculiar manner in which that gentleman employs it. The remedy does not appear to have had a sufficiently extended trial in the manner recommended by Mr. Stafford. It is proper to add, that Mr. Stafford considers this treatment as adapted, in a great measure, to the early stages of the disease only. Most probably it will be found principally beneficial in those cases of hard enlargement of the prostate, which take place in early life.

These are the only internal remedies, with which I am acquainted, that are calculated to be of any service in causing the enlarged gland to diminish in size. It must be remembered that each of them requires cautious administration, lest the patient should suffer injury rather than receive benefit from their use; and that the use of the catheter is the only certain means, by which the effects of enlargement of the prostate in old age can be warded off.

GLASGOW:—GEORGE RICHARDSON, PRINTER TO THE UNIVERSITY.

PLATES, &c.

EXPLANATION OF PLATE 1.

This is a view of the base of the bladder with the prostate gland, vesiculæ seminales, and vasa deferentia.

A.A.—The lateral lobes of the prostate.

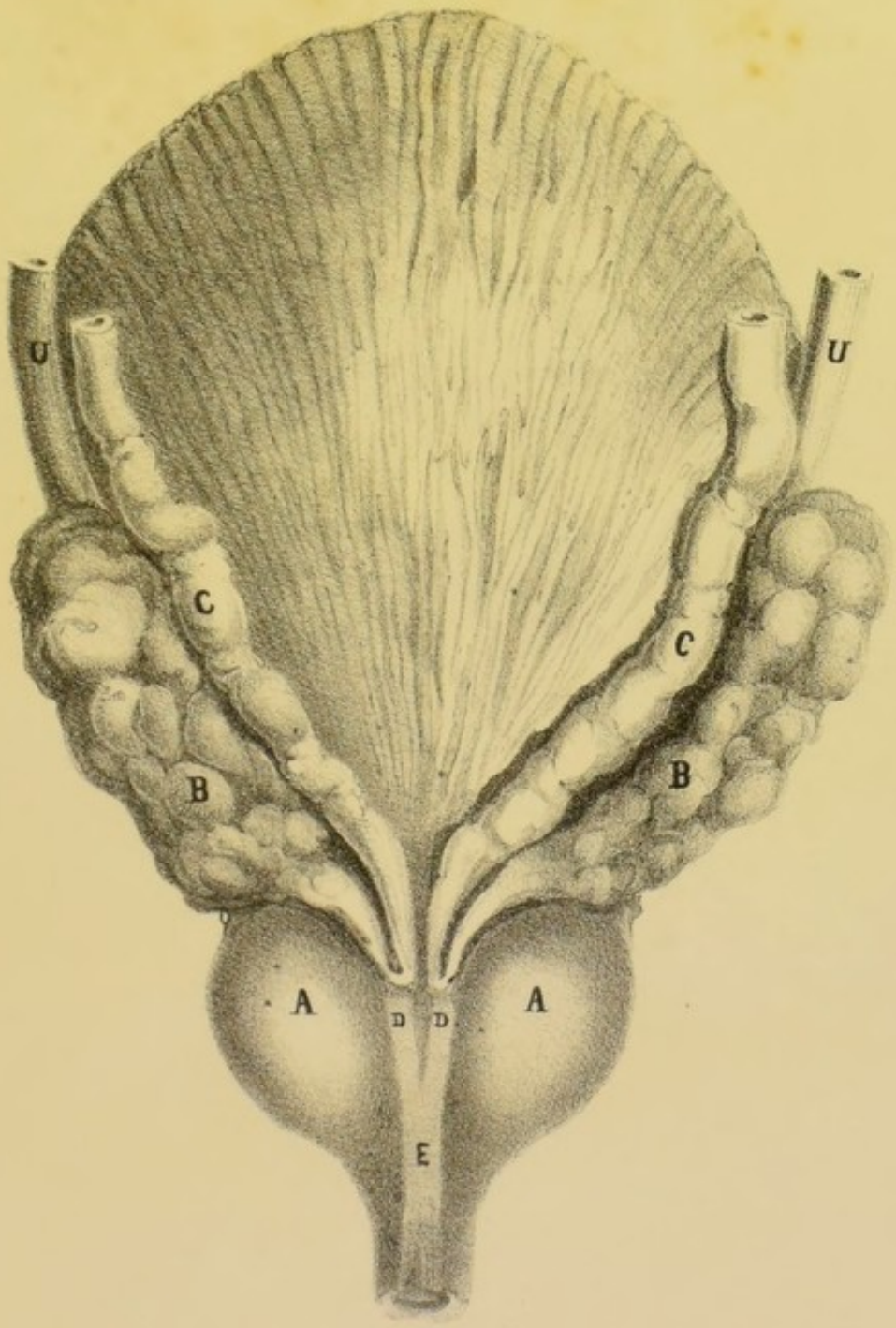
B.B.—The vesiculæ seminales.

C.C.—Terminal portions of the vasa deferentia.

D.D.—A pair of shallow grooves, which indicate the course of the ejaculatory ducts.

E.—A groove, which is sometimes seen on the under surface of the prostate, and corresponds to the urethra at that part.

U.U.—The terminal portions of the ureters.



Maclure & Macdonald, Lith.

Fig 1.

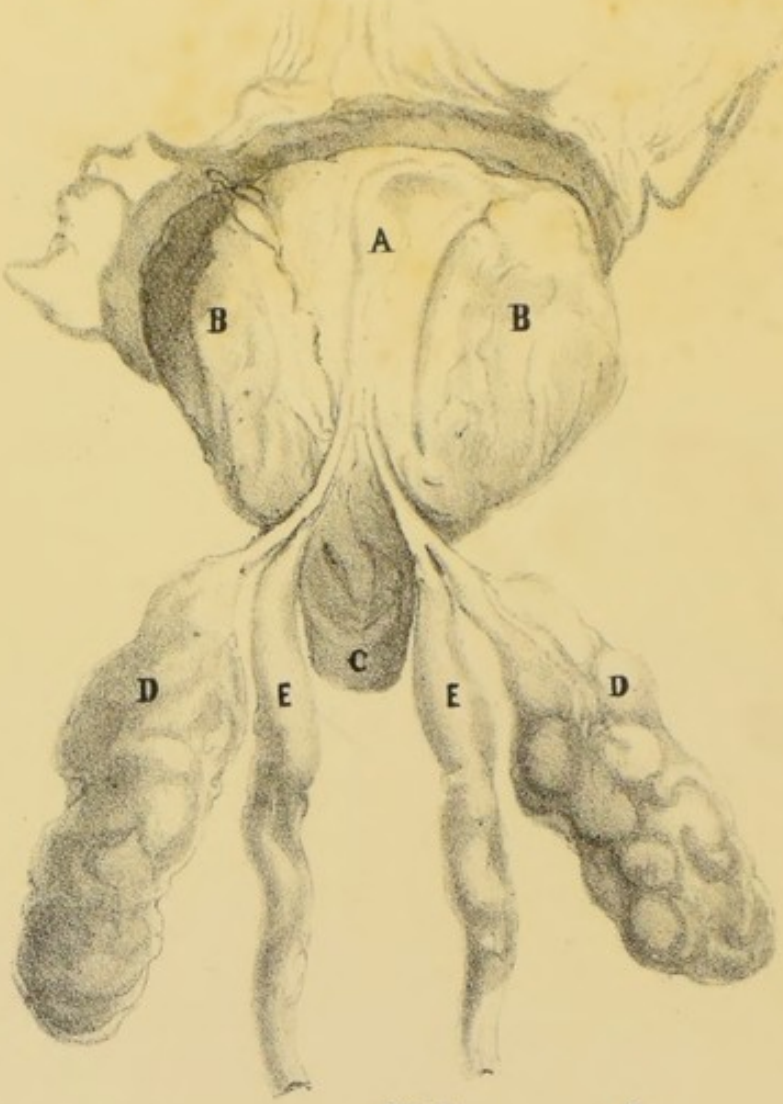
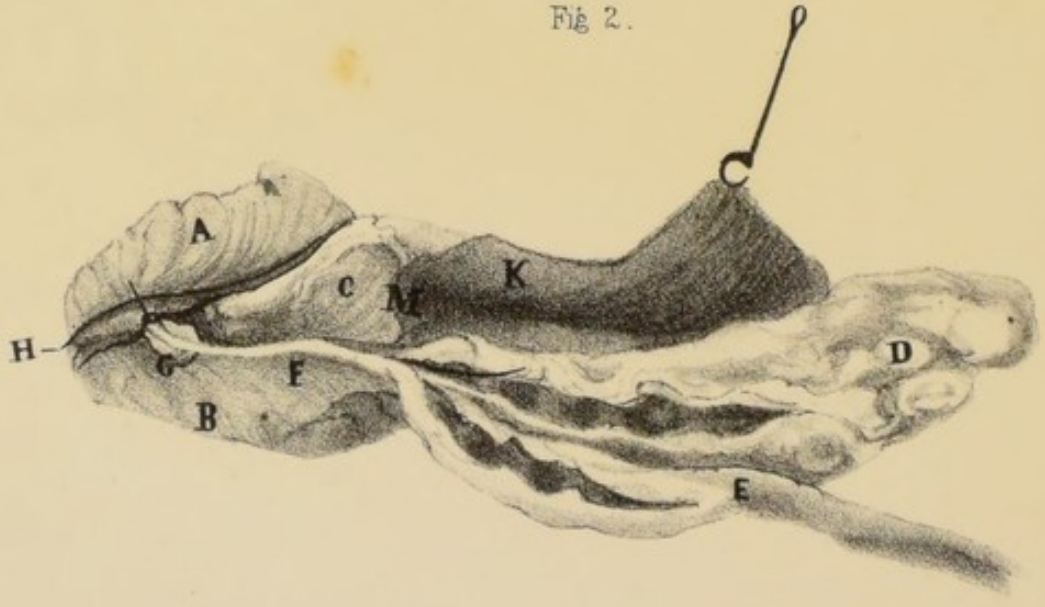


Fig 2.



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EXPLANATION OF PLATE 2.

FIG. 1. The lower surface of a prostate, taken from the body of a man about 70 years of age.

The vesiculæ and vasa, with their continuations, the ejaculatory ducts, have been dissected off and thrown forwards, to show the third or middle lobe of the prostate.

A.—The middle lobe of the prostate.

B.B.—The lateral lobes of the prostate.

C.—Apex of the gland, with a part of the membraneous portion of the urethra.

D.D.—Vesiculæ seminales.

E.E.—Vasa deferentia.

FIG. 2. This specimen was taken from a man about 50 years old.

The prostate gland and the neck of the bladder have been dissected from the left side, in order to show the relations of the third lobe, and the course of the ejaculatory duct of one side in its passage to the prostatic portion of the urethra. The vesicula seminalis and vas deferens have been partly laid open by a longitudinal incision.

A.—Portion of the prostate above the urethra.

B.— Do. do. below the urethra.

C.—Middle lobe, below the neck of the bladder and above the ejaculatory duct.

D.—Left vesicula seminalis.

E.— " vas deferens.

F.G.—Are placed below the left ejaculatory duct.

G.—Is immediately below the utricle.

H.—Points to the apex of the prostate, and the prostatic urethra.

K.—A portion of the muscular coat of the base of the bladder, held up by a hook.

M.—That portion of the third lobe, which is seen at A in Fig. 1.

EXPLANATION OF PLATE 3.

The internal surface of the bladder and prostatic urethra has been exposed by a longitudinal incision carried along their upper surface. The cut margins of the prostate are very slightly separated, in order that the longitudinal folds of the urethra, at that part, may be seen.

A.A.—Cut margins of the prostate.

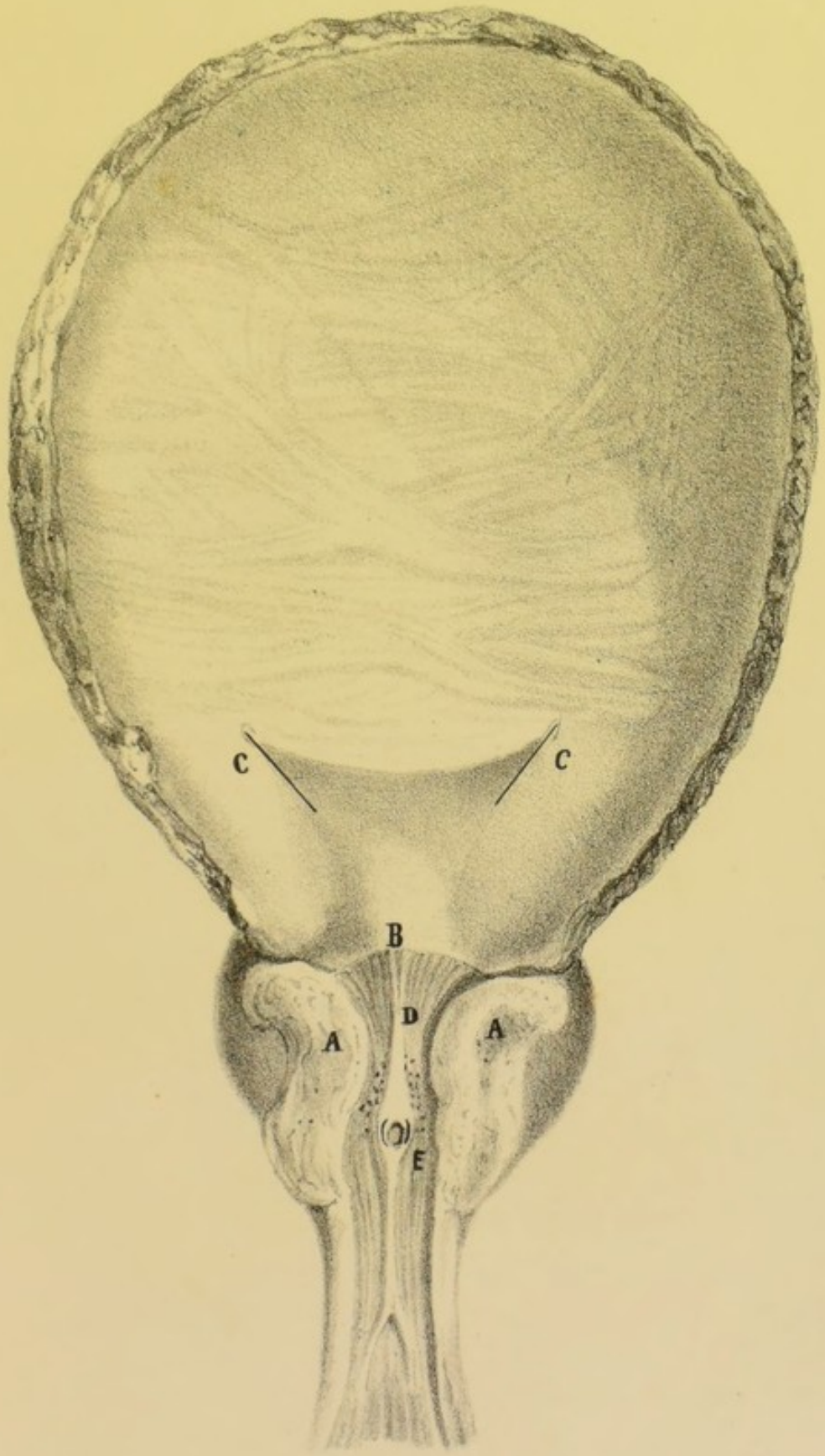
B.—Is placed over the uvula of the bladder.

C.C.—The orifices of the ureters. The dark lines represent a pair of bristles protruding from them.

C.C.B.—Bound the trigone of the bladder.

B.D.E.—Indicate the verumontanum, which is seen to terminate at the membraneous portion of the urethra by a bifurcation.

E.—Is placed a little on one side of, and below the most elevated portion of the verumontanum. At this part, the pair of orifices of the ejaculatory ducts, with the opening of the utricle between them, may be seen. The smaller orifices on each side of the verumontanum are those of the glandular structure of the prostate. All these orifices have been somewhat exaggerated for clearness.



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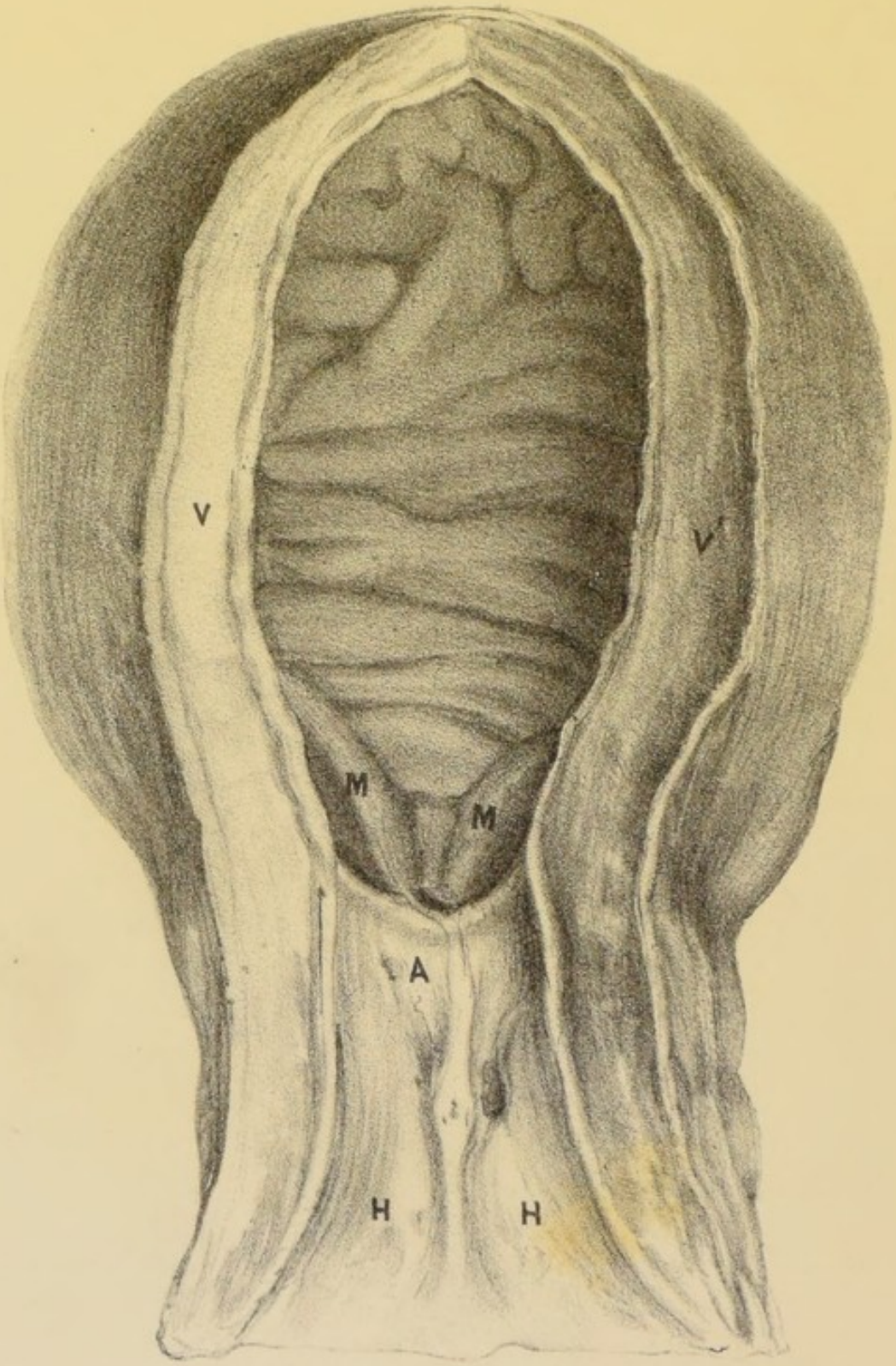
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EXPLANATION OF PLATE 4.

This Plate is a representation of preparation No. 882 in the Museum of King's College, London.

The effects of an obstinate stricture of the urethra on the bladder and prostate are well seen in this specimen. The muscular coat of the bladder is hypertrophied to a very great extent. The prostate is somewhat larger than usual, and the prostatic urethra is dilated. The neck of the bladder is elevated, and thickened, forming a ridge which rises between the cavity of the viscus and the urethra. If this be compared with the subsequent Plates, it will be seen that the alteration, which the prostate and prostatic urethra have undergone in this case, is very different from that which takes place in senile hypertrophy.

A.—The neck of the bladder.

H.H.—The prostatic urethra, dilated on account of the pressure brought to bear on it by the force exercised on the urine by the hypertrophied bladder.

M.M.—The muscles of the ureters, hypertrophied in common with the general muscular coat of the bladder.

V.V′.—The cut margins of the thickened coats of the bladder.

EXPLANATION OF PLATE 5.

This is a specimen of glandular hypertrophy of the prostate. The neck of the bladder is elevated by a tumour, which is composed of the middle and lateral lobes at that part, and is surmounted by a small valvular excrescence (B) in the centre. The right side of the prostate and a portion of the bladder have been removed in order to show more clearly, the elevation of the neck of the bladder. The specimen is seen from the right side, and a little obliquely.

A.A.—Orifices of the ureters.

B.—Small valvular body, rising from the tumour at the neck of the bladder.

C.—Left lateral lobe, showing the nodular structure of the gland.

D.—Portion of the gland below the urethra.

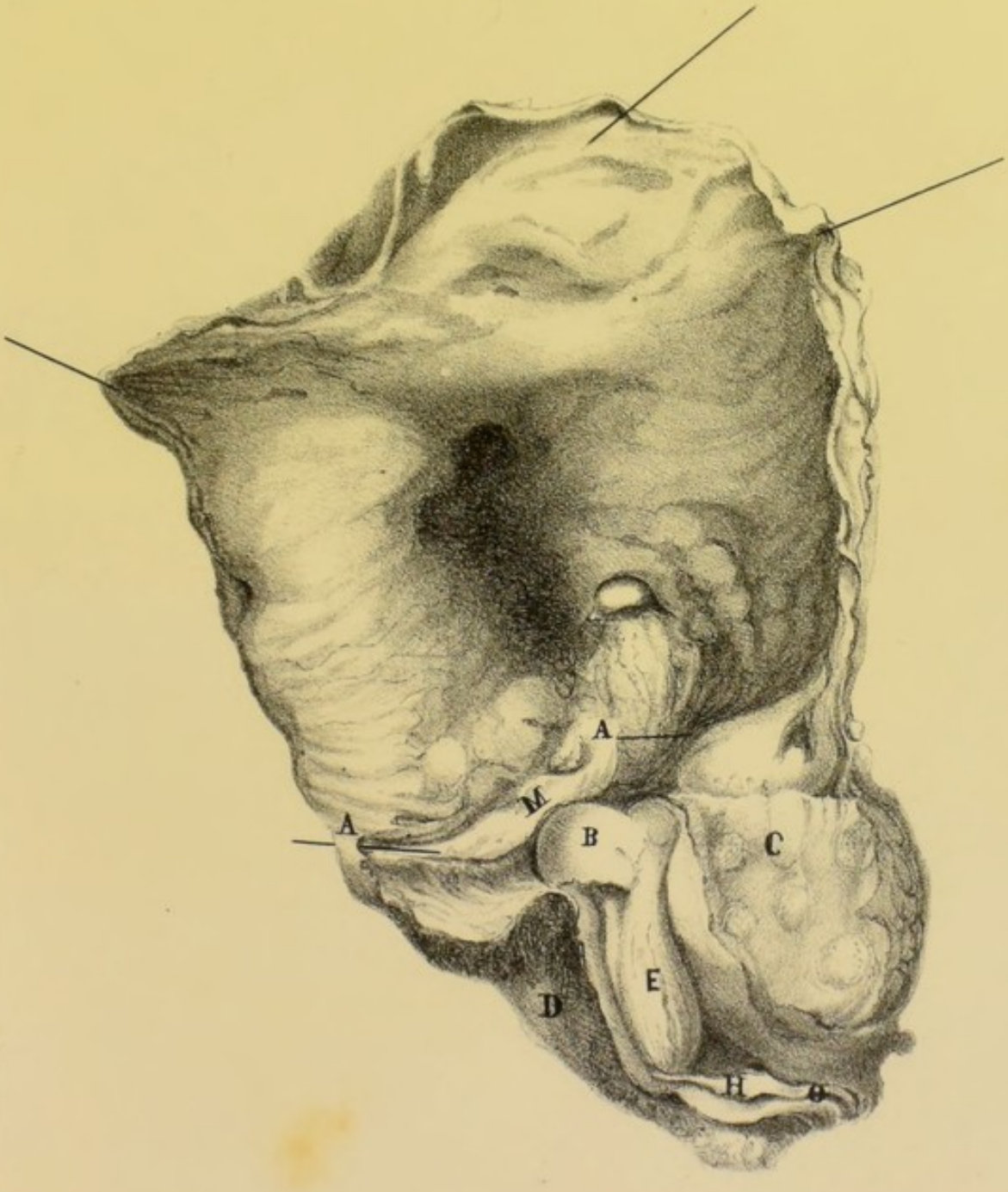
E.—A nodule, projecting on the anterior aspect of the tumour at the neck of the bladder.

M.B.—Indicate the axis of the base of the bladder.

B.E.—Show the elevation of the neck of the bladder.

H.O.—Show the axis of the prostatic urethra.

Between E and H is the angle, at which the neck of the bladder rises from the urethra.



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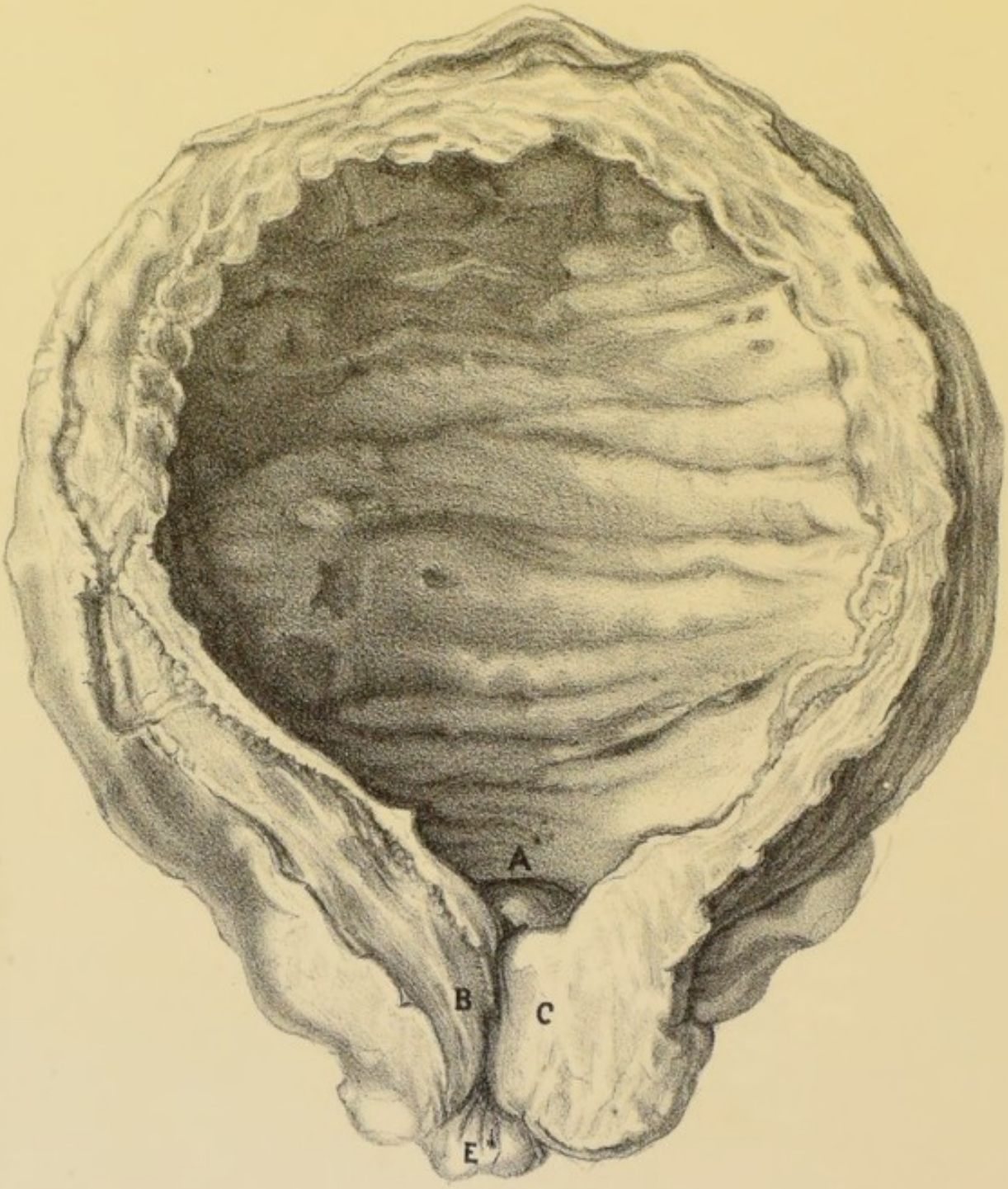


Maclure & Macdonald, Lith.

EXPLANATION OF PLATE 6.

Preparation No. 883 in the Museum of King's College.

The prostate is considerably enlarged in this case. The upper surface of the gland has been removed to show the manner in which the hypertrophied lateral lobes compress the urethra from side to side. The vesical coats are much thickened.

A.—A small valvular growth of the middle lobe at the neck of the bladder.

B.C.—The lateral lobes.

From the neck of the bladder (A) to the apex of the prostate (E) the urethra forms a curve, of which the convexity is directed downwards.

EXPLANATION OF PLATE 7.

Preparation No. 911 in the Museum of King's College.

This is a specimen of unequal enlargement of the lateral lobes of the prostate.

A.—The right lateral lobe.

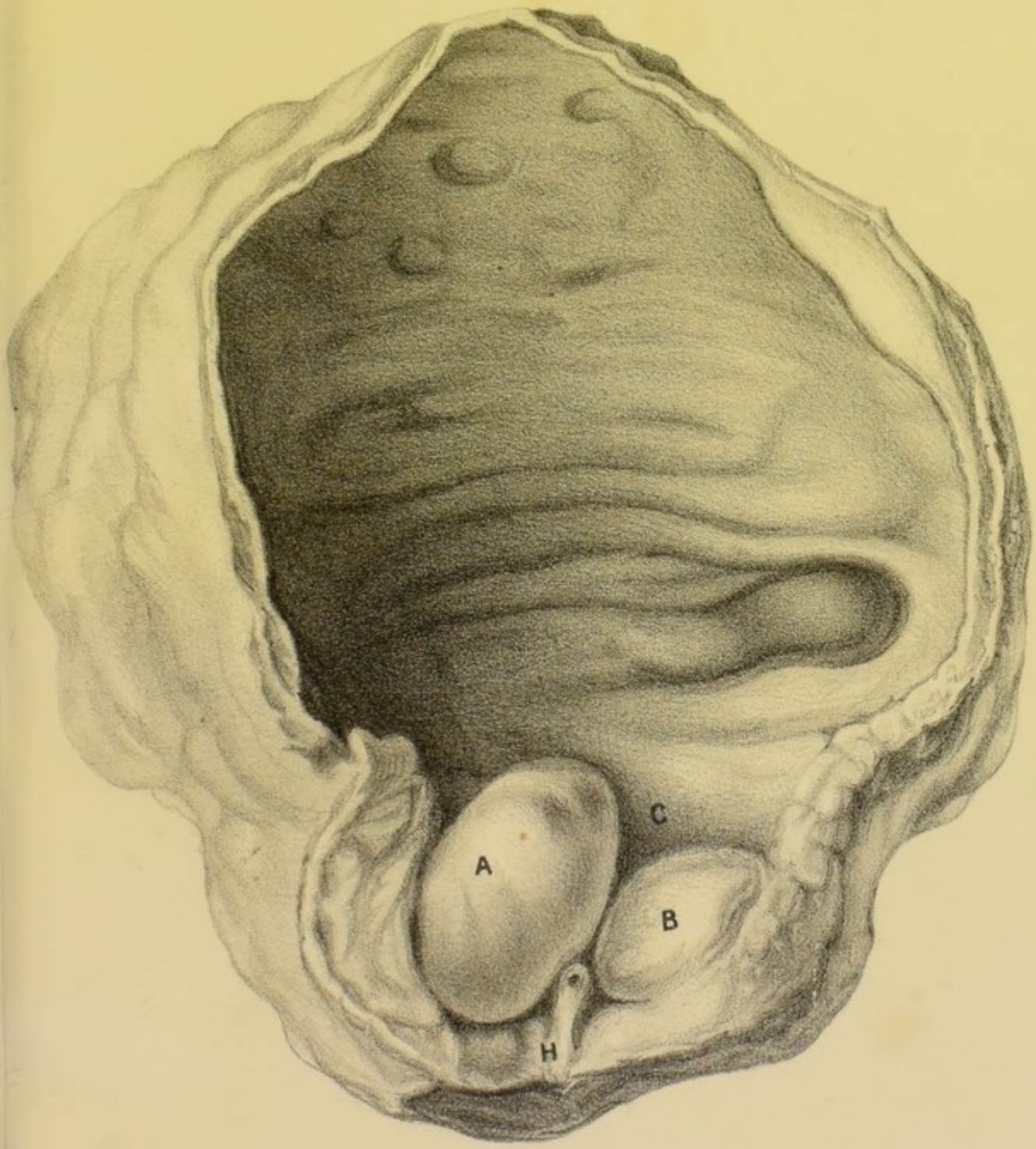
B.—The left lateral lobe.

C.—The neck of the bladder.

H.—Anterior part of the verumontanum.

The right lateral lobe projects into the urethra in the form of an oblong tumour, of which the long axis is directed from the right side obliquely upwards towards the left; the upper part of this tumour presses the neck of the bladder a little to the left, while the lower portion does not encroach to an equal extent upon the urethra. The left lateral lobe is much smaller than the right, and encroaches on the urethra principally opposite the middle and lower part of the tumour of the right lobe. The neck of the bladder is somewhat elevated by an enlargement of the middle lobe. In consequence of this alteration in the lobes of the gland, the prostatic urethra is rendered tortuous, and takes on something of the form of an inverted **S**; moreover, it is curved by the elevation of the neck of the bladder.

It is obvious that in such a case as this, the elastic catheter is better adapted to relieve retention of urine than the metallic instrument. During its introduction, the beak of the catheter should be directed to one side or the other at first; should it be implicated by a tumour of one of the lateral lobes, and fail to pass easily, an attempt should be made to pass it by keeping the beak directed to the other side.



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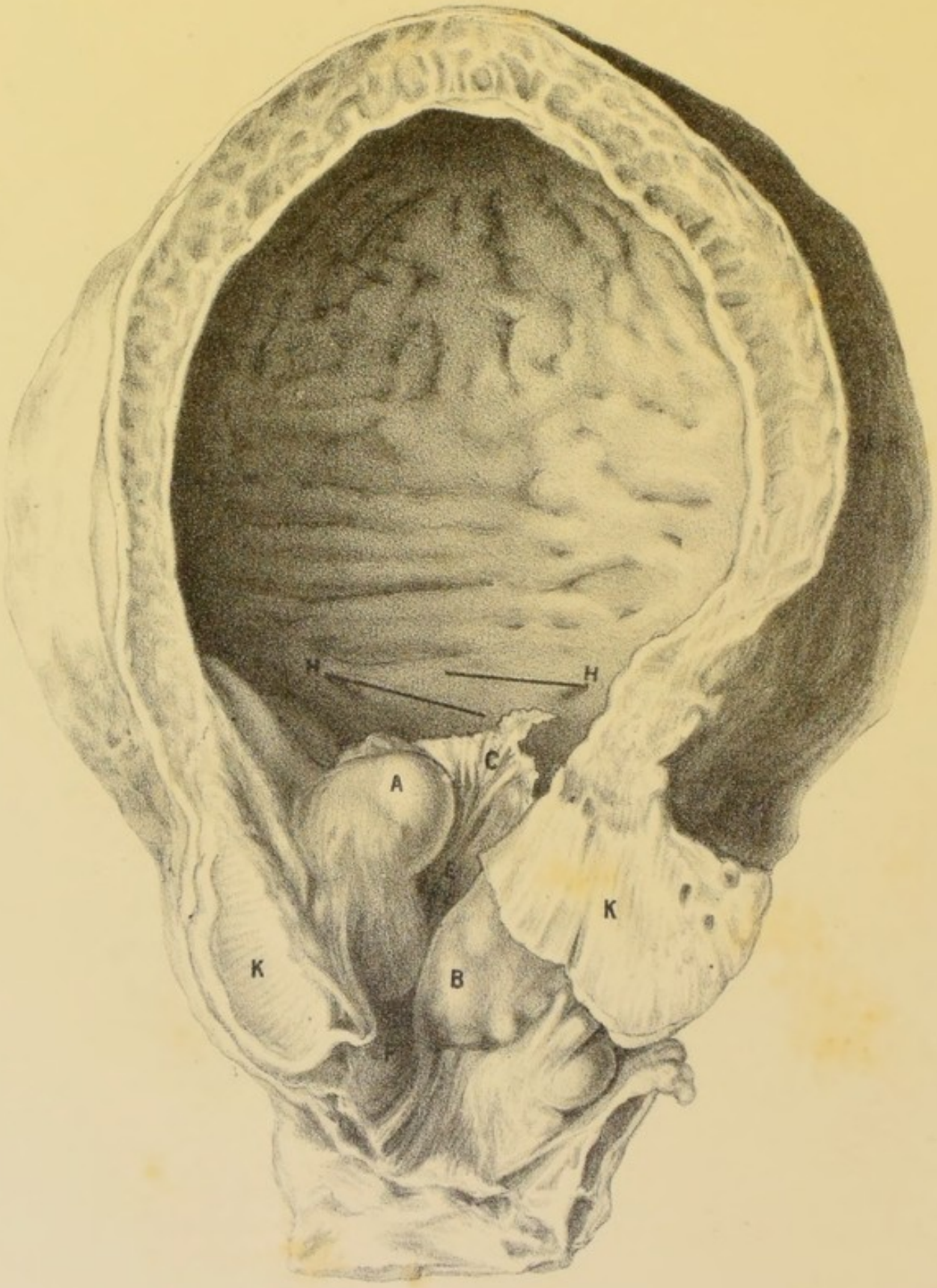


D.F.J. G. Westmacott. ad nat. del. 1856.

EXPLANATION OF PLATE 8.

Preparation No. 2500 of the Pathological series in the Museum of the Royal College of Surgeons of England. This is another specimen of unequal enlargement of the lobes of the prostate. It is represented in the Fourth Plate of Sir E. Home's second volume on diseases of the prostate.

A.—Process of the right lobe.

B.—Tumour of the left lobe.

C.—Process of the middle lobe.

E.F.—Are placed in the prostatic urethra.

H.H.—Orifices of the ureters.

K.K.—Cut surfaces of the prostate.

All the three lobes of the prostate are enlarged in this specimen. The right lobe sends out a nipple-shaped process (A), which encroaches on the neck of the bladder, and lies partly in front of the enlarged middle lobe. The left lateral lobe gives rise to a nodulated growth (B), which projects over the verumontanum and impinges on the opposite side of the urethra. The middle lobe rises as a transverse process at the neck of the bladder; it is pressed towards the left side by the process of the right lobe. The urethra is rendered tortuous by these excrescences; it is first displaced towards the left side by the process of the right lobe; more anteriorly it is driven towards the right side by the growth from the left lobe; and lastly it turns sharply round the growth of the left lobe.

The middle lobe bears evidence of having been injured by introduction of the catheter.

EXPLANATION OF PLATE 9.

Preparation No. 913 K. C. L.

This is a specimen of a prostate very greatly enlarged, so much so, that the bladder is half filled by the tumour.

A.A'.—Tumour of the middle lobe projecting into the bladder. It bears a somewhat lobulated appearance. A tributary channel runs round each side of it to connect the reservoir at the base of the bladder to the urethra; of these channels the one on the left side (N) has apparently been the most efficient for the conveyance of urine.

B.—Right lateral lobe.

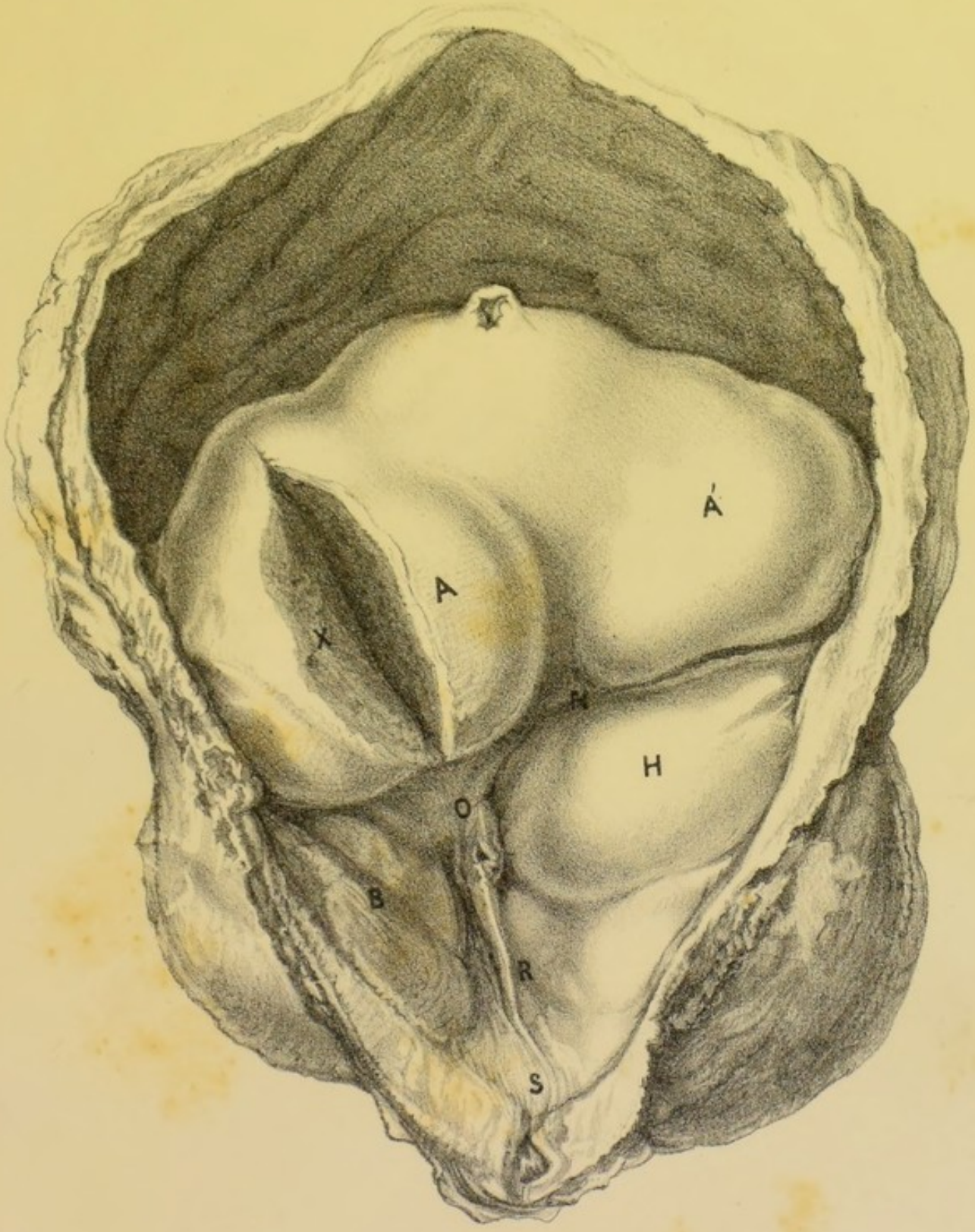
H.—Left lateral lobe.

O.R.S.—Are placed over the verumontanum and floor of the urethra. The urethra has been much deepened and compressed from side to side by the lateral lobes; above it receives two tributary channels which have been already mentioned.

X.—An incision which has been made into the middle lobe to see the structure of the tumour.

A remarkable character in this preparation is, that although the prostate is enlarged to a size very rarely seen, the bladder does not appear to have suffered much from it. It seems that the form of the tumour was not such as to present much impediment to evacuation of the urine. The vesical coats are not greatly thickened; what thickening they have undergone is principally at the base of the bladder, behind the tumour of the third lobe.

It is obvious that it would be a matter of great difficulty to introduce a catheter into the bladder in this case, and that the catheter ought to be very much longer than usual. If there were a necessity for puncture of the bladder, it is evident that the operation above the pubes would answer better than any other; indeed, it is doubtful whether any other operation could be successfully carried out. The external surface of the gland is so large and well-defined that there would be no difficulty in determining on the particular operation in the living body.



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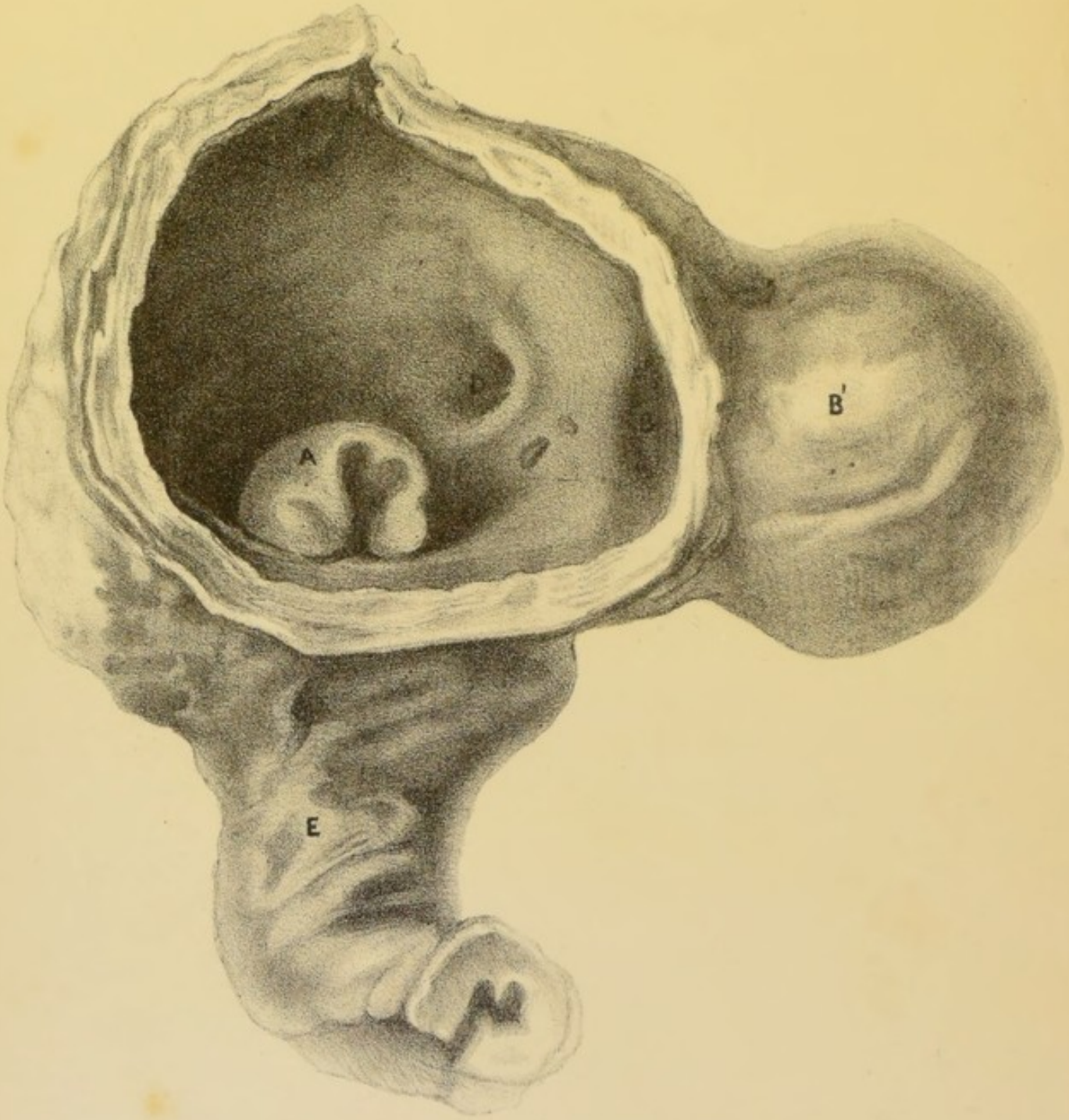

A
B'
E

EXPLANATION OF PLATE 10.

Preparation 915 K. C. L.

In this specimen the anterior walls of the bladder have been cut away in order that a valvular growth of the middle lobe at the neck of the bladder may be seen *in situ*. The urethra remains entire.

A.—Valvular growth of the middle lobe. It is attached to the lower two-thirds of the neck of the bladder; and appears as if its sides had been brought forwards and folded on themselves; hence it has a somewhat lobulated appearance.

B.B′.—Orifice and body of a large vesical pouch. This pouch has a shready appearance internally, as if it had suffered from inflammation.

D.—Orifice of a smaller pouch, of which the body is not seen.

E.—The urethra, &c., entire.

EXPLANATION OF PLATE 11.

This preparation is in Mr. Goodsir's Collection. It shews the advantage of puncture of the bladder above the pubes in cases where such an operation is required, on account of retention of urine due to enlargement of the prostate. Mr. Goodsir's father found it necessary to perform this operation; a stone, whose presence had never been previously suspected, was removed; and the patient lived for eight years, constantly making water by the false passage above the pubes. The bladder and neighbouring parts are shewn by a lateral dissection; a portion of the right side of the viscus has been removed to shew the interior.

A.—Valvular tumour of the third lobe projecting into the bladder.

B.B′.—A probe, shewing the false passage above the pubes into the bladder.

C.—External surface of the body of the prostate greatly enlarged.

D.—Right uretur.

E.F.—One vas deferens and vesicula, respectively.

H.H′.H″.—Indicate the course of the urethra.

L.—Bulb of the urethra.

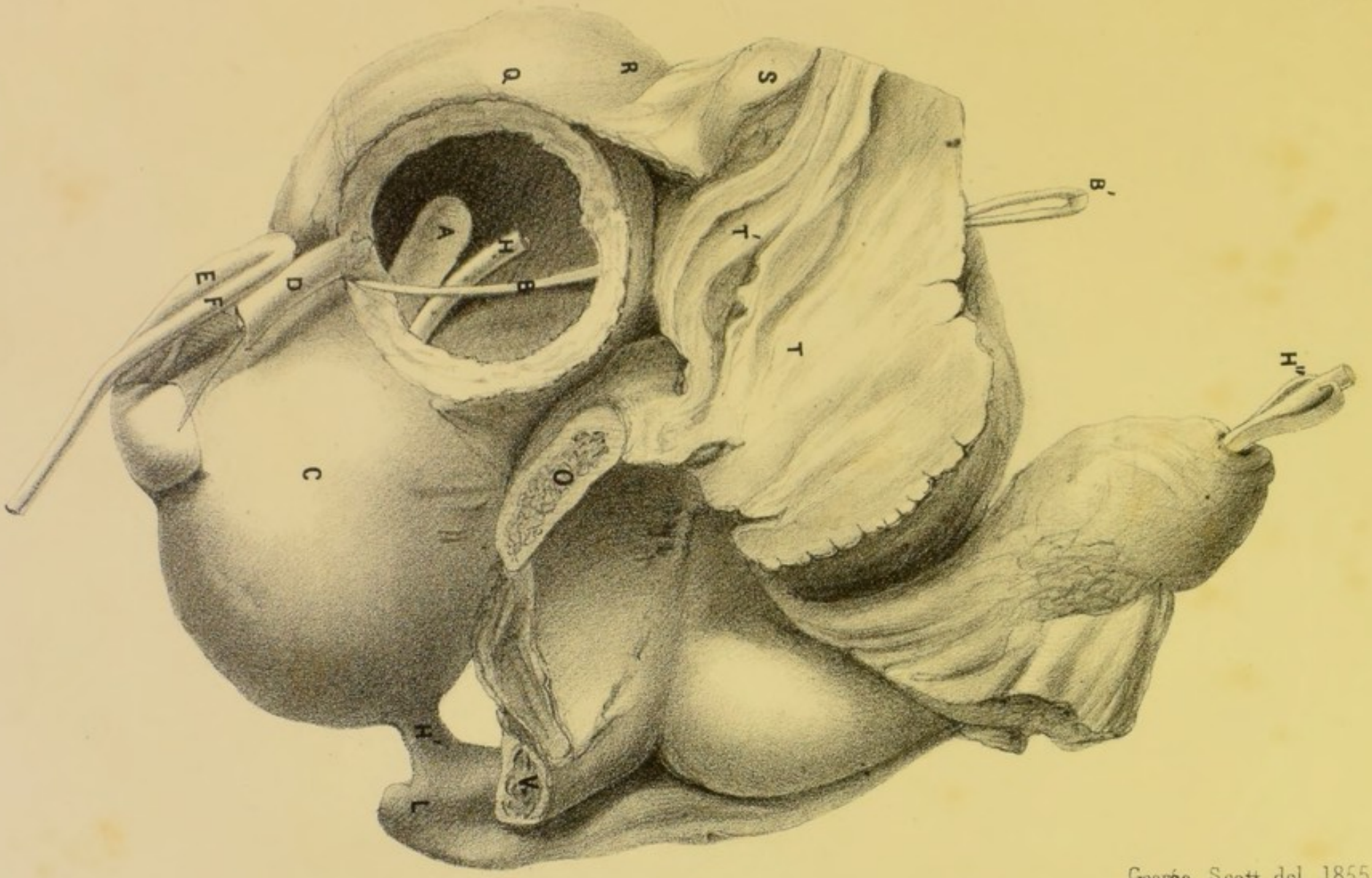
Q.R.S.—Reflection of peritoneum from the bladder to abdominal walls, elevated to a great height from the upper margin of the pubic bone (O), notwithstanding that the bladder is empty.

T.T′.—Subcutaneous tissues of the supra-pubic region.

O.—Cut surface of the pubic bone.

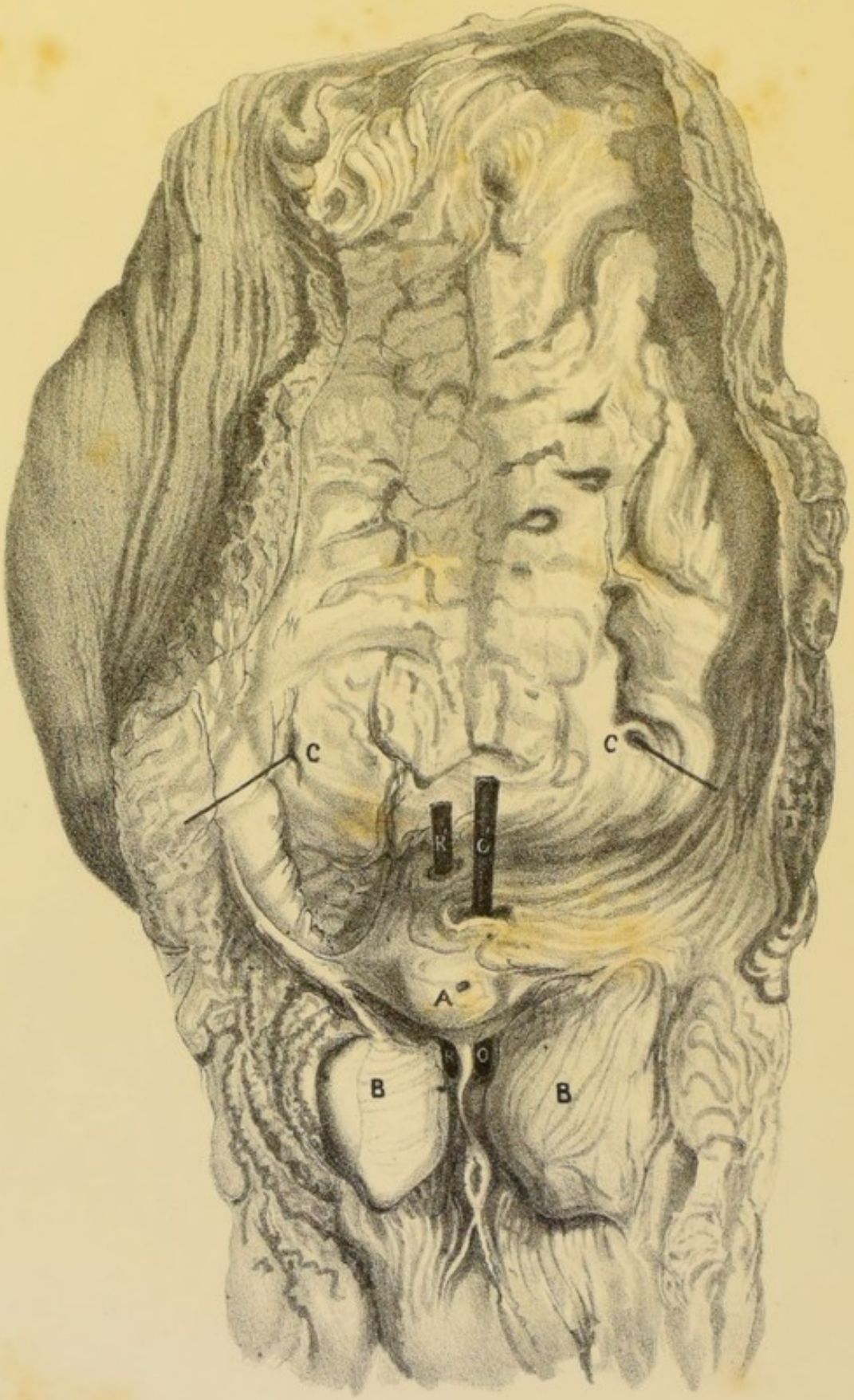
V.—Cut surface of the ischium.

N.B—This plate is seen in its proper position from the right side of the book; unfortunately, the reference letters have not been made to correspond to this position.



George Scott del. 1855.

Maclure & Macdonald, Lith.



Machure & Macdonald. Lith.

EXPLANATION OF PLATE 12.

This is the bladder and prostate of a person about 70 years of age. The bladder is enlarged and thickened in consequence of senile hypertrophy of the prostate. The interesting point in this preparation is the existence of two false passages, made through the middle lobe by the catheter; these appear to have afforded a very free passage for the urine for some years before the patient's death, which took place from another disease.

A.—Valvular process of the middle lobe.

B.B.—Urethral surfaces of the lateral lobes, somewhat marked by striæ of the mucous membrane.

C.C.—Orifices of the ureters, through which a pair of bristles are passed; although the ureters are dilated to the diameter of a fore-finger, these orifices are of the average size.

R.R′.—A piece of whalebone passed through a false passage, which is situated on the right side of the middle line and of the verumontanum.

O.O′.—Indicate in the same manner a false passage on the left side of the middle line.

London, New Burlington Street,
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