A treatise on stricture of the urethra : containing an account of improved methods of treatment; with an appendix, noticing the application of a new instrument to the treatment of enlarged prostate gland, gleet, fistula, and other diseases of the urethra, oesophagus, and rectum / by James Arnott.

A TREATISE ON STRICTURE OF THE URETHRA,

CONTAINING AN ACCOUNT

OF

IMPROVED METHODS OF TREATMENT;

WITH AN

APPENDIX,

NOTICING THE APPLICATION OF A NEW INSTRUMENT TO THE TREATMENT OF ENLARGED PROSTATE GLAND, GLEET, FISTULA, AND OTHER DISEASES OF THE URETHRA, ŒSOPHAGUS, AND RECTUM.

BY

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PREFACE.

No disease is more prevalent, and few are productive of more distress, than Stricture, or Narrowing of the Urethra. It has often been asserted, that a fifth or sixth of the male population of the great cities of Europe are affected with it; and Sir Everard Home, in his Treatise on the disease, has adduced good authority for believing that the still greater proportion of three-fourths among the higher ranks of the natives of India, are in the same situation.

The frequent original occurrence of the complaint, is sufficiently accounted for, by the sensibility of the urethra, its complicated relations with continuous or

neighbouring parts, and by the frequency of diseases in it and in these parts, of which stricture is the natural consequence—its continued prevalence is explained by the fact, that as yet, no remedy has been proposed capable of effecting a permanent cure in the majority of instances;—and the distress which accompanies it, arises from the obstruction to the urine, and the local and general irritation, obstinate disorders of the prostate gland and bladder, derangement of the functions of generation, &c. which this produces.

Stricture, thus, from its frequency and consequences, forming so great a part of Surgeons' employment, and from its long duration under the present curative means, being often a reproach to the art, I have much satisfaction in laying before the profession, an account of improvements in the treatment, which will much shorten

the miseries of the disease, and which promise a radical cure where the means hitherto practised could only palliate symptoms.

This does not imply, however, that the means already possessed by Surgeons, are not of very great importance. Although, in the generality of cases, they cannot effect a permanent cure, still in all, they obviate immediate danger, and by their continued application, they reduce to an inconvenience only, a disease, which, without them, would render what might remain of life a torment. The best of these, viz. the bougie, has been only known to the profession within the last century. A French Surgeon, named Daran, first attracted public attention to the benefits resulting from its use; but he did not himself understand the principle on which it acted, and he attributed its beneficial operation to medicines which he incorporated with its substance. Our

countryman, Mr. Sharp, in his "Critical Enquiry into the State of Surgery," and still more perfectly, Mr. Hunter, shewed that the bougie was useful by its mechanical action only, and that the medicaments so praised by Daran and succeeding empirics, were unnecessary, and often hurtful.

Mr. Hunter, to whom alone scientific Surgery is, perhaps, more indebted than to all his predecessors, bestowed great attention on the subject of stricture. By repeated morbid dissection, he was enabled to expose the erroneous ideas of former Surgeons regarding its nature, and he pointed out several imperfections in their plans of cure. He likewise revived and improved the use of caustic for the treatment of stricture, and employed it in cases where he could not pass the simple bougie.

His successor, Sir Everard Home, con-

tinued the practice by caustic, and soon extended it to all strictures, in preference to the common bougie, because he found that it generally cured more quickly and permanently. About twenty years ago, he recommended the adoption of the plan in a voluminous publication, the cases recorded in which, proved, that, at least, some of the objections against the practice were unfounded, and some of the advantages attributed to it certain. After this publication, the practice by the caustic became pretty general; but from the many mischiefs that followed it, in the hands of even the most expert Surgeons, it has fallen again into disuse, and practitioners appear now to have returned to the former temporizing plans by the bougie, and the similar instruments, the catheter and sound. The chief of these mischiefs, viz. hemorrhage and false passage, arise, however, from defects in the

method of applying the caustic, which are remediable, and means of obviating which are pointed out in this Treatise.

With respect to the bougie, and the similar means of dilatation, by which strictures are now commonly treated, Mr. Hunter, although he trusted to the bougie alone in all cases where it could be passed, has remarked, that "it seldom or ever effects more than a temporary cure;" leaving it necessary, therefore, for the prevention of relape, to continue the use of the instrument from time to time, during the remainder of life. The failure in the treatment by dilatation, has been generally attributed to the circumstance of the last bougie used not having been large enough to dilate the stricture sufficiently; or, to its having been too soon laid aside to overcome the tendency to contraction which existed in the diseased parts. This is true; but unhappily as

regards the use of these instruments, the orifice of the urethra is the smallest part of the canal, and is only half the diameter of the bulb, so that a bougie which the orifice will admit, can never dilate a stricture, in any other part, to the level of the adjoining surface. It is on this account, and with the idea that proper dilatation will always be sufficient for the cure, that some good surgeons of the present day resort to the cruel expedient of breaking down or tearing the orifice of the urethra, to admit a larger bougie. They find an advantage in so doing, but still the dilatation is often insufficient, and if any thing of the stricture be left, or of the tendency to contract which the parts had assumed, without occasional dilatation, the stricture will soon return.—This I conceive to be the true explanation of the insufficiency of every measure hitherto employed for the dilatation of stricture.

From a consideration of the imperfections of all existing means of cure in this, and in some other diseases of canals, my brother, Dr. Arnott, some years ago, during an enquiry to what greater extent the principles of the collateral branches of science might be applied to the improvement of medicine, contrived the dilator, an instrument admirably calculated to accomplish the ends desired, and which obviates the defects of the means at present in use. With regard to the disease in question, it is easily passed through the stricture, and is then dilated in any part, with any force, and to any size, and will distend at once, and almost with equal power, any number of strictures that may exist in the canal; being at the same time, in all respects perfectly under the control of the Surgeon. As the distension is made by condensed air, from the elasticity of this, as the stricture yields,

the instrument enlarges to follow it, and thus, without exciting irritation, quickly, but gently, accomplishes the end in view.

Dr. Arnott was aware of the great importance of this instrument in the treatment of these diseases; but he was so much engaged in other practice, and in professional pursuits, tending to more general application, that he took few opportunities of attending to its use in practice; it was his design, however, to include an account of it among observations on some other medical subjects, which he intends for the press. In the mean time, while returning on my last voyage from India, my attention was particularly directed to the subject of stricture, from having under my care many cases of it in invalid Soldiers, who had been long there, and whose constitutions, debilitated by the climate and its diseases, were ill adapted for bearing the additional miseries of this

troublesome complaint. There is, perhaps, no time or situation more favourable for the study of any particular disease, than when it occurs extensively on ship-board. As the patients are constantly under the eye of the practitioner, every circumstance and change of the malady is noted, and nothing existing to divert his attention from the subject of his enquiry, he reasons undisturbed, from the most perfect acquaintance with the facts. Several novelties in practice occurred to me then, and it was with much pleasure that I soon afterwards undertook the prosecution of a new remedy, so well calculated, in one of its applications, for the relief of a complaint in which I had lately been so feelingly interested.

The work which I now publish on the subject of stricture, is intended to describe in the clearest way to the profession, the improvements that the ordinary treat-

ment required, and seemed susceptible of which have occurred to me, or have been suggested as above mentioned, and most of which my experience has fully sanctioned. The shortest method of doing this I have found to be, to treat the subject of stricture systematically, and to notice the improvements under each particular head. A systematic account of stricture was wanted, at any rate; for though every thing important, already known, regarding its nature and the common methods of cure, may be found, interspersed in Mr. Hunter's valuable writings, in the voluminous Treatise of Sir Everard Home, and in some later publications of less note, still a connected view of the whole, or a complete treattise in a succinct form, does not exist. In Mr. Hunter's work, the consideration of stricture is mixed with that of other important matters; the Treatise of Sir

Everard Home was more adapted for establishing a new practice than for giving a general and unbiassed view of the subject; and the plans of later writers are less comprehensive, and have generally indeed, had in view only, by details of cases, to establish some novelty of partial application, or to influence the public in favour of one of the common modes of treatment, which the author happened to prefer; several of these latter works only prove that the writer had studied the subject and understood it, while many have less merit even than that. It has been my object to render this system as complete, but as brief as possible;—complete, by including with what is original, every thing of importance already known, which I had found in other works, or had heard in the schools of London and Edinburgh;—and brief, by excluding all irrelevant matter, and particularly unneces-

sary details of cases. Cases are useful where it is intended to establish a new principle, or where the advantage of a remedy is so doubtful, that the profession should be left to judge for themselves respecting it; but as the novelties contained in this work are only more perfect applications of the principles of cure universally admitted, and as the improvements themselves are so simple, and their effects so immediately perceived, I have contented myself with merely stating the general results of my experience.

As to the less important object of the style of this Essay, I have endeavoured to be perspicuous, which is the essential point in a work so purely didactic. There are marks of haste, and perhaps of premature decision on some points, which I would willingly have avoided; but the necessity of satisfying the enquiries of professional and other persons, which have of late been

so numerously addressed to me, respecting my peculiar practice, obliged me to publish it as speedily as possible, and in a less matured state than that, in which, with further leisure I may afterwards present it.

38, *Bedford Square*,
May 5th, 1819.

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CHAP. I.

OF THE URETHRA.

As correct ideas of the Anatomy and Functions of the Urethra, are essentially requisite to the understanding of its diseases, I introduce the systematic consideration of Strictures, with a sufficiently minute account of these. I am the more inclined to such a commencement, because former writers on stricture have contented themselves with general remarks on the anatomy of the urethra, referring the reader to professed anatomical works for further, though not less necessary information; and because of the controversy still subsisting respect- Of the Urethra.

ing its muscularity—a point of great importance, to which I have paid proportional attention, and which I trust will be now no longer a subject of doubt. At the same time then, that the uninformed, by the perusal of this introductory section, will be saved the trouble of searching into books of anatomy, the more advanced in the profession may not find it unworthy their pains, by glancing over the following details, to refresh their memory of the anatomy of an intricate part, important as the seat of frequent and obstinate disease.

Functions of the Urethra.

The urethra is the canal by which the urine flows from the bladder. It is short and simple in the female, where it serves that purpose only; but long and with complicated relations in the male, where it has a most important additional office, as the conduit of the seminal fluid in the act of generation. It is rarely the seat of

morbid affection in the female; but in the male, its diseases, and those of the parts intimately connected with it, are more frequent and distressing than any other class in the table of human sufferings.

Course of the Urethra.

The male urethra, then, becomes the chief object of our study. It extends from the bladder to the extremity of the penis, about nine inches in length. It arises from that part of the bladder which in the erect position of the body is the lowest, and may be considered a tubular continuation of its inner coat; from thence, describing the arc of a circle downwards and forwards for two and a half inches, it passes out of the pelvis in the angle of the gothic arch formed by the ossa pubis, and enters the penis, which begins at this part, to run along its length. The penis, at its commencement, is suspended by ligamentous fibres

from the front of the pubis, and consists of three cylindrical bodies, kept together by an appropriate sheath or covering, viz. the two corpora cavernosa forming the upper part, or dorsum penis, and the corpus spongiosum enclosing the urethra, lying in the groove of these two, and forming its lower part. The corpora cavernosa come like roots, one from each side of the arch of the pubis just alluded to, to unite at the symphysis pubis, and to receive there the corpus spongiosum, which enclosing the urethra, comes directly from within. The urethra, till it enters the penis, being connected with fixed parts, can suffer little change in its curvature or dimensions,—an important recollection to the surgeon;—but in the penis, it lengthens and shortens with it, and shares in all its motions.*

Divided into three portions.

For the sake of perspicuity in their

* Plate 1. Fig. 1.

descriptions, Anatomists have given distinct names to three portions of the urethra. The first, continuous with the neck of the bladder, and of about an inch in length, they have called the prostatic portion, because it is surrounded by the prostate gland, a solid conoid body, about the size of a horse chesnut. The second portion, also about an inch in length, is called the membranous, because the membranous tube of the urethra is there unprotected, but by some muscular fibres surrounding it, and the common cellular substance. The third is called the spongy portion, because embedded all the way in its thick sheath the corpus spongiosum, which it enters as it approaches the arch of the pubis. This spongy texture has a bulbous form where the urethra enters it, from which circumstance, that part is called the bulb of the urethra; it is then nearly cylindrical, until at the point of

the penis, where it again expands to form the glans penis, giving a covering to the extremities of the corpora cavernosa, and completing the form of the member.

The first portion in passing through the prostate gland adheres closely to it, and is connected by the anterior and upper surface of this, through the medium of cellular substance, to the posterior surface of the pubis, and on the other side, through the same medium, to the rectum or great gut. On the under side of this portion, and within, there is a longitudinal ridge, named caput gallinaginis, from its fancied resemblance to the head of a woodcock; it lessens towards each end, and its anterior extremity, dwindled into a slightly rising line, may be traced as far as the bulb. About the sides of the caput gallinaginis several small excretory ducts open, two larger than the rest, the excretory ducts of the vesiculæ

seminales, and the others of the same nature belonging to the prostate gland.

The only points to be attended to in the anatomy of the membranous part of the urethra, besides what have been already mentioned, are these ; that it is the narrowest portion of the canal, especially where it enters the bulb;—that it passes through a slit in the funnel-shaped muscle, called the levator ani, and is liable to be closed by it;—and that, like the prostatic division, it is situated between the pubis and extremity of the rectum.

The anterior or spongy portion, constituting more than three-fourths of the whole length of the canal, is chiefly remarkable for the numerous lacunæ, or small mucous follicles, which are placed obliquely in its substance opening forwards—and for the openings into the bulb of the short ducts of two pea-sized glands, first described by Cowper. Lon-

gitudinal rugæ or wrinkles are observable in the collapsed state of this portion, which indicate the loose texture of the surrounding cellular coat.

Diameter of the Urethra.

Little difference exists between the diameters of different urethræ, and as Sir Everard Home has already published accurate measurements of the widths of the several parts of the canal, taken from waxen casts, not to multiply authorities, I shall transcribe the principal of these.

The inch is divided into 20 parts.

At $\frac{3}{4}$ths of an inch from the outer extremity of the urethra, its diameter is - - - - - - - $\frac{9}{20}$ths

At $4\frac{1}{2}$ inches down - - - - - - - - - - - - - - - $\frac{7}{20}$ths

At the middle of the bulb - - - - - - - - - - - $\frac{12}{20}$ths

At the membranous part directly beyond the bulb - $\frac{7}{20}$ths

At the middle of the prostatic portion - - - - $\frac{11}{20}$ths

At the orifice of the bladder - - - - - - - - - $\frac{9}{20}$ths

Home observes that the largest bougie, (a flexible cylindrical instrument used in

diseases of the urethra*) he had ever employed, being only 5-20ths of an inch in diameter, was consequently 2-20ths less than any of the above dimensions. These diameters of the cast, however, are larger than those of the natural easy urethra, and it is capable of being still farther stretched.

It appears then, from the above scale, and other anatomical observations, that the orifice of the urethra is narrower than any part of the canal; that about 3-4ths of an inch from this, it is considerably dilated, forming what has been called the fossa navicularis; that the average width of the moderately stretched urethra, and which is preserved with considerable accuracy from this fossa to the bulb, is about the third of an inch; that at the bulb it is enlarged more than at any other part for about the space of an inch;

* Plate 2. Fig. 1.

that immediately behind this, it is more contracted than at any other part, which, in addition to other circumstances, accounts for the frequent occurrence of strictures at this point; and that a third dilatation is found in the middle of the prostatic portion*.

Structure of the Urethra.

The inner coat of the urethra possesses equal elasticity with other resembling textures, but greater vascularity and sensibility; and these latter qualities predominate chiefly about the bulb. Irritation of this sensible membrane by the acrid urine, is partly obviated in the fore part of the canal, by the bland mucus excreted from the follicles above mentioned, and in the further part, the secretion from the prostate and Cowper's glands may afford the same protection. What has been described as the outer coat of the urethra, is nothing but the cellular

* Plate 2. Fig. 3.

membrane which connects the inner or mucous coat to the surrounding parts, requiring therefore no particular description.

The most material point regarding the structure of the urethra as a whole, is whether it possesses that power of contraction and relaxation which we observe in muscular tissues. The profession are still divided in their opinions on this subject; some asserting that several phenomena of the urethra, as well as other circumstances, clearly demonstrate this power; while others deny its existence, because they have not discovered fibres in the texture, and they attempt to explain its actions on other principles. As it is of great importance for the management of stricture, that the question be decided, I shall review the facts and arguments.

First, a bougie introduced four inches

into the urethra, will sometimes remain there quietly, and may be withdrawn as easily as it was introduced; sometimes it will be thrust out again with greater or less force, and sometimes will be firmly grasped and retained. The advocates of the muscularity, account these phenomena alone, sufficient proof of their opinion; in the one instance, the bougie being gradually expelled by the successive contraction of the fibres against its point, as when a substance is moved forwards in the intestine by its muscular action; in the other instance, the bougie is supposed to be retained by the contraction upon it of all the circular fibres which it distends.—Those, on the other side, who deny the muscularity, attribute these phenomena to simple elasticity of the urethra.

Between these two I may remark, that although grasping elasticity might re-

tain the bougie passed far into the urethra, because the friction upon its sides, would be greater than the effort of the same degree of elasticity on its extremity; or might expel a very short length of bougie from the orifice of the canal, because there the action of the elasticity on the end, would be superior to the obstacle of the friction on the sides; still in the case of a bougie pushed out when far in the canal, uniform elasticity cannot be the agent, as more force must be exerted on the extremity than on the sides. When the end of a bougie lies in the bulb surrounded by the ejaculator seminis muscle, we see it expelled by that muscle as the urine or semen is; and the same thing happens, though in a less degree, in the anterior part of the canal. As this fact then clearly proves that the fibres at the point of the bougie act with greater force than the fibres that surround

its length, it proves at the same time that contractility, quite dictinct from elasticity, must be exerted.

Secondly, in an irritable state of the urethra, as in gonorrhœa, the stream of urine is often suddenly obstructed or stopped, by a temporary contraction of the canal. This, in the fore part of the canal where there are no exterior muscular fibres, may be produced either by muscular contraction of the urethra itself, or by its lining membrane becoming suddenly gorged with blood, but cannot be caused by elasticity. The same thing happens in permanent stricture of this canal, which is often suddenly increased, causing retention of the urine, and preventing the passage of the smallest instrument, and yet quickly yielding to means of an antispasmodic nature.

Thirdly, in cases of stricture in the anterior part of the urethra, a bougie

will be passed, and will remain for some time in the part without exciting pain, and be easily moveable backwards or forwards. Suddenly however, a sharp pain will be felt, and on attempting to withdraw the instrument, it is found to be firmly grasped. On forcibly extracting it some minutes after, when the pain becomes almost insupportable, it will be found strongly marked, as if a thread had been tied tightly round it. No explanation can be given of this fact, but by supposing the fibres of the urethra separately contractile, for elasticity would act at once and equally upon the whole surface of the bougie, and the gorging of the blood, above mentioned, could not be limited to so few fibres.

Fourthly, the existence of thread stricture is inexplicable on any other supposition, than that of the contractility of the distinct fibres. The objection that stric-

tures would always be completely circular, if caused by contraction of muscular fibres surrounding the canal, instead of being found only a segment, or occupying only one side of the canal, as they frequently are, is untenable; for the fibres, although muscular, may not be complete circles, two or more being required to complete a circle.

Fifthly, although in the human urethra, the fibres cannot be distinctly shewn, still in larger animals, the horse for instance, they are very evident, and as the part performs the same functions in both animals, we may reasonably suppose the analogy of structure to hold as well as the analogy of function; and other animal structures might be mentioned which evidently possess a power of contraction and relaxation, without the appearance of fibres in their texture.

These facts furnish complete proof of

the contractility and fibrous structure of the urethra, and these are the points which it is of importance for the surgeon to know.

Whether the contractile fibres of the urethra should be called muscular fibres, is a matter of very little moment; though this seems to have been a chief point of dispute between those who have taken different sides of the question regarding its structure. The contractile fibres of the intestines and great arteries, differ amongst themselves, and from voluntary muscles, in several of their properties, and are yet all called muscular, because of their contractility. And if this qualification be alone sufficient to entitle them to the appellation, the fibres of the urethra have the same claim.

The urine and semen are expelled from the back part of the urethra by muscles

surrounding it, and acknowledged by all parties. In the fore part of the canal, this effect must be produced either by contraction of the urethra itself, or by the pressure of the corpus spongiosum surrounding it; and it is probable, that both causes operate.

CHAP. II.

Of the Nature of Stricture of the Urethra.

A diminution of the diameter of the urethra from disease of its coats, is termed a stricture. Of the Nature of Stricture.

With a view to practice, it becomes very important to distinguish different kinds of stricture from each other. They are conveniently classed: first, with reference to their contractility and structure; secondly, with reference to their dimensions.

In the first class, Mr. Hunter distinguished the spasmodic, the permanent, and the mixed; the last consisting of a combination of the other two; and subsequent writers have described an irritable and a dilatable stricture. With reference to their dimensions, we shall have to con-

sider the wide and narrow, the long and short stricture.

Spasmodic Stricture.

The spasmodic stricture depends entirely on excessive or spasmodic contraction of some of the urethral fibres, and exists no longer than that contraction continues.

Permanent Stricture.

The permanent stricture depends altogether upon a change of structure in the narrow part.

Mixed Stricture.

The mixed stricture has change of structure, conjoined with spasmodic action of the fibres.

These three varieties are often the different stages of the same case. A simple spasm of the fibres may first occur, giving alarm from the retention of urine which it causes; but on again subsiding, may leave the parts in their natural state. If the spasm continue longer, however, the natural consequence will be, inflammation, and the deposition of coagulable lymph.

This will cause the sides of the obstructing duplicature to adhere together, and though the spasm should then cease, the return of the parts to their natural situation is no longer possible. This state would be called the mixed stricture. Again, by the continuance of the inflammation just described, the contractile fibres may be so altered, and their sensibility so diminished, as no longer to be liable to any sudden change; and this constitutes the true permanent stricture.

Strictures are generally of the mixed kind, and of these, unless it be otherwise stated, I wish to be understood as speaking in the future course of this essay.

Mere inflammation of the urethra, as it diminishes the capability of distension, and by thickening its substance, narrows the canal, may be as properly reckoned a temporary species of stricture, as the pure spasmodic affection. And accordingly, a

chronic inflammatory state of the urethra, well known as a consequence of gonorrhœa, and a frequent cause of permanent stricture, has of late been particularly described, under the name of dilatable stricture, because it yields to the superior force of the bougie, although the stream of urine is unable to widen it.

Dilatable Stricture.

It is of material importance to the patient, that he should be made acquainted with the liability of stricture to spasmodic aggravation of contraction; for by avoiding the causes of this, he will escape the more sudden and alarming dangers of the disease. The caution is less necessary in old strictures; but in more recent ones, the irritability is frequently so great, as to render the passage of the urine, or of any extraneous body through the stricture, exquisitely painful; and then the slightest causes of spasm are to be feared. Strictures under this state, have appro-

priately enough received the epithet of irritable. Irritable Stricture.

The French surgeons, from inattention to the spasmodic nature of stricture, which is often the first circumstance to be regarded in its treatment, with their consequent neglect of the means best fitted to relieve it, pursue a method of treatment which is frequently unnecessarily painful and dangerous.

To Mr. Hunter we owe the first accurate account of the most important particulars regarding the nature of stricture, and the value of our information on this head may be appreciated, when we reflect, that chiefly to the vague and erroneous notions of the older surgeons, as to the nature of stricture, may be traced their inefficient and dangerous methods of treatment.

Strictures, with reference to their dimensions, are distinguished, as above

Wide and Narrow Strictures.

stated, into wide, where there is little diminution of the canal, and narrow, where there is much; varieties depending chiefly on the time that the stricture has existed. Strictures become narrower and narrower, with a progress proportioned to the irritation present; but as the urine must always have a passage, complete organic obstruction is only found, where fistula in perinæo has opened to the urine a new channel. Sometimes the obstructing fold, or thickening of the membrane, is an arc, or occupies only a part of the circumference of the passage, and then generally the under side; and even, as in common cases, where it arises from all round, this may not be equally, or the opening through it may not correspond with the centre of the canal.

Long and short Strictures.

The epithets, long and short, applied to stricture, regard the length of the canal occupied by it, a circumstance on

which the particular method of treatment to be pursued, often depends. Long strictures have also been called ribbon, or tape strictures, because the urethra appears as if a ribbon were tied round it; the extent may be a quarter, half, or whole inch, or more.* Short strictures have also been called thread strictures, because they appear as if produced by a thread tied round the canal.† The short stricture is by much, of most frequent occurrence, a proof that contraction of the fibres is the most common cause of stricture. Long strictures are probably caused by inflammation attacking a considerable portion of the canal at once, and changing its structure, and this either primarily, or in consequence of thread stricture already existing.

In short stricture, the disease is pretty much confined to the projecting fold of

* Plate 1. Fig. 2. † Plate 1. Fig. 3.

membrane; but in long strictures the contiguous part of the corpus spongiosum is likewise affected.

Inflammation, in a greater or less degree, affects the urethra behind all strictures, and sometimes by throwing out coagulable lymph, which consolidates, lengthens the stricture; and sometimes by ulcerating, begins a new passage for the urine by the perinæum.

A rare obstruction in the urethra is a band extending across it like a bow string, produced probably by coagulable lymph, secreted and organized.

Colour and consistence of Stricture.

The constricted portions are usually harder than the rest of the canal, and of a white appearance. This hardness increases with their age, occasionally even to a cartilaginous consistence.

Seat of Stricture.

The common seat of strictures of the urethra is about the bulb, and especially where this and the membranous portion

join, which, as we saw above, is the narrowest part of the whole canal, and is about seven inches from the orifice. When more strictures than one exist, which in patients who have long had the disease, is generally the case, that which may be accounted the primitive is generally found at the bulb, and the others, nearer the orifice. Besides being more frequent, strictures at the bulb are more obstinate than in other parts of the canal. These peculiarities are owing doubtless, to the greater vascularity of this part of the canal, and to its greater activity, from serving as an intermediate receptacle for the semen, in the act of generation; during this, the muscle surrounding the bulb contracts to eject the semen, while the posterior or narrower part closes, to prevent its return towards the bladder.

Where a stricture exists at the bulb, the whole canal becomes irritable and

disposed to the formation of fresh strictures in the anterior part.

These are the principal circumstances regarding the nature of stricture, which the examination of the patient labouring under the disease, and morbid dissection, have brought to light. From our knowledge of them, the proper indications of cure are easily deduced; and that this has been often unsuccessful, is to be ascribed not to the error of the indications, but to the imperfect means by which surgeons have tried to fulfil them.

CHAP. III.

Of the Causes of Stricture of the Urethra.

Causes of Stricture.

A perfect knowledge of all the circumstances which can operate in the production of this disease, not only brings with it to the practitioner, the satisfaction of understanding well every case of the disease that occurs to him, but is also frequently very useful in the treatment; for a cause little obvious may be neglected, and allowed to recur, or to continue, so as to embarrass, and render inefficacious the plan of cure.

The causes of strictures, as of other diseases, may be distinguished into those which predispose to the disease, and those which excite it. To the former class belong, living in a warm climate, a sedentary life, too frequent or unnaturally protracted

sexual intercourse, and certain peculiarities of constitution, having as their common character great irritability. Some of these by long continuance, or when in extreme degree, will excite the disease without the intervention of any other.

The immediate cause of stricture is irritation of the urethra, produced either directly, or by sympathy, with some contiguous part under disease.

Gonorrhœa

Gonorrhœa is a cause so much more common than all the others, that by many it has even been considered as the sole one. The inflammation of gonorrhœa is, in general, confined to near the orifice, but sometimes is translated to the bulb, or prostatic portion, as we observe in dissecting the bodies of men, who have died while labouring under this disease; where these three situations are often found to be red and inflamed, while the other parts of the urethra have their na-

tural appearance. For the reason stated in the preceding chaper, it is at the bulb that the first stricture generally forms.

There is reason however to believe, that stricture would be a much less common consequence of gonorrhœa, were the irritation induced by it not exasperated by the employment of improper injections for its cure. Many surgeons have been so impressed with the idea that frequent harm is done in this way, and no good, as to lay it down as a rule, to employ no injection at all in the inflammatory stage of gonorrhœa. Sir Everard Home has published this as his opinion; I recollect that Mr. Abernethy also inculcated it in his lectures; and Dessault, among the French, was of the same mind. Hunter, on the other hand, although he admitted that in certain cases of peculiar irritability it might be improper to interfere, yet he thought that in the greater

number, a judicious local treatment moderated the violence, and shortened the duration of the disease. My experience in the management of these disorders inclines me to prefer this latter view of the subject; and certainly by shortening the duration of the disease, the chance is diminished of succeeding gleet or stricture.

External violence.

Any other irritation of the canal may produce stricture, as well as gonorrhœa. External violence to the perinæum, as by falls or blows—pieces of gravel passing through the urethra—wounds or irritation from the unskilful passing of instruments, &c.

Irritation of adjoining parts.

The irritation of neighbouring parts may be communicated to the urethra, as of the bladder, or rectum. The irritation from stone in the bladder very frequently gives rise to stricture. Disease of the prostate gland has often the same effect. The acrid matter of cantharides

absorbed from blistered surfaces, or when the medicine has been taken by the mouth, producing its specific irritation on the urinary system, may also be a cause of stricture. So may some constitutional disorders, and morbid states of the primæ viæ.

Some strictures yield altogether upon a removal of their causes, and in all cases the removal of any remaining cause is an assistance in the cure.

CHAP. IV.

Of the Symptoms of Stricture of the Urethra.

Of the Symptoms of Stricture

THE symptoms of stricture may be conveniently arranged under three heads; first, the effects of the mechanical obstruction of the urethra on the passage of the urine and semen; secondly, local irritations in the urethra, and its neighbouring and connected parts; thirdly, some general disorders of the constitution which occasionally accompany it.

Effects on the passage of the urine and semen.

The first symptom of stricture is a diminution of the stream of urine; but it is often for a long time unobserved by the patient, until his attention be called to the subject by some other more marked symptoms. As the stream goes on diminishing, it acquires also other peculiarities, such as being forked, or divided;

issuing of a spiral appearance; &c. and when the opening at last becomes very narrow, the urine can no longer be voided in a continued stream, but falls from the penis in drops. In these extreme cases, it rarely happens that the bladder is completely emptied, owing to the long continued and extraordinary exertions required for this purpose, and the pain which accompanies the attempt. The bladder in this way remaining constantly more or less distended, the desire to make water returns very frequently; and arising from this and other causes, is one of the most distressing symptoms in bad cases of stricture.

Stricture, by being farther spasmodically contracted during the venereal act, often prevents altogether the emission of the semen at that time, and thus proves a cause of temporary impotence.

Local Irritations.

Among the local irritations accompanying stricture, we may first attend to the state of the urethra itself. There is a greater or less degree of pain at the stricture, and pain is also often felt about an inch and a half from the extremity of the penis, where no stricture exists; pain here being a common symptom of irritations deeper seated, in the urethra or in the bladder; as for instance, the pain near the end of the penis, in cases of stone in the bladder. A gleety discharge usually accompanies stricture, and often for a long while, is supposed to be the only disease present; until by resisting all the common remedies, its real cause is discovered. Where a stricture exists, exposure to cold, or a venereal use of the parts, will often bring on so much irritation and discharge, that in the latter case, gonorrhœa is suspected. Nocturnal

emissions very often arise from the irritation of stricture in the canal. The irritation spreading backwards, may induce inflammation of the prostate gland, or of the urethra passing through it, a state similar to what we have already observed as arising from the translation of the inflammation of gonorrhœa.

But it is in the affections of the urinary bladder that we find the most distressing local symptoms of stricture. Irritation of this viscus, which we have noticed above as an occasional cause of stricture, is also a frequent consequence; and arises either by sympathy with the diseased urethra, or, which is more frequent, by the retention of the acrid urine, and the forcible efforts which the bladder makes to empty itself. The effects of this irritation of the bladder are, frequent and painful calls to make water; sometimes, inflammation of its coats, which may extend even to the

peritoneum; and contraction of its cavity. The urine, when its receptacle is highly irritated, acquires a peculiar smell, and is mixed with a glairy, viscous, and sometimes puriform discharge; which settles at the bottom of the vessel in which the urine has stood, and adheres to it sometimes with considerable force. Occasionally with irritable bladder, the urine dribbles off involuntarily, obliging the patient to keep something attached to the penis, for its reception. Even in the cases in which the bladder is completely emptied, a straining, or still farther desire to urine, may continue for several minutes, and to this may be partly imputed the uneasiness of the loins, of which patients at such times complain.

Remoter effects.

It would be tedious to enumerate other less important topical irritations from derangement of the urethra, but some more

remote effects of great moment have yet to be considered.

It has just been stated, that the bladder becomes contracted by the long continuance of stricture. Sometimes, this is merely a temporary unaptness to dilate, produced by the state of irritation present, and then the effect will cease soon after the cause; but at other times it depends upon a changed organization of the bladder, and is then generally a disease for life. Upon inspecting such contracted bladders, the muscular bands of the inside are found enlarged, and the whole substance of the bladder thickened, often to a surprising degree.

The urethra behind the stricture, and the ureters, instead of being contracted like the bladder in such cases, are often exceedingly enlarged, owing, of course, to the difference of texture and action between these and the bladder.

The inflammation of the prostate gland arising from urethral irritation, is occasionally converted into that hard enlargement, called scirrhus, which has hitherto been little under the control of medicine, and has formed an insuperable bar to the comfort of many, during the last years of their lives.

When the inflammation immediately behind a stricture is severe, ulceration is often induced, and the urine escapes through the side of the canal. This ulceration, in obedience to a general law of the economy, takes place towards the external surface, that is, on the under side of the urethra: and unless previous adhesive inflammation has existed in the part to be perforated by the ulceration, the urine on first escaping from the canal will insinuate itself into the loose cellular membrane around, and spread under the the skin to a prodigious extent. In this

way the urine sometimes swells the scrotum to the size of the head, and penetrating the spongy substance of the penis, causes by its acrimony, the most fatal mischief. If the patient survive the immediate effects of this diffusion, within a few days the skin sloughs at different points, and allows the urine, with pieces of gangrenous cellular substance, to escape by the openings.—On other occasions again, a new passage for the urine is formed with less danger and suffering, the parts being prepared for it by previous adhesive inflammation; so that while the ulceration makes its way to the skin, the adhesions of the cellular substance completely prevent the urine from being diffused; or an abscess may form in the perinæum, and open both into the urethra, and through the skin, thus giving a ready exit to the urine. These new passages, when their sides become of a

callous nature, are called fistulæ in perinæo. Upon removing the stricture which caused them, they in general heal of their own accord. It has happened in some cases of fistula, that the ulceration which perforated the urethra, has also destroyed the stricture, and a complete cure within a short time has been the consequence. Where strictures are not destroyed by such an ulceration, they are often so much shortened or opened by it, as to allow the passing of an instrument, which could not be passed before; and where it is possible to get a large catheter introduced, to remain in the canal for the purpose of drawing off the urine, the breach of the urethra will speedily close, and a cure be obtained.

Hemorrhoids are a very common effect of the irritation of stricture. Sores on the prepuce resembling chancres, after the unsuccessful trial of every ordinary

expedient for their removal, have been known to disappear immediately on the cure of co-existing stricture, and from it they have accordingly with justice been thought to arise. The same course has sometimes been observed in chronic enlargement of the testicles, and still more frequently in dropsical affections of these or hydroceles.

It is obvious that a facility in discovering, and skill in treating, these symptomatic affections, which so often arise in the progress of stricture, and react to the increase of the original complaint, will form no unimportant auxiliary in its management. And the pointing them out to the patient, will serve the good purpose of rendering him aware of the dangers to which he is exposed, by delaying to use the proper remedial measures in the early stages of the disease.

Constitutional Irritations.

The constant interruption of rest in bad cases of stricture, from the frequent and uncontrollable desire to make water, and the pain experienced during the operation, produce a state of disorder, both mental and corporeal, which is scarcely to be equalled in any other complaint. The function of digestion becomes deranged, various nervous affections arise, and delirium of some hours continuance occasionally illustrates to what extent the mental faculties participate in the general disturbance. A feverish irritability resembling hectic, will sometimes come on with the evening, and continue during the night, recurring at the same hour for a week or so, and then ceasing for a considerable interval. A violent paroxysm of fever sometimes occurs, so nearly resembling an ague fit, as to be occasionally mistaken for it. The

ordinary remedies of agues, however, are useless here, and a strict comparison of the two diseases, will always enable a person of experience to distinguish them. The cold fit in stricture is more violent, and the sweating in its last stage is more profuse; it does not recur with regular intervals as ague, and often, when the paroxysm is complete, there is no return for several days.—Epilepsy, gout, and erysipelas, may be mentioned among the diseases which stricture occasionally excites.

Progress of Symptoms.

Strictures are often of slow progress. They may exist for years, with the stream of urine becoming narrower all the while, before the singular appearance of this, the frequency of voiding the urine, or the length of time required, attract the patient's attention. For the most part, it is not until the obstruction becomes suddenly greater, from exposure to cold, a

debauch of some sort, much exercise, retaining the urine after a desire to evacuate it is felt, &c. that the patient applies for assistance. If he should still defer checking its progress, it will advance with a quickened pace; the increase not being regular throughout the different stages, but accelerated as the stricture becomes narrower, from the constantly increasing irritation.

CHAP. V.

Of the Diagnosis of Stricture of the Urethra.

Of the Diagnosis of Stricture

As there are several other affections of the urinary organs which are apt to be confounded with permanent stricture, it becomes of importance to point out the circumstances by which they may be distinguished. These affections are spasm of the urethra or muscles surrounding it; inflammation of the urethra; gonorrhœa; tumour inflammation or abscess in the neighbouring parts pressing upon the urethra, and swellings of the lacunæ seated in its texture; stone in the urethra; stone in the bladder; and diseased prostate.

Resembling affections.

Characteristics of Stricture.

A permanent stricture of the urethra is suspected when obstruction to the passage of the urine has existed for a con-

siderable period, of an uniform or increasing degree, and without any evident external cause; and the truth is ascertained by introducing a full-sized bougie into the canal, which, if there be no stricture, may be passed on to the prostate gland; and if there is, it will mark the situation of the first it meets, and will even shew its dimensions, if soft enough to receive an impression.

Of Spasm and Inflammation of the Urethra

The temporary stricture, arising from spasm or inflammation, may be easily distinguished from the other by its sudden origin, and the pain which accompanies it. But although it be of the greatest consequence to distinguish these, when the question is of the propriety of using the caustic or even the common bougie for the cure, yet where the new plan of cure by dilatation, which I have to propose, is adopted, it signifies little to what species of stricture it is applied; for pro-

ducing little additional irritation, the only difference of its action on the two kinds will be, that temporary strictures especially when from spasm, will be readily relieved by it, while such as are of a more permanent or stubborn kind, will require its longer continuance.

Of Gonorrhœa.

As the aggravation of the discharge after sexual intercourse, in some cases of stricture alluded to in the former chapter, so nearly resembles the infectious discharge in gonorrhœa, as on different occasions to have been mistaken for it, the peculiar character of each requires to be carefully noticed. The increase of the gleety discharge and pain in stricture, comes on suddenly after the cause, and if left to itself, will, generally, in the space of a week, gradually decline. In gonorrhœa, on the other hand, a few days usually intervene, after exposure to the infection, before the symptoms arise; they

then gradually increase to their acme, and only begin to subside so late as ten days from their commencement. In gonorrhœa too, the pain felt while the urine traverses the inflamed surface, is greater than in stricture, and the stream usually enlarges as it flows.

Of Tumours, &c. in the adjoining parts.

Phlegmons, abscesses, and tumours in the adjoining parts, pressing on the canal, and causing an approximation of its sides, are sufficiently obvious. The only question that can arise in such cases, is, whether the obstruction is to be relieved by dilating the part concerned, or, by treatment from without, and the decision of this will depend on the nature of the tumour. The inflamed lacuna may also be mentioned here, which is often felt of the size of a pea, in the course of the canal, obstructing the flow of urine, and requiring treatment similar to that of stricture. And so may aneurismal, or

varicose swellings in the corpus spongiosum, which are mentioned by authors as occasional causes of obstruction, and as being of difficult removal.

Gravel in the Urethra

A small calculus passing along the urethra, may stick in it, and become a very troublesome species of obstruction. The mischief is increased, when it is stopped by a stricture already existing in the canal; for it may then act as a valve to the opening of this, and entirely prevent the escape of the urine. This accident is to be apprehended when strictures occur in constitutions disposed to the formation of gravel; and it has happened, that a small stone, thus shutting the passage, has not been discovered until after the patient's death, of which it was the cause. Obstructions from calculi in the urethra, are discriminated by the preceding symptoms of gravel; by the peculiar sensation from metallic instruments

striking them; by the sudden, severe, and continued pain which they produce; and often, by being obvious to the touch from without.

Stone in the Bladder

Stone in the bladder has occasionally, for a while, been mistaken for stricture, from its being forced, at times, against the entrance of the urethra, so as to obstruct the flow of urine, and from the irritation of the bladder which it produces. The circumstances, however, of the stream being generally full, and sometimes suddenly stopped; of the patient being able to make water more easily in some positions of the body than in others; of there being no obstruction to the passage of instruments into the bladder; the sensation communicated to the hand of the surgeon, when the instrument strikes the stone; the peculiar pain and itching at the point of the penis, which always attends the complaint, &c.—are so illus-

trative of the nature of calculus, as not to leave a shadow of doubt respecting the nature of the disease.

Diseased Prostate Gland.

It has been already stated, that strictures are very rarely found farther in the urethra than the beginning of its membranous portion; and as the prostate gland, especially in old men, is very liable to disease, when the bougie can pass seven inches and a half, but not into the bladder, the presumption follows, that it is prevented by the swelling of this gland. To remove doubt in such a case, we have the means of examination of the gland per anum, and of passing a soft bougie to the obstruction, to take an impression of its form. The possiebility, in most cases, of introducing an elastic catheter into the bladder, over the projecting part, is another diagnostic circumstance.

CHAP. VI.

Of the Prognosis of Stricture of the Urethra.

Of the Prognosis of Stricture

Stricture of the urethra, though one of the most troublesome complaints to which the human frame is subject, is only dangerous where there has been negligence or mismanagement. The occurrences most to be dreaded with stricture, are, retention of urine; inflammation of the bladder; and those remoter effects of long continued irritation of the parts which we have already enumerated.

The risk of retention is not proportioned to the narrowness of the stricture, but to its irritability; so that from diminution of this, the latter stages of the disease are often really less immediately dangerous than the earlier.

Dangers from retention of Urine.

Complete retention of urine, besides more general effects, may either cause the bladder to give way, allowing the escape of the urine: or, from the excessive distension, its muscular coat may be paralyzed, perhaps never afterwards to regain its power of contraction. When the urine escapes from the bladder in such cases, it is by one or more openings formed by ulceration; and where the coats have already been thinned by this, the danger in retention is increased. The fundus, or upper part of the bladder, is not that which usually gives way; and but in that case, the urine does not find its way into the cavity of the abdomen, which is an accident certainly and speedily mortal.

From Inflammation of the Bladder.

Besides its chronic effects, ulceration, induration, and scirrhus, the inflammation of the bladder, when severe, may, by extending to the abdomen, quickly produce the most fatal consequences.

Time required to effect a cure of Stricture.

In judging of the time that may be required for the cure of a stricture, or of the probability of effecting a cure at all, it is necessary to advert to the following circumstances.

Old patients, and such as have weak or irritable constitutions, are the cases, *cæteris paribus*, in which the practice is the least expeditious and successful; and it has been remarked, that the gouty are liable to an aggravation or return of stricture, during the paroxysms of their disease.

Where recourse is had to any of the more violent methods of removing stricture, it is evident, that the nearer it is to the orifice of the urethra, from the greater facility with which the surgeon can apply his measures, the less chance there is of hurting important contiguous parts.

It is almost unnecessary to add, that the facility of removing strictures will

vary, according as they are of harder or softer consistence; occupy greater or less extent of the canal; or, are more or less numerous:—but it may be remarked, that the two last circumstances become unimportant where the new method of dilatation, to be described below, is employed.

CHAP. VII.

OF THE

Methods of Treating Stricture of the Urethra.

Of the methods of treating Stricture.

From the local nature of stricture, local remedies are the only kind, in the generality of cases, employed for the cure. It is only where sudden spasm or inflammation, and the consequences of these, arise, that other and more general assistance becomes necessary. The courses of mercury, adopted by the older surgeons, from the supposed venereal nature of the complaint, and some other general remedies, formerly accounted specifics, are now totally discarded from practice.

Its remedies divisable into two Classes.

Of the local remedies of stricture, we shall consider, 1st, Those which do not produce breach of its substance: and 2dly, Those, more violent in their nature, which do.

The first class comprehends different means of dilating and pressing upon the strictures, by bougies, sounds, &c. and by the new instrument called the dilator; with some medicinal applications to the diseased part, to alter its sensibility.

In the second class are comprehended, caustic, by which the diseased part is directly killed and removed; and the different ways of destroying it by rupturing, by causing ulceration, and by cutting.

Section I.

Of the Cure of Stricture by Dilatation.

Dilatation acts in removing strictures, by stretching the contracted fibres; by removing their irritability, and tendency to contraction, when gentle pressure only is used; and by exciting the absorbents of the newly organized substance into action, which removes it. Of the cure by Dilatation.

The means hitherto in use for this pur-

pose, has been to pass a smooth, cylindrical, or slightly conical body, of sufficient diameter and consistence, through the stricture; of which description are bougies, sounds, and catheters. The instrument is then allowed to remain for a limited time, distending the stricture, and successively larger ones are substituted, as it widens, till that of a full size can be introduced.

By using these instruments with force, the stricture may be ruptured, or caused to ulcerate: but it is with a view to their gentler agency, above described, that they are now to be considered.

Dilatation the best and most generally adapted remedy

It is well known, that continued pressure made upon any animal structure, where there is no counteracting circumstance, has the effect of exciting the absorbents of the part into increased action, or of otherwise diminishing its bulk. The justness of this principle, as exemplified in the action of the bougie on stric-

ture, was never questioned, even by those who for a time preferred caustic to the bougie, in its cure; but they appear to have accounted the means proposed, as inadequate to the end. The surgeons of the present day, almost with common consent, prefer the treatment of stricture by dilatation, as a general remedy, to all others. But in some cases, where the stricture is of peculiarly hard texture, or has something else in its character, which would render the cure by dilatation inapplicable or tedious, some of the speedier means of destroying it are preferred.

The first means employed for this purpose.

The first instruments used for dilating strictures, were probes of lead or whalebone, and common wax-tapers. Bougie, the French name of this last, has since been applied to most instruments used with the same view. The lead was unyielding, and apt to break; the whalebone produced much irritation; and the wax-taper was

too soft to make any impression on the stricture.

Of the wax cloth Bougie.

These defects suggested the substitution of the common wax-cloth bougie, which has since been in general use in all countries. In its present improved state, it is thus manufactured:—A piece of cloth, dipped in a composition of melted wax, oil, and litharge, is cut into pieces of the proper dimensions, and these are rolled upon a plain surface, until they become perfectly smooth cylinders, with a rounded or conical end. They are made of about ten inches in length, and of various diameters, from the smallest that will pass, to upwards of a third of an inch. Their advantages over the means formerly employed, are their smoothness and flexibility, adapting them for easy introduction, their consistence and strength.

Determined scale of the sizes of Bougies, &c.

It would be convenient, for ascertaining the progress of the cure, as well as

for other reasons, to know always with precision, the diameter of the instrument employed. For this purpose, a scale with increments of a fortieth of an inch, may be adopted, and each increment made to designate a size of bougie, to be numbered from 1 to 17 or 18, the largest that has been used, even after breaking down the orifice of the urethra for its admission.* It is of the more importance to have a fixed scale for determining the sizes of bougies; because, at present, the scales of no two instrument-makers, perfectly agree; and this which I have followed, has the advantage of being definite, easily constructed, and the different scales already in use, all approximate to it.

Very soft bougies are employed in examining the dimensions of stricture, as they easily receive an impression from

Soft, white Bougies.

* Plate 2. Fig. 1, and 2.

its anterior surface. They are generally made of white materials, that the impression may be more conspicuous.

Elastic Gum Bougie.

Some surgeons, particularly in France, prefer bougies made of elastic gum, because their consistence is not liable to alteration from the warmth and moisture of the urethra; and their elasticity, prevents the permanent bending of their points when it is necessary to use some force in passing them.

Catgut Bougie.

Small bougies of catgut are used when the passage is too narrow to admit a cloth bougie of a size that could pass down to it.

Metallic Bougie and Sound.

Of late years, instead of these more pliable materials, a mixture of the soft metals, forming what has been called the flexible metallic bougie, has been employed by many surgeons. When expertly introduced, from their smoothness, hard consistence, and durability, they may

certainly be preferable; but where the inexperienced patient himself has to introduce them, the chance of wounding the weak canal is increased in proportion as they are more unyielding than the common cloth bougie. This objection is still more applicable to the iron bougie or sound, at present adopted by some surgeons.

Catheter.

The catheter is another instrument used as a means of dilatation. It is a tube of metal or elastic gum, about ten inches in length. When made of unbending materials, a third of its length from the point is generally curved, so as to be part of a circle of six inches diameter—this form best corresponding to the natural curve of the urethra. Towards its rounded point, there are a few small holes drilled, by which the urine enters it to pass from the bladder, and at its outer extremity, there is a ring on each side, or other projection, by which, amongst

other uses, the surgeon may know its situation in the canal, and be able to direct its course with precision. The original intention of the catheter, and that for which it is chiefly used, is to draw off the urine, when the bladder cannot relieve itself.

New Instrument.

Such are the common means that have been used for the cure of stricture on the principle of dilatation. The new instrument which I have to describe, as its peculiarities of action and construction require minuter detail, will be better understood after explaining the usual manner in which the cure by dilatation is conducted.

Method of passing Instruments into the Bladder.

The first thing we have to consider, is the manner of introducing instruments into the bladder. As an example or rule for the others, we shall describe the introduction of the catheter.

The patient may either stand or recline

during the operation. The surgeon having warmed and oiled the instrument, and holding the penis with the left hand just behind the glans, so as not to compress the urethra, which is on its under side, inserts the instrument, with its concavity towards the patient's belly, and as it passes onwards in the canal, requiring little more force to move it than its own weight, with its straight part remaining almost parallel to the patient's body, the penis is at the same time drawn upwards upon it. On its reaching the bulb, the penis is again allowed to shrink, and the outer end of the catheter is depressed so that the curved part may rise along the back part of the urethra, behind the pubis. Its entrance into the bladder is announced by the flow of urine, and the greater facility with which it then moves, as well as by the length of it which has passed.

Some prefer introducing the catheter as far as the bulb, with its convexity upwards, and the straight part consequently down and parallel to the thighs; then by a semi-circular sweep of this, they bring the instrument round to the situation described in the last paragraph, and the operation is finished as there stated. Unless the patient's corpulency prevent the adoption of the first and more simple method, there can be nothing gained by the employment of the other; on the contrary, as it is a nice matter to keep the point of the catheter in the same situation during the turning, in the hands of many this mode is productive of more pain.

How the passage of Instruments is impeded.

The passage of instruments through the healthy urethra may be variously impeded. If not flexible, they may be stopped by the os pubis when the handle is depressed too soon; or if their curva-

ture does not correspond with that of the urethra, they may be impeded from this circumstance. It is evident how these occurrences are to be avoided.

If an instrument has a small point, it may enter and be arrested by one of the lacunæ in the fore part of the canal. When this happens, it must be withdrawn a little, and passed again with its point bearing against a different side of the passage.

Irritation from the presence of an instrument in the urethra may induce spasm of some of its fibres, which either by grasping it, or closing the canal before the point, may prevent its farther progress. This obstacle is so apt to occur in some particularly irritable constitutions, that it may be proper to give an opiate to obviate or relieve it; but a gentle and continued pressure of the instrument against the obstruction, rubbing the perinæum, or

suddenly applying cold water to the parts, will in general, either separately or conjointly, be sufficient to remove the difficulty.

The progress of an instrument may again be prevented, by its point pushing the lax membrane of the urethra into a fold before it. By gently drawing forward the penis on the instrument until it has turned under the pubis, the surgeon will greatly diminish the chance of this inconvenience. Something of the same kind frequently happens when the instrument is entering the narrow membranous part of the urethra from the widening of the bulb. As a general rule in such cases, the point must be made to bear lightly against the upper side, while attention is had to keep it in the natural direction of the urethra; and if this be insufficient, assistance must be given in directing the point by the finger on the

perinæum or passed per anum; or success will sometimes attend the trial with an instrument of different curvature or size—means especially necessary where enlargement of the prostate is the cause of the obstruction.

When the catheter is not carried forward in the natural direction of the canal, on arriving at the prostate gland, it may be stopped by coming against the edge of it. An inattentive surgeon may himself produce this difficulty, while attempting to overcome the last one mentioned, by passing the finger per anum so high, as to displace the gland, and change the direction of the canal enclosed in it.

The elastic Catheter sometimes preferable to the Metallic.

The catheter of elastic gum, in many instances where a catheter is required, from its pliability and accommodating nature, causing less pain and trouble in the introduction, is to be preferred to that which is metallic and inflexible.

It will often pass in cases of obstruction, where no dexterity can get a rigid catheter through. In such instances, the wire which lies in it for the purpose of giving the proper degree of stiffness and curvature, is withdrawn about an inch, and its point being then easily flexible will often surmount the difficulty with little force applied. From a consideration of the weakness of the membrane of the urethra, the maxim is correctly deduced, that no very forcible attempt should ever be made to overcome any difficulty or obstruction; and the degree of force which is sometimes allowable and proper where a dexterous and well informed surgeon operates, would often be highly detrimental in the hands of another of a different description.

New method of introducing the Catheter.

There is scarcely another operation in the whole province of surgery, on which the preservation of life may more imme-

diately depend, than on the speedy introduction of the catheter. Bursting of the bladder, extensive inflammation, and other disasters already described, result from retention of urine unrelieved. And although an observance of the established rules, which I have just given, for conducting the operation, and surmounting the several difficulties, will be sufficient in most cases to effect the desirable end, yet as there are some in which all these are insufficient, I have much satisfaction in describing the following new means, which is frequently of great assistance to the others, and sometimes will secure the introduction, where without it, these would entirely fail. The simplicity of the means is a recommendation. It is to distend the urethra during the operation with a liquid, injected through the catheter from a bag attached to its outer

extremity.* It is necessary that during the operation, the penis be gently grasped, so as to prevent the return of the liquid by the sides of the instrument, and the stricture or action of the bladder opposing its flow backwards, the whole urethra is distended with moderate force, while the catheter may still be freely advanced or withdrawn. This distention of the canal removes every obstacle to the passing of the catheter, until it reaches the stricture itself, (an object of considerable importance where it is necessary to pass an instrument in an irritable urethra,) and the orifice of the stricture being also filled and distended by this unirritating fluid, is open for the reception of the instrument's point. In this way the urethra before the stricture becomes a distended bag, and the

* Plate II. Fig. 4.

extremity of the catheter moving about in the free space, may touch every point of its surface until it enters the narrow continuation of the canal. By distending the urethra in this manner, considerable facility will be likewise given to the extraction of stones, or of any instrument that has been broken and is retained in the canal.

Introduction of the wax cloth Bougie.

The sure diagnostic circumstance of stricture, it has been before remarked, is the impediment which it offers to the passage of instruments to the bladder. The examination is usually made by a wax cloth bougie. One exactly cylindrical, and of a full size, should be chosen, because it is not liable to be caught in the lacunæ or wrinkles, like a smaller one, and because it will give intimation of commencing strictures, which being as yet wide, might be otherwise missed. There is no additional rule for the intro-

duction of this bougie to those already given for the introduction of the catheter. In consequence of its flexibility and softer texture, it is less likely to do harm in the hands of an unskilful operator; but still if of hard consistence, it must receive pretty exactly the curvature of the canal before introduction, and its passage must be humoured by the depression of the hand, as in the case of the catheter. By continuing, for a little while, to press the bougie against the obstruction, at the same time that we become certain of its permanent nature, we are also enabled to judge by the impression received on its point, of the size and form of the aperture: which is the next circumstance requiring the attention of the surgeon in undertaking the cure by the bougie.

How the size of the opening of Stricture is ascertained

To take an impression from the surface of a stricture on the extremity of a hard bougie, considerable pressure must be used,

and this, in many cases, gives excessive pain; very soft, white bougies, as already described, have therefore been substituted; but in these, the impression is often injured during their extraction. To avoid this source of error, I have protected such a bougie by passing it through a canula.* There are other means of ascertaining the size of the opening of stricture. As by knowing how the water is voided from the urethra, whether in a large or small stream, or only in drops; though this is a circumstance which cannot be always depended upon, as illustrative of the point in question, from the spasmodic increase of contraction, which most strictures undergo on the contact of the urine. Or, the same end is effected by successive trials of differently sized cylindrical bougies, till that which just fills the stricture is found. This is a

* Plate IV. Fig. 4.

very common method, but tedious and painful. A better is to introduce a conical bougie or sound through the stricture until arrested; the part of the cone then embraced by the stricture, is its diameter, and this part is known, by comparing the distance of the stricture from the orifice of the urethra, with the length of the conical bougie which has passed. For the purpose of ascertaining the size of the opening of the stricture, and the appearance of its anterior surface, (circumstances, a knowledge of which is almost equally desirable, whatever method of cure we adopt,) I usually combine the employment of this last means with that of a soft bougie. The manner of farther examining the urethra, preparatory to some of the other modes of cure, will be more properly examined afterwards.

Methods of passing a Bougie through a very narrow Stricture.

Having ascertained the existence and situation of the first stricture, and the size of its opening, the surgeon proceeds to pass a bougie through it, to dilate it. In the beginning of the treatment of a narrow stricture, this is often attended with considerable difficulty and embarrassment. A small, soft, wax cloth bougie, on reaching the stricture, unless it immediately enter the opening, is apt to have its point bent and turned back on itself, while the surgeon may suppose it has penetrated the stricture; and the bougie being again straightened on withdrawing it, he may continue in his error, and persist in useless applications of the same sort. But this mistake may in general be avoided by attention to this circumstance, that the bougie when bending and not entering the stricture generally recoils a little, on the surgeon ceasing to press it forward. The body of the bougie bending, however, af-

ter the point has passed the stricture, may also, give occason to this, so that the sure sign of its having passed, is its becoming wedged in the stricture, or grasped by it, and when an indentation or chafing is discovered upon its being withdrawn. The difficulty of introducing small bougies is very much increased, when the opening of the stricture is not in the centre of the canal. If we know on which side the opening lies, we will more readily hit it, by bending the point of the bougie a little in the necessary direction, previous to passing it; or not knowing the direction, by turning the bougie round as a gimlet between the fingers with the point bent, the orifice may still be found.

Improved mode of effecting this.

The introduction of instruments through a very narrow stricture, is allowed to be a very nice and difficult part of the treatment, and a point on which the safety of

the patient may immediately depend. As a bougie of wax cloth, of the small size that will pass through the stricture, has not strength sufficient to retain its form while passing down the urethra; as much danger of piercing the urethra attends the use of a sharp pointed metallic instrument in such a case; and as the catgut, which has been commonly substituted for these, on account of its having greater strength with less bulk than any other substance, here applicable, is liable, if retained, to swell from the moisture of the canal, so as to become of difficult extraction, and, consequently, to produce inflammation, which may entirely close the remaining opening; I have for some time made use of the following expedient:—I pass a full sized canula down to the stricture, ascertain the situation of the opening, as explained at page 77, and then

introduce through the canula the smallest wax cloth bougie. This being unimpeded by the contact of the urethra, searches for the opening with great advantage; and if the first one fail, others may be successively used, without exciting new irritation. This method possesses some of the advantages of that already explained, for the introduction of the catheter where the urethra is distended with water.

These rules for passing an instrument through a very narrow stricture, are sufficient when the narrowness is permanent, or not dependent upon temporary spasm; in this latter case, other means, to be considered below, must be added.

A cause of difficulty in introducing instruments, not mentioned above, which Mr. Hunter has described, is where the narrow canal, in cases of long stricture, has a tortuous course.

It is likewise necessary for the surgeon to recollect, that difficulty in passing a bougie may arise from its entering a false passage, formed by the previous unskilful use of instruments. He should, therefore, in such cases, carefully ascertain whether the patient has been under treatment before; and if so, whether the instrument made progress in the canal without relieving the obstruction: a method of discovering the exact state of the parts will be pointed out in the section on false passage.

How the treatment by the bougie; &c. is conducted.

There is a diversity of opinion as to the time that a bougie should remain in the urethra, some thinking, that unless it be left for hours in the stricture, little benefit need be expected from it; while others maintain, that every advantage from its use may be obtained by its being there during two or three minutes. The weight of authority, however, is on the side of the

first opinion ; and although I have found that momentary action of the bougie has occasionally much relieved the symptoms, the cure has always been more rapid when the dilatation was longer continued. The circumstances of the patient, as they render it convenient to him or otherwise to retain the bougie in the canal for a length of time, must often determine the practice. It is a rule in using the bougie, never to produce great pain, either by the length of time during which it lies in the canal, or by the size being greater than the stricture will readily admit, as inflammation might be the consequence, and would retard the cure, more than the violent or prolonged dilatation would advance it. This rule does not apply where the instrument is withdrawn only for the purpose of being cleaned, or immediately replaced by a larger, (as in the plan of cure by

catheters, almost universal in France); because the presence of an instrument prevents the closure of the canal, which irritation favours. The pain produced by the latter method of cure is often almost insupportable, and that the patient may tolerate the continuance of the instrument in the passage, it often becomes necessary to give him large doses of opium. The disorder however, of the general health, proceeding from these causes, and the obligation of remaining in bed during the whole of the cure, are strong objections to the practice.

Where the cure is attempted by repeated introductions of the bougie, the intervals may be from half a day to three days, according to the degree of irritation produced: the size of the instrument being increased as the stricture widens, until the urine pass in a full stream. Severe pain and faintness are occasionally

induced by the first passing of an instrument into the urethra, but in general every subsequent operation causes less uneasiness, as the urethra becomes habituated to the sensation, till at length the patient may readily use it himself. Not unfrequently, however, the bougie produces so much irritation, that the surgeon is obliged to interrupt its use completely for a time, and to have recourse to remedies against spasm and inflammation.—The time required for the cure by the bougie will vary according to the nature of the stricture, and the constitution of the patient: and although relief may now and then be so speedy as to excite surprise, more frequently unremitting perseverance for months is required, to produce considerable amendment of the symptoms.

When a large bougie can pass, the rule is, that it must still be used occasionally for several weeks, to prevent re-

lapse; a practice, which, at longer intervals, is often required during the life of the patient.

Amongst other points deserving attention in the use of the bougie, the possibility of its slipping into the bladder may be mentioned. This may be prevented by tying a tape or thread round its extremity, and to the penis, or by bending down the end of it.—Some surgeons think it advisable in the cure of stricture, to pass the bougie completely into the bladder, alleging that it then lies with more ease to the patient, than when its point is but an inch or two beyond the stricture. I conceive this to be true only when the instrument is unbending, and has not previously received the curvature of the urethra; when it reaches but a little beyond the stricture, the irritation of the sensible posterior part of the canal is prevented.

Defects of Bougies, Sounds,&c.

No bougie or sound, it is evident, whose diameter much exceeds that of the opening of the stricture, can be introduced through it. When the largest that can be admitted is used, its effect at first is violent distension, which, if the instrument can be left in the canal, gradually diminishes by dilatation or absorption taking place; so that, at last, it lies without any distending action. After this, its longer continuance in the passage can be of little avail, but may prove hurtful by the irritation excited. In curing stricture by the bougie, it often happens, from the increased tendency to contract, that, in the intervals between the introductions, whatever is gained by one, is nearly lost before the succeeding; and this interruption of the process of distension, with the irritation produced by the so frequent passing of an instrument, is sufficient to account for the ordi-

nary tediousness of the cure. Indeed, the surgeon is often obliged to continue his efforts at cure, for a long time, without being enabled to increase at all the size of the instrument; often probably because the bougie, at each time, only overcomes the fresh spasm of the stricture, which the irritation of its introduction has produced, and lies loosely afterwards in the original opening, without the least dilating agency.

Certain practitioners, whose reasonings on the subject probably corresponded with the above, have had recourse to the introduction of substances through the stricture, which, after being passed, gradually swell by the moisture, and thus continue the dilatation longer, and carry it farther, than could be done by the ordinary and unchangeable instruments. Of this nature was the sponge tent, fixed to a thread, and passed into the narrow-

ing through a canula; but the difficulty of extracting it in its swollen state, and other defects, soon obliged surgeons to relinquish the use of it. Because leather swells by moisture, bougies have been made of it with the same intention, and also of catgut. The objection to all these instruments is, that their swelling is not under our control, and the extreme pain and irritation caused on withdrawing them, does much more injury than the former peculiarity does good.

The greatest defect of all the methods of dilating stricture now in use is, that, in the majority of cases, they cannot effect a permanent cure. Writers on the subject have attributed this chiefly to the fact, that the obstruction is often supposed to be removed, and the use of the instrument desisted from, when enough of it still remains, considerably to intercept the stream of urine, and thereby to renew the irri-

tation and tendency to contraction. Hence the first part of their rule for obviating the return of the stricture, is not to leave off the use of the bougie until one of a full size can pass easily into the bladder. Yet this is very often insufficient, because, if the stricture happen to be in a part of the canal considerably wider than the orifice, and every part is wider, it is evident that no bougie, which this admits, can dilate the stricture to the degree required. Strictures in the bulb, which is about twice the diameter of the orifice, have always been found, for this reason principally, to be the most obstinate; and in such cases, some practitioners have even been in the habit of tearing, or breaking down, the orifice by a large bougie, to enable them to distend sufficiently. The other part of the rule for completing the cure of the stricture by the bougie, is to continue its use occasionally afterwards, that

the tendency to relapse may be combated and overcome. It is possible that some strictures may be levelled to the surface of the urethra by the usual means, especially when the orifice of this has been ruptured to admit a large instrument; but, unless the distension of the diseased fibres be carried still farther, any disposition to contract which may exist, will not be destroyed.

Great desideratum in the treatment of stricture.

As surgeons, then, have believed that where dilatation could be properly made no stricture would resist it, the great desideratum was an instrument which could be easily passed through the stricture, and any part of which could be then increased in diameter to any size, and with any force; and be again reducible to its primitive small bulk, when the operator should wish to extract it. They seem, however, not to have suspected the possibility of constructing an instrument perfectly an-

swering all these ends, and, up to the present time, nothing nearer to such has been tried than the catgut and leather bougies, or the sponge, above mentioned. It is my task now, minutely to describe to the profession the instrument invented by Dr. Arnott, as stated in the preface, called the Dilator, which completely supplies the desideratum above mentioned.* I may mention previously, however, that seve-

* Great part of this Essay was printed, when I accidentally laid my hand on a book on strictures, by Mr. Luxmore. I had already seen it among the many works that have appeared on the subject; but to this copy there was attached an appendix, said to contain an account of an improved method of treating strictures, by a new instrument as well as by the catheter. Singularly enough, however, the author has not described the instrument farther than that it operated by a screw; he must either have forgotten to do so, which is scarcely possible, or must have thought that the description might not be satisfactory to the profession. I take notice of it merely because it is likewise mentioned under the name Dilator, a term which is used very appropriately in old surgical writings, to signify any instrument for dilatation, and particularly that which dilated the back part of the urethra in the operation for extracting stone by the greater apparatus.

ral less perfect means occurred to him at the same time; such as,—a cylindrical piece of elastic matter (India rubber for instance) introduced into the stricture, and then compressed longitudinally, so as to make it increase in diameter, and open the stricture. Again, a square bit of sheet steel or gold, rolled cylindrically upon itself, as a watch-spring, and resembling, in external appearance, part of a small common pencil-case, with one edge overlapping the other; by two wires affixed near the outer and inner edges of such a spring, it is rolled up closely, so as to make a small cylinder, or unrolled so as to make a large one.—Or, eight or ten wires, of an inch long, applied round a central wire or axis, and fixed to it at one end, as the ribs of an umbrella are fixed to the staff, and at the other end to a ring which slides upon the axis; by pushing this

moveable ring towards the fixed one at the end of the axis, the centres of the wires are made to bulge out, and being flat, the whole forms a smooth metallic bulb, varying in size according to the approximation of the ends. Or, an instrument, in principle resembling Mr. Hunter's urethra forceps, consisting of several flattened ribs, which diverge by elasticity when pushed out of the canula that contains them during introduction; they may be secured together at the far end, so as also to make a bulb when dilated. The dilatation of this, or the last, may be effected, without elasticity, by a button made to run upon the central wire from end to end, within the bulb; on coming near one end of which, it would lift the ribs all round from the centre, and thus increase the diameter.

All these and similar instruments, however, are harder, of less equal surface, and

less elastic, than the perfect dilator which I am now to describe; and this, besides its superiority to all the foregoing in the cure of stricture, is so well adapted for the treatment of various other diseases, that they were merely tried for the sake of experiment.

Description of the Dilator.

A dilator proper for the cure of strictures, requires, and this one possesses, the following qualities:

1. To be of little bulk and of easy introduction.

2. To be made capable of assuming and retaining any shape and magnitude when in the canal.

3. To be capable of exerting distending force to any degree, and always under control.

A tube of oiled silk, lined with the thin gut of some small animal to make it air-tight, and then attached upon the extremity of a small canula, by which it is

distended with air or water from a bag or syringe at the outer end, with a stop cock or valve, to keep the air in when received, is a description of the apparatus.*

The thinnest silk ribbon of different breadths, with the edges neatly sewed together, so as to make it tubular, and then varnished with prepared linseed oil, which dries upon it, and leaves the surface perfectly smooth and soft, is what I have found to answer best. The gut of any small animal will form the lining; but that of the cat is preferable, on account of its thinness and strength. The canula may be of elastic gum, or of the flexible metal used to make the metallic bougies, or of silver; and the injected air may be retained, either by a stop cock at the outer extremity of the ca-

* See Plate III. and its explanation.

nula, or by a valve at the silk tube or bag itself. This last method is the only one applicable to the insulated dilator, which is a short length or bulb of the lined silk, to be distended and left in the canal, and having a bit of canula in the centre, for the free passage of the urine; the patient while wearing it being frequently at liberty to follow his usual occupation.*

Properties of the dilator.

The dilator, when empty, is introduced or withdrawn with the greatest ease to the patient.

As the shape of the silk tube or bag is in our power, it may be made so as to have any desired form when distended; and the sizes of dilators may be ascertained with as much precision as of metallic bougies. It has the important property also of being permanent in its dimensions. On one or two occasions,

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* Plate III. Fig. 4.

where silk tube of the size wanted was not ready, I substituted sewed bladder; but I found that in the moisture and warmth of the urethra, this yielded in the course of a little time, so as to become of double the original diameter, thus stretching the sound canal on each side of the stricture beyond what it could bear: and in any case where strong pressure were required, such a tube would burst before the effect could be produced.

It possesses strength to bear any degree of pressure which can be useful, for the membrane of the urethra itself would be torn, before a strong silk tube would give way: it is almost needless to add, that by injecting more air, the pressure in any given case is increased, or that it is diminished by opening the cock or valve.

Explanation of the action of the dilator

To those who understand the phenomena of fluid pressure, the precise kind

and force of the actions of this dilator are at once intelligible. To those who do not, the following short exposition will be acceptable:—Suppose a vessel filled with any fluid, and having an opening in its circumference; were pressure made upon the fluid at that opening, as by an attempt to force more fluid into the vessel, this pressure would be immediately communicated through the fluid, to all parts of the internal surface of the vessel, and quite equally; so that if the hole supposed were of an inch square, and a pressure of ten pounds were made upon it, every square inch of the vessel's surface would immediately be bearing the same degree of pressure. This fact in natural philosophy, has often been called the hydrostatic paradox, from the extraordinary results which present themselves from it under certain circumstances. It is familiar to us, for instance, that by

one of the patent fluid presses, a pressure of 10,000 pounds may be produced where the acting power is only a small syringe or pump worked by the hand, and forcing water into a distending recipient. Let us now consider the action of the dilator. If by a syringe having a piston of half an inch square, I fill the bag, and condense the air in it with a force of five pounds, every half inch square of the surface of the silk tube is bearing the same degree of pressure; and, if a stricture should be indenting, or holding in a contracted state, that extent of the surface of the dilator's bag, the stricture itself, instead of the bag, is supporting the five pounds of pressure, and of course is dilated by a force of five pounds. We see, then, that the action of the dilator upon a stricture is always proportioned to the extent of the dilator's surface, which is depressed by its bearing against it; and

this quantity depends upon three circumstances: 1st. The size of the bag, of the dilator. 2d. The narrowness of the stricture. 3d. The resistance to bending, which is offered by the longitudinal fibres of the dilator.

1st. The greater the diameter of the dilator, the greater is its distending force; for a band of the circumference of a large bag, contains necessarily more surface than a band of the same breadth of a small one, and the extent of surface acting upon the narrowing is the measure of the force. It is for this reason, that a large dilator requires to be made of stronger materials than a small one.

2nd. If the stricture be wide, it scarcely makes an impression on the dilator bag, and therefore bears little of the pressure; if narrow, on the contrary, it makes a large depression, which extends perhaps half an inch each way from the stricture,

and the stricture bears the pressure of all that part of the dilator, which is thus narrowed or depressed.

3dly. If by any circumstance the substance of the dilator be rendered difficult to bend in its longitudinal direction, the action on the stricture is much increased thereby; for the stricture, in depressing any part of an unbending longitudinal fibre, must necessarily depress the whole, and would, therefore, have to bear the distending force of the whole surface. Tying the dilator tube upon its canula, so as to be rather tight longitudinally, has this effect in some degree; but if for any purpose we wish much to increase its power, we have means of doing it to any extent even to rupture or tear the hardest stricture. A few hogs bristles, or thin laminæ of goose quill, interwoven longitudinally in the silk of the bag, will answer in many cases; or the best means

of all, is to surround the bag with a cylindrical very thin gold spring, which contracts upon it when empty, and is opened by it when distended.

Resembling surgical expedients.

In cases of hemorrhage from the nose and rectum, a piece of sheep or hog's gut, with one end tied, introduced into the part, and then distended with water, has been used to stop the bleeding; and Bromfield dilated the urethra of a young woman, to make passage for a small stone by the same means: but the manner of using the fluid distension in these cases was so imperfect, that it is scarcely noticed in books of surgery, and is unheard of in practice. Some marvellous stories are likewise told of Egyptian surgeons having inflated the male urethra to such a degree, as to allow of the suction of calculi from the bladder; and it has somewhere been recommended, when stones stick in the urethra, to ren-

der their passage easier by distending the canal before them with a piece of gut tied upon the end of a catheter. It may seem somewhat extraordinary, that persons who thought of, or tried these contrivances, should not have made the perfect dilator, which is so like them, and which is but a new application of a principle quite familiar to us. We have, however, many examples of a similar kind in the history of the arts; to compare great things with small—the application of steam to move a piston, which single thought has so much changed the state of society, seems to be that which would most readily strike any man who saw the lid of a vessel of boiling water blown off, or the water projected from its spout by the force of the steam; yet this application was long unthought of and unknown. Dr. Arnott contrived the dilator several years ago, merely from the

consideration of the means most fitted to cure stricture.

Manner of using the Dilator.

The manner of using the dilator is as follows. Though in general it passes as easily down to the stricture as a small bougie, yet on some occasions, especially in irritable urethræ, unaccustomed to the presence of instruments, I have preferred introducing it through a smooth canula, in the manner already mentioned. As soon as the bag is sufficiently within the stricture or strictures, (if more than one exist in the canal) as much air is to be injected into it as the patient can easily bear; and during the time it remains in the urethra, the future admission or escape of the air is regulated by his sensations; that is, if the feeling of distension abate, more may be injected; but if it should increase into pain, a little of the air may be allowed to escape.

Much pain should never be given by

the distension ; for it is wonderful how little force is required to dilate strictures, when it is divested of the irritating, and consequently counteracting quality, that often attends it when produced by the bougie. There are instances of stricture lately recorded by Bruninghausen, a German practitioner, which were removed solely by his patients distending their urethræ with urine, by endeavouring to expel it, while they closed the point of the canal. Such distension, however, must have been so very slight, and continued for so short a space of time, that Mr. Charles Bell supposes, with reason, that the strictures removed by it were only temporary, or depending on inflammation ; nor is the urine, from its acrid nature, well adapted for retention amongst such irritable parts. Instead of using a small bougie I have sometimes widened narrow strictures sufficiently, to admit the proper silk tube dilator, by a single or double

very small gut, introduced upon a fine wire, projecting from the canula, distended, and the wire then extracted.

An important advantage peculiar to the dilator, arising when it is not distended too forcibly, is, that it yields for some time to the violent spasm that is occasionally induced by passing any foreign body through a stricture. When a bougie yields, its power of distension is immediately lost; but the force of the dilator is only concentrated, and, returning to the charge, ultimately overcomes every obstruction. Perseverance, in most instances, is equivalent to strength; the hardest bones will in time give way to the pressure of a soft aneurismal swelling; and for the same reason the firmest stricture soon yields to the unceasing and gentle efforts of a moderately distended dilator.

Comparison between Bougies, &c. and the Dilator.

To shew in a connected manner the superiority of the dilator over the different kinds of bougies, sounds, &c. I shall make the following comparative statement of their respective effects:—

In the first place, with regard to the time required to effect considerable dilatation of the stricture by these latter means, and the pain attendant on their use, it may be remarked, that in old cases, where for the most part more than one stricture is found, dilatation by the bougie becomes a very tedious and painful process; and before the passage is tolerably cleared, fistula in perinæo, diseased bladder or prostate, or some other obstinate malady, is too often the consequence of the spreading irritation. Ten weeks have been mentioned as the average period required, with regular passing of the instrument, before considerable relief can be obtained. This proceeds from the

necessity of making the removal of each stricture, in a great measure, a separate business; to accomplish which, from the unchangeable size of the bougie, numerous applications of it are requisite: great irritation is hence occasionally induced, causing interruption and delay in the treatment, and is brought on, not only by these repeated introductions, or attempts at introduction, and the violent dilatation, but by the unyielding opposition of the instrument to spasm. From this incapacity of receding for a time, to humour such irregular contractions, arises the great pain that often accompanies the use of the bougie, and the frequent instant necessity of withdrawing it, before any benefit be derived from its distension. Whenever interruption to the use of the bougie occurs from irritation, as the contraction of the stricture then goes on very rapidly, the surgeon resembles a boatman

rowing against the stream, who immediately loses ground upon intermitting his labour.

Speaking of the effects of the bougie, I have used the expression "considerable dilatation," for the term, cure, is hardly applicable, as the disease generally recurs after the instrument is laid aside, notwithstanding that the orifice of the urethra may have been broken down, to permit the passage of one of the largest size.

The dilator, on the contrary, may be introduced in a collapsed state, by an accustomed hand, without exciting irritation, and is as easily retained. By its equable, moderate, and continued distending force—by its yielding for a time to any irregular spasm that may arise—by its capability of dilating any part of the urethra to any extent, and of removing any tendency to contraction—by para-

lyzing the irritable fibres if necessary; the dilator completely and permanently removes the obstruction, and if this be recent, by a very few applications. Its power of dilating at once and equally any number of strictures that may exist, is a quality, perhaps, not less important than its capability of effecting a permanent cure: and as the canula of the dilator should be always small, to whatever degree its bag may be dilated, little additional uneasiness can arise from its presence in the canal. In the use of the insulated form of the instrument, as there is only a thread or very narrow flexible tube attached to it, instead of increasing, it will be often found to diminish the irritation accompanying stricture, by defending this from the contract of the acrid urine as it passes through the urethra.

Section II.

Of removing the Irritability of Strictures.

Caustics, when used so as not to destroy substance, and other means of removing the irritability of strictures, must be regarded as only occasional assistants in the prosecution of cure, by more efficacious remedies. They often remove spasm or inflammation from the urethra, but as permanent stricture does not depend on these alone, they, of course, cannot effect the complete removal of such. In some cases, however, they may excite absorption of the diseased parts, and thus produce more permanent good.

Of removing the irritability of Strictures.

Simply touching a stricture with a bougie, as has been already remarked, often diminishes its sensibility, as moderate admission of light gradually removes exces-

By the Bougie.

sive sensibility from the eye; but if great stretching is produced by it, much irritation may follow.

By Caustic.

Another customary means is to touch the stricture for a moment with lunar caustic, or, what is generally preferred, to allow a small particle of caustic potass to dissolve within the inflamed part, and thus completely to destroy the sensibility of its surface. This may be carried to the stricture in a hole or depression in the point of a bougie, or other convenient instrument; and as the inflammation of surface and irritation is always greater behind the stricture than before it, it is an important object to make the caustic pass through so as to reach this. Where an instrument cannot enter the stricture, still if closely applied to it, a little of the caustic, on dissolving, will find its way through the opening.

By Medicated Bougies.

I am at a loss whether to speak of

medicated bougies (in the particular sense of the term) at one time so generally used, as the most inefficient means of removing irritation, or as really a cause of its increase; but it is of little consequence, as they are now abandoned by regular practitioners.

By other applications.

It may be a question, however, of more importance, whether the direct and continued application of liquid anodyne medicines, as of opium or belladonna, to the contracted portion, might not diminish its irritability. Such an application can be easily made by putting the liquid into a tube, resembling that of the dilator, attached to the end of a small canula, and pervious enough to allow the parts in contact, to be constantly bedewed. From the few trials which I have made, I am inclined to think favourably of this.

Of retention of urine from Stricture.

When the irritation from bougies, exposure to cold, debauch, &c. has proceeded to such a height as completely to close a stricture, every means that our art can afford, is demanded to relieve the consequent retention of urine.

Treatment of iritability by general remedies.

It is chiefly when the irritability is in this degree, that more general remedies become useful. If the retention has not existed long, and the patient does not as yet complain of great uneasiness, general and topical antispasmodic and antiphlogistic measures may be alone sufficient for his relief, and the one or the other of these will be chiefly employed according as the retention is supposed to proceed more from spasm or inflammation. Opium, in some of its forms, taken by the mouth, or injected per anum, the warm bath, warm fomentation, or the application of a bladder containing warm water to the perinæum, or blistering this part, are amongst

the best antispasmodics; venesection, topical bleeding by leeches, and the exhibition of cooling purgatives or clysters, are the antiphlogistic remedies to be employed.

Of relieving the retention by the Bougie, Catheter, &c.

Generally, however, with some of these it becomes necessary, from the suffering of the patient, and the danger of delay, to resort to the introduction of the catheter or bougie; the temporary increase of contraction may in time give way to the other means, and to the force of the accumulating urine, without great mischief ensuing; yet we must by no means, with this expectation, overlook the patient's present misery, and become remiss in our endeavours at more certain relief. The power of contraction in the bladder would in many cases be lost by too long delay; inflammation might be excited, and even spread over the abdomen; and a fatal effusion of the urine from ulcera-

tion of the bladder would at last ensue.

In addition to the rules for passing instruments in cases of difficulty, already given in this chapter, I have to add, as particularly applicable to this case, the following. When the bougie cannot be made to pass immediately, by leaving it in the canal, with its end close to the stricture, for a considerable time, and then repeating the attempt, it will often either go through, or the irritability will be so decreased as to allow the escape of the urine. When a very small catheter can be passed, in such a case it is to be preferred, because by leaving it in the canal, we ensure a ready passage for the urine, till the irritation be removed.

Many opinions have been entertained regarding the manner in which instruments operate to the relief of the patient, by thus lying in the urethra. Sharp supposed, that the stricture might be relaxed

either by the instrument's causing a discharge from the canal anterior to it, because on other occasions, such a discharge frequently relieves the irritation: or, that by exciting the urethra, it causes the bladder to act with force sufficient to overcome the recent increase of contraction. Hunter imagined that the bougie, by acting in another part of the urethra, and causing it to contract, might diminish the irritability of the diseased part; and he remarks, that stimulant injections have a similar beneficial effect. Others have thought, that the contact of the bougie with the stricture, directly diminishes its irritability; and the advantage derived from a slight application of caustic in such cases, is an argument in favour of this latter opinion.

New Means.

Surgeons have hitherto used small instruments in cases of retention from closed stricture, that they might pass through

when the spasm yielded: but in pressing against the stricture with a point, unless it bear upon the orifice, it can have no tendency to open it, and there is danger, of piercing the side of the canal.

It seems not to have occurred to them, that a large instrument pressed against the stricture, and not expected to pass through, will still frequently open it more certainly than a small one. We see a hole in an elastic substance greatly stretched, by pressing a ball or rounded end against it; and such is, indeed, often the best and most certain means of opening a narrow stricture. The plan which I have recommended above, of passing a large canula, (which in this case has a rounded end) enclosing an instrument down to the stricture, is very applicable here; pushing the canula against the stricture, opens it, while the small bougie, or catheter within, is ready to

be passed through. By simply pressing a large bougie against a closed stricture, the urine will frequently follow.

When these methods to open a stricture prove unsuccessful after a sufficient trial, others of a more violent nature must be had recourse to. Such are forcing the passage by a well directed conical metallic catheter, or even piercing the stricture with a cutting instrument. Puncturing the bladder is our last resource; but fortunately is an expedient, which the skilful surgeon has scarcely ever occasion to employ.

Of removing irritation of the prostatic Urethra.

It will not be deemed foreign to the subject, just to mention here that irritation which frequently exists for a long time in the prostatic portion of the urethra, producing strictures, or embarrassing and preventing their cure. The characteristic symptoms are strangury, a burning sensation, and faintness experienced on the introduction of the bougie, the point of

which is often found on extraction, to be soiled with a bloody purulent discharge. The best method of removing this irritation, according to Mr. Abernethy, who first particularly described the complaint, is to pass a bougie occasionally over the part; if this prove insufficient, topical bleeding, blistering, and fomentation may be used.

Section III.

Of the Destruction of Stricture by Caustic.

Of destroying Stricture by caustic.

The term caustic, is given to all those substances which possess the power of destroying any part of the texture of the body to which they are directly applied. Many kinds of caustic were used to destroy strictures before last century, with variety of result, according to the kind used, the manner of applying it, and the state of the disease; but generally with so much pain, and other mischief, as to

have caused the practice to be long forsaken. About fifty years ago Mr. Hunter revived this method of treatment, having ascertained, from morbid dissection, that strictures are in general but simple projections inwards, or folds of the membrane of the urethra, and consequently so short as to be easily destroyed by caustic. He devised a more perfect manner of applying it than had been before practised, and used it with great success in cases where, from the smallness of the opening, or other causes, the common bougie was inapplicable. His successor, Sir Everard Home, convinced of the insufficiency of the bougie alone to effect a permanent cure, in almost any case, extended the application of caustic to all. This indiscriminate extension, from the mischievous effects that followed it, when adopted by less able practitioners, and sometimes even in the hands of the most dexterous, owing

to the still imperfect mode of application, has brought upon the caustic unmerited obloquy, and it is now again little used.

Modern surgeons have used two kinds of caustic—the argentum nitratum, or lunar caustic, and the potassa, or caustic vegetable alkali. The lunar caustic is preferred to the potass, being more manageable from its hardness, and because, from its slow solution, its action is confined, in a great measure, to the part touched. On the other hand, the solubility of the potass is an advantage, where it is the intention only to deaden the sensibility of the inflamed urethra, as the small particle used soon becomes liquid, and mixing with the secretions of the canal, spreads over the surface; but its employment in great quantity is inadmissible, because, from this spreading, sound parts would suffer equally with the diseased.

Mr. Hunter employed the lunar caustic in two manners, which I shall describe, with the phenomena resulting from its application, before explaining the method which I have myself practised.

Hunter's method of applying it through a canula.

His first mode was to pass it by a large silver canula, of the proper curvature, down to the stricture. To make the canula enter, and to prevent the accumulation of mucus in its extremity, he filled this up during the introduction, by a hemispherical button, fixed to the end of a wire. At the other end of this wire, the caustic was held by a kind of porte-crayon; and on the canula's reaching the stricture, the button-end of the wire was withdrawn, and the caustic introduced in its stead. When the caustic had pressed moderately against the stricture for about a minute, it was drawn within the tube, and the whole apparatus extracted. He finished the operation by injecting some water, or by

desiring the patient to void his urine, to wash off any of the caustic, which by remaining might hurt the parts. From the unyielding nature of this canula, he found it difficult to apply the caustic exactly to the surface of the stricture, and therefore, when the obstacle was at the bend of the urethra, there was considerable risk of burning a false passage under the true one. The employment of a flexible canula remedied, in part, this defect; but he ultimately preferred a wax cloth bougie, with a bit of caustic inserted into the end of it. Sir Everard Home was the first who gave an account of this latter method, and from his work the following description is taken.

"Take a bougie, of a size that can be readily passed down to the stricture, and insert a small piece of lunar caustic into the end of it, exposing the surface of the caustic, but surrounding it every where

laterally by the substance of the bougie. This should be done some little time before it is used; for the materials of which the bougie is composed, become warm and soft by being handled in inserting the caustic; and therefore the hold the bougie has of the caustic, is rendered more secure after it has been allowed to cool and harden. This bougie, so prepared, is to be oiled, and made ready for use; but previous to passing it, a common bougie, of the same size, is to be introduced down to the stricture, to clear the canal, and to measure exactly the distance of the stricture from the external orifice; this distance being marked upon the armed bougie, it is to be passed down to the stricture immediately on the other being withdrawn. In its passage, the caustic is scarcely allowed to come in contact with any part of the membrane, the point of the bougie, of which it forms the central

part, always moving in the middle line of the canal; and, indeed, the quickness with which it is conveyed to the stricture, prevents any injury to the membrane when it is accidentally brought to oppose it."

Method of prosecuting the cure by caustic.

The caustic should never be kept in contact with the stricture above a minute, nor often above half a minute, especially in irritable subjects, and at the commencement of the practice. A slough, or pellicle of dead matter, is formed by each application, which ought to separate from the remaining part of the stricture before the caustic is repeated. Two or three days may be commonly required for this separation, and the patient should carefully notice it. If large, the dead matter may be discharged in one bit, and if small, little filaments observable on passing the urine, will commonly give intimation of its removal;

or the increased sensibility of the parts on the passage of the urine, will strengthen our presumption that this has taken place. I am convinced, that from want of proper attention to the circumstance of the separation, the surgeon has frequently given himself needless trouble, and his patient needless pain, by repeating the application of the caustic too soon. It is only by this supposition, that we can account for the numerous cases of stricture on record, that have withstood more than fifty applications, (for we know that nearly an eighth of an inch of the substance of a stricture is destroyed by every proper application of the caustic,) or from the circumstance that the caustic has often been kept the usual time at the stricture, without the patient's experiencing any pain from it.

After allowing a reasonable time for the separation of the slough, when it has

passed without being seen, if no great degree of irritation be present, the caustic is to be again applied, and the treatment continued in this manner till a bougie can pass through the stricture. Home, who had the permanent removal of the stricture in view, insists on the propriety of using caustic till a full-sized bougie can pass, and directs that for this purpose as thick a piece be employed as can be readily passed down to it; but as Hunter used the caustic chiefly in cases where he could not introduce the bougie at all, as soon as the stricture was wide enough to admit a small one, he laid the caustic aside.

The patient experiences a burning pain almost immediately on the caustic touching the stricture, but not very acute, nor of long continuance; and unless the application be severe, irritation seldom ensues. The supposition that great irritation would follow the caustic, deterred

Surgeons, for some time after Mr. Hunter's publication, from attempting the cure of stricture by it, and a chief merit of Sir Everard Home's work was, that his numerous collection of cases proved how groundless these terrors were. He has shewn even, that if a small bit of caustic should accidentally drop from the point of the bougie, and remain in the canal, no great mischief need be dreaded. It is a good rule, however, during the use of caustic, to avoid all additional causes of irritation.—The number of applications necessary to the destruction of a stricture will, of course, depend on its length and consistence, and on the correctness and duration of the several applications. One severe touching may remove a short stricture, while fifty have been insufficient in cases of a different description.

Of several unpleasant effects of caustic applied to stricture.

Several disagreeable circumstances may occur during the prosecution of the treatment by caustic, as it is usually applied, which have been magnified and detailed in all their horrors by some practitioners, whose interests, rather than their opinions, have been inimical to it.

Of hemorrhage from caustic.

Of these, hemorrhage may be first considered, an unpleasant occurrence, but generally, from the small quantity of blood lost, more terrifying to the patient, than noxious to his constitution. Several pints of blood, however, have flowed at once, from the caustic's having probably opened a passage into the corpus spongiosum ; a circumstance which greatly weakens the patient, and retards the cure of the stricture. What constitutes the danger of this hemorrhage is, that Surgeons have hitherto been obliged to leave the stopping of it almost entirely to the efforts

of nature. It would be dangerous to close the canal anterior to the stricture, as the blood would then flow into the bladder, coagulate there, and prove an obstinate cause of retention of urine; and the only other means they had for moderating it, were astringent injections, cold external applications, and external pressure. We have now, however, in the dilator, a means which will arrest such a discharge instantly; pressure may be made by it, either directly on the bleeding vessels, or behind them, while the anterior extremity of the urethra is closed.

Fever is occasionally induced.

We have seen that a violent paroxysm of fever is an occasional symptom in bad cases of stricture. The same affection sometimes follows the employment of caustic, and in old or irritable cases may be so violent, or so liable to recur a few minutes after every touching, as to render

perseverance in the plan by caustic dangerous. These paroxysms always debilitate the patient, and have occasionally proved fatal. Sir Everard Home, whose experience in the treatment by caustic has exceeded perhaps that of any other Surgeon, mentions, that such paroxysms were particularly apt to occur when the cure was nearly completed, or just before a large bougie could pass on to the next stricture, or to the bladder. From a consideration of this fact, and the circumstance that hemorrhage generally occurs about the same period of the cure, I thought it advisable, whilst engaged in practice of this sort amongst patients who had been long in India, and were consequently particularly disposed to this affection, not to employ the caustic to the same extent; and I found that by this limitation, the paroxysm was a very rare occurrence. This difference in practice

was moreover founded on the idea, that all obstructions in the urethra can seldom be, in their whole length, of the same consistence, and that, although the caustic may be more effectual than the bougie for destroying the anterior harder part of the stricture, yet as the posterior portion of this is generally more soft, vascular, and irritable, being chiefly a swelling of the coats from inflammation, excited there by the resistance to the urine, it by no means requires nor admits of such a powerful remedy for its removal. When these paroxysms occur, however, in spite of every precaution, a cooling laxative and sudorific have been found useful in promoting their speedy subsidence.

Of obstruction from the separation of the slough.

That danger may be incurred in the treatment by caustic, from the slough on its separation plugging up the passage, is certainly possible; but I have never as

yet observed it in practice, nor can I easily conceive how such an obstruction could resist the stream of urine, or the introduction of a bougie.

The pain and spasm from caustic.

The pain and spasms from caustic have been mentioned as reasons against preferring it to the bougie; but I doubt whether, on an average, more distress is not experienced by the tedious and irritating employment of the latter.

Of a false passage from caustic.

The last and most powerful argument against the application of caustic, is, the danger of its burning a new or false passage, either into the body of the penis, or, more commonly, through the cellular substance between the urethra and the rectum. This has been a very frequent occurrence, and when we reflect on the hitherto imperfect mode of applying the caustic, and that there have been as yet no satisfactory means of discovering the length of the stricture, we

see that in the attempt to burrow through one of the long kind, there are many chances of the caustic's leaving the line of the urethra; and even in short strictures, especially when they are hard, the same disastrous occurrence is liable to happen, from the caustic solution acting chiefly on the lower side of the canal. To obviate this danger, we have been desired to press, from time to time, a soft bougie against the stricture, and thus to obtain an idea of the advances made, and whether or not the caustic holds the proper course through the stricture.

All these disagreeable consequences from the use of caustic will be found to proceed chiefly from the methods of applying it hitherto in use. It is by burning unequally or too much, that false passage is formed, that hemorrhage occurs, that the violent fever fit is produced; and from the uncertainty in

which the Surgeon is of making the application exactly to the spot intended to be destroyed, arises, in general also, the tediousness of the cure. I am now going to describe a new method which I have practised, and which obviates all the defects of the others; and as it is important previous to any application of caustic, to know exactly the state of the parts, I will first explain a more complete mode of sounding or examining the urethra than has as yet been practised.

The Dilator sound.

It is a modification of the dilator which supplies us with a perfect urethra sound, for discovering, not only the length of strictures, but their number and relative situations. Little attention has been paid to the two last mentioned circumstances, because no means was known of removing more than one stricture at a time, and Surgeons accordingly, and merely for the sake of prognosis, had been content

to conjecture, that if a stricture occurs in old cases before the bulb, one more, at least, will be found nearer the bladder. The canula of the dilator sound, should be stiff and very narrow, and the bag very short, nearly of the natural diameter of the urethra, with its extremities as flat as possible.* It is introduced to the first stricture, and the distance from the orifice of the urethra observed; letting out the air, it is then passed through the narrowing, again distended and retracted, till the posterior surface of the same stricture opposes it; the distance of this from the end of the canal is then marked, and the space between this mark and the former shews the extent of the urethra occupied by the stricture. The instrument is now passed to another stricture, the same process repeated if deemed ne-

* Pl. III. Fig. 5.

cessary, and so on till the whole length of the urethra is examined. By feeling the impression made by a stricture on the bag of a long dilator lying in it, I have been able to ascertain, with considerable precision, its length, when in the perinæal portion of the urethra.

Usual means of measuring stricture.

The means generally in use for examining the urethra in such cases, are these:

1st. To introduce a bougie through the stricture, and to observe whether it passes it with a sensible jerk; if so, it is supposed to be a thread stricture. This criterion, however, cannot be depended upon, as the differences of consistence, with a thousand other circumstances, would continually mislead us.

2d. Others form an opinion from this: they pass a soft bougie through the stricture, and on its being withdrawn, if a transverse groove or indentation be observable upon it, they presume that the

stricture is short; but if no groove is discovered, they deem it of the ribband species. Now were violent spasm of a short stricture excited by the bougie lying in its opening, and the spasm to cease, a groove might certainly appear on the bougie when extracted; but if no spasm should arise, or having arisen, should continue during the extraction of the bougie, the groove would be little observable, and the form of the point of the instrument would, as far as it had been introduced, be throughout equally lessened.

Mr. Charles Bell proposed a means very ingenious and of good promise, but not fulfilling expectation in practice. He recommends to use wires, terminated by silver balls of different sizes, and to try until one be found that will just pass into the stricture; and he supposes, that by then attending to whether it moves along easily, as in the healthy wide urethra, or

with difficulty, as in a narrowing, the length of a stricture may be decided upon. When we reflect upon the irritability of the diseased canal, and the pain and spasm likely to be produced by pushing the ball through irritable portions, we see the sources of error to which the feeling of the operator is exposed; and if a narrow stricture exist anteriorily, none beyond it can be felt. It is moreover objected to the use of these probes, that by the supervention of spasm of the muscular fibres of the urethra itself, or of those surrounding its further portion, the extraction of the ball has for a long time been prevented.

A new method of applying caustic.

The new plan of introducing the caustic adverted to, is this: having sounded the canal as described, and ascertained the size of the passage through the stricture, I pass a full sized canula down to it, and then through this, the caustic, previously prepared in the following man-

ner. A short cylindrical bit is chosen, of diameter rather less than the stricture, and it is pierced so that a wire may pass through its axis; this wire has a ring end to be held by, and is a little longer than the canula. Half an inch of it is then passed through the caustic, and is covered by a piece of common bougie, that it may pass through the stricture without chance of wounding the urethra; and behind the caustic another portion of the wire is surrounded by bougie, in order that the caustic may be firmly held half an inch from the point of the wire.* The wire thus armed, is passed down the canula, and the bougie point entering the stricture, conducts the caustic exactly into it. The canula, during introduction, has its open extremity filled and rounded by a button, projecting from it as already described, and when close down, the button is with-

* Pl. IV.

drawn with the wire to which it is fixed. On the other end of this wire a little dossil of lint is fixed, which is introduced before the caustic, to absorb any superfluous moisture at the stricture, and after it again, to take up any dissolved caustic which might spread in the canal. The time during which the caustic should remain touching the stricture, and the repetitions of the application, are regulated by the ordinary rules.

Comparison between this new method and Mr. Hunter's.

The following are the advantages of this method over that proposed by Mr. Hunter. A very great one is, the impossibility of its making a false passage in whatever kind of stricture it may be employed. Even though the caustic should be applied to the anterior surface of the stricture only, the projecting guide would prevent this hazard.

If the stricture be chiefly from spasm, the destruction of the innermost fibres

may suddenly remove all the worst symptoms of obstruction, as these fibres may be the only irritable ones, and the rest of the stricture but a portion of the membrane of the urethra, drawn inwards by them from its natural position. I cannot otherwise account for the frequent sudden relief of obstruction that has followed this practice.

But whatever may be the nature of the stricture, by every partial destruction of its inner surface, its caliber must be enlarged. Whereas it has been often objected to caustic, as hitherto employed, that it may be applied to the anterior surface of a long stricture for months, without at all relieving the symptoms.

As the action of the caustic is confined to the stricture, as well from being applied to its inside only, and passed to it in a canula, as by the employment of the sponge, which prevents the spreading

much better than the injection of water, all unnecessary pain and spasm will be prevented.

Besides, by the immediate destruction of the irritable inner fibres, the risk of spasmodical retention of urine will be very much diminished.

For the same reason that false passages and unnecessary pain are prevented, the occurrence of hemorrhage will be very unfrequent, as there is no danger of breaking into the cells of the corpus spongiosum.

I shall subjoin the following remarks, for the purpose of obviating such objections as I conceive may be made to this new method.

If the opening of the stricture should not be exactly in the centre of the urethra as usual, it will be proper, to ensure the destruction of the stricture only, to cover part of the caustic previous to using it

with wax, or other similar substance, to limit its action; and to examine, from time to time, by the introduction of a soft bougie, whether the effect be what is desired.

No fear need be entertained, when using the caustic in this way, of harm arising from its breaking and remaining in the urethra; for if the canula be kept close to the stricture, any particle that might accidentally drop from the wire, must be drawn again into the canula, by the end of the returning guide.

Caustic useful only as a last resource.

However superior caustic, employed in this improved manner, may be to the common dilating bougie in the cure of stricture, as really upon the whole producing less pain and irritation, and being certainly of much speedier benefit, while it has also more permanent effect from its capability of burning to any extent

the sides of the stricture closely applied to it; still, from the almost universal applicability of the dilator, the cases requiring the caustic will not be numerous. If no bougie can be made to pass, this method of applying caustic cannot of course be used, and the question will then be, whether Hunter's caustic bougie, or some of the plans about to be mentioned, is to be preferred. Great objections to the use of caustic in such cases are, that, from the impossibility of measuring the length of the stricture by the sound, we may apply it to one of the long kind, and that the inflammation which might succeed to the touching, would be apt to close the opening entirely.

Sect. IV.

Of Rupturing Stricture.

Of rupturing Stricture.

The speedy widening of a stricture is sometimes effected, by pushing forcibly into it a sound, or catheter, to break it down or rupture it. This, like the caustic, is a very old practice lately revived; but it is hazardous and painful, and therefore improper, wherever a safer method can be substituted. If the stricture indeed be short, and of soft consistence, and the point of a conical instrument can be introduced a little way into its passage, by forcing it on, the muscular contraction may either be suddenly relaxed, or the stricture ruptured into several bleeding caruncles, which must afterwards be removed by the use of a bougie. But if, on the other hand, and which is by far more

A dangerous mode of treatment, as at present practised.

likely, the stricture be long, of harder texture than the adjoining urethra, or the point of the instrument cannot be properly lodged in its opening, it is evident that if this method of rupturing be adopted, the instrument will be more apt to tear the urethra anterior to the stricture, than the harder stricture itself, and may thus produce great hemorrhage, and false passage. In very narrow permanent strictures, where no instrument can pass without rupturing, or where close spasm cannot be otherwise removed, when the point of a conical instrument can be correctly applied, it may be allowable for a dexterous surgeon to use force, but under no other circumstances. For a false passage is so troublesome an occurrence, that no advantage by rupture over slower means can compensate for the great hazard of this, that is incurred; keeping

the pain out of the question, which must in general be very severe.

In cases where the stricture is short, and will not yield to gradual dilatation, if it be deemed proper to open the canal immediately, and there is yet room for the dilator to pass through the stricture, it may be ruptured without the foremen-tioned danger, by distending it suddenly with a dilator of powerful action.

Can be safely effected in many cases by the Dilator.

Sect. V.

Of destroying Strictures by Ulceration.

Although ulceration of the stricture may be produced by most of the methods of clearing the canal, I mention it separately, because it was once the practice of Surgeons to treat strictures only by making them ulcerate, applying considerable pressure against them with a bou-

Destruction of Strictures by ulceration.

gie, or some other similar instrument. The pain from such a measure, however, is excessive, and the operation so slow, that in the present state of our knowledge of the treatment of stricture, the practitioner, who should attempt it, would not often be left to consult his own judgment about the propriety of continuing it.

The pain and confinement, we have already stated, are the chief objections to the French method of curing stricture by leaving a catheter in the canal. This probably operates to the cure, in many instances, more by producing ulceration than simple dilatation of the stricture. If the stricture be narrow, they first force a metallic catheter through it into the bladder, which, after remaining four or five days, is replaced by a larger of elastic gum, and this, after the same period, by one still larger, and so on until the obstruction is removed.

Sect. VI.

Of the Treatment of Stricture by Cutting.

Of piercing Strictures.

When the urine is obstinately retained by closure of the passage through a stricture, and there is reason for supposing that the stricture is short, by the little space observed between the urethra behind the stricture when full of urine, and a bougie, or the dilator before it, it may be advisable, when other methods have failed, to attempt the patient's relief by piercing the stricture. This may be accomplished by passing a stilet in a canula down to the stricture, and perforating it, while the patient distends the urethra behind it with urine. Such an operation is recommended in books of surgery; but without a means of stopping the hemorrhage that might be caused by the stilet's

accidentally piercing the corpus spongisum, the patient would incur considerable danger. Since we have the dilator, however, which can press directly upon the bleeding vessels, this hazard is completely removed, and thus another means is obtained, whereby we may sometimes avoid the operation of puncturing the bladder.

Former methods of cutting Stricture very imperfect.

But in cases where no perforation is necessary on account of retention, it has still been proposed, for the purpose of accelerating the cure, to slit open the stricture by passing through it a probe pointed trocar, made to cut on withdrawing. And I have read somewhere of a knife for the same use, consisting of two cutting blades, which being passed through the stricture in a sheath, are then expanded like the sides of the letter T, and on withdrawing, cut with their inner edges. Those methods, however, of slitting the stricture, labour, like rupturing,

under this defect, that they still leave the obstructing substance, though in another shape, which requires for its complete removal, and to prevent the divided edges again growing together, the constant and painful presence of the bougie.

A method of cutting out Stricture.

There is, however, another means of cutting, or rather of cutting out strictures, which the invention of the dilator enables us to practise, and which has not the defects of the operations just mentioned. It seems applicable in the following cases: —where the stricture has a peculiar tendency to return; where it is important to obtain immediate relief, to obviate bursting of the canal, or other disagreeable consequence; or where the narrowness of the stricture, its spasmodic nature, or the existence of a false passage, renders the attempt to cure by dilatation, abortive.

In this operation, which resembles in some respects that of cutting out a por-

tion of the cranium by the trephine, the whole substance forming the stricture is instantly removed by one push and turn of a circular knife carried against it. Before cutting, the urethra before and behind the stricture is fully distended, the outer portion by a large canula introduced down to the stricture, and the inner by a dilator which has been passed through it, and drawn close against its posterior surface, so that the stricture itself remains compressed between these two, and projecting inwards. The knife, then, like a second canula issuing from the first, makes its way through to the dilator, and detaches the whole of the stricture, which comes away in its tube. The canula and knife are then withdrawn from the urethra, but the dilator remains, brought forward upon the newly cut surface, to stop the hemorrhage. The knife is managed by a wire handle, by which the operator

gives it the forward and turning motion necessary; and lest in passing through the stricture it cut into the dilator (if an air one be used) before the excision of the stricture is complete, the dilator is made to recede a little, as the knife advances.

This operation promises, from its speedy, safe, and effectual action, to be a fitter remedy for the cases of stricture above mentioned, than any of the other methods; and the momentary pain will generally be less than that proceeding from a single application of the caustic.

Operation for false Passage.

When a false passage has been made by the incautious use of instruments, it is often a very difficult matter to act again upon the stricture, which is therefore generally left increasing, till sudden suppression of urine from spasm, or the patient's aggravated misery, from great organic obstruction, require something decisive to be done.

John Hunter first proposed an operation for the case where no instrument could be passed with advantage in such circumstances, which was this:—He cut down upon the stricture from the perinæum, introduced a canula by the wound, until it was close to the posterior surface of the stricture, and another by the orifice of the urethra, to its anterior surface; and then, while the canulæ were held steadily in a line, he pierced the stricture between them; the operation was concluded by removing the canulæ, and by passing a catheter into the bladder. The urethra at length heals over the catheter, which is constantly retained in it, completely to remove the stricture; and by drawing the urine off, to prevent this from reaching the wound, which would otherwise be irritated, and become fistulous, or indisposed to heal. A catheter with a short silk tube, for dis-

tention, placed upon it somewhere beyond the wound, or an insulated dilator, is a valuable substitute in this and similar cases. For a large catheter can seldom be introduced through the lately constricted parts, or at least retained without producing much irritation; and a small one does not answer the purpose well, because, according as the canal for the passage of the urine decreases, so is the exertion of the bladder to expel it increased; and thus, probably notwithstanding all our preventive efforts, the urine would be forced between the canula and membrane of the urethra, and ooze at each time of expulsion through the wound. By substituting a dilator, or the catheter above stated, this inconvenience will be completely prevented.

To prevent insinuation of urine into wounds of the Urethra.

When an instrument has made advances in the canal, without in any degree re-

Of examining the urethra where there is Stricture and false passage.

lieving the obstruction of the urine, Surgeons suspect the formation of a false passage: but as yet there have been no means proposed for ascertaining this with certainty, nor for discovering the seat of a stricture in the canal, when such passage has rendered it impossible to proceed with the ordinary methods of cure. This, indeed, was of little consequence, while we had only the old modes of treatment; but now, as several means are in our choice, by which, provided we can introduce an instrument through the stricture, it may be speedily cured, a method of ascertaining these points becomes of great importance, as it will often save the patient from the above operation of Mr. Hunter's, which is painful, and which, from the hemorrhage attending it, and the collapsed state of the urethra, is frequently very difficult of performance. A perfect method which I have

used, is the following:—let a small silver tube, with a very short dilator bag or button at its end, of a diameter that when distended in any part of the urethra will prevent the passage of the urine by its sides, be introduced as far as possible, and dilated. If the urine flow by the side of the canula, and not through it, we may be sure there exists a false passage, and that the bag of the dilator has passed into it; and the change, as we withdraw the instrument, from the urine passing by its sides, to its being discharged through the canula, or its complete stoppage, will indicate the precise seat of the stricture.* In complete retention of urine, this method is evidently inapplicable; we can then only endeavour to pass an instrument, with its end turned up, (as the false passage is

* Plate IV. Fig. 5.

almost invariably on the lower side of the urethra) in that part of the canal which may be supposed the likeliest seat of the stricture, from its narrowness, or from the information the patient can give.

Removal of the Stricture by cutting from the outside.

It was once the usual practice in obstinate cases of stricture, and may be still requisite in some very uncommon instances, to dissect out the obstruction, and heal the canal over a catheter remaining in the urethra. The incision through the skin in this operation, and in cases where it is necessary to open the urethra on account of a false passage, is directed by feeling the end of an instrument passed down to the obstruction.

APPENDIX.

Of other Applications of the Dilator.

The dilator is a new instrument in surgery, applicable to many other cases besides stricture of the urethra. The following may be the principal of these:—

1. In strictures of the œsophagus and rectum. *In strictures of the œsophagus and rectum.*

After what has been said respecting the use of the dilator in examining and curing stricture of the urethra, it were unnecessary to enlarge upon its application to these.

2. In chronic enlargement of the prostate gland. *In swelling of the prostate gland.*

The obstruction to the urine from this

disease generally arises from the projection of the middle part of the gland into the lower part of the channel of the urethra. The common local remedy is, a catheter passed through the obstruction; but the trifling degree of pressure on the tumour, or of dilatation of the canal, that even a large one can produce, cannot be expected to effect long continued benefit. By the dilator, on the other hand, which may be made to enlarge to any diameter, while it produces little irritation, the patient, if not completely cured, will at least be enabled to live with much greater comfort than when depending solely upon the catheter.

In urinary calculus

3. In urinary calculus.

In the early stage of this complaint in men, and in later stages in women, for the purpose of dilating the urethra that the stone may be extracted, the dilator, from its strength of distension, and from being

so much under our control, would appear preferable to the sponge tent, or to any other means.

In Gonorrhœa and Gleet.

4. In the second stage of gonorrhœa and in gleet.

On the subsiding of the acute inflammatory symptoms of gonorrhœa, there remains a discharge, differing from that in the former stage of the disease, in its consistence, and in its non-infectious quality. This, when protracted beyond the usual period, is denominated a gleet, and is an affection not only unpleasant from its long continuance, and the difficulty of removal by the ordinary remedies, but producing greater remote evil, inasmuch as it is a frequent cause of permanent stricture.

What the peculiar state of the urethra is in this disease, is a point differently explained by different authors. Some have spoken of an habitual tendency, which the

urethra contracts in gonorrhœa, to increased and changed secretion; and others, of a laxity of its vessels—circumstances which may certainly increase the obstinacy of the disease: but the most reasonable opinion that has been advanced on the subject is, that as the discharge in the first stages of gonorrhœa is accompanied with acute inflammation, arising from a specific poison; so in the latter stages, it is attended with, and depends upon, a chronic indolent inflammation, such as occurs in other parts, and from common causes. Hence, on the same principle that we employ gently stimulant collyria in chronic inflammation of the eye, stimulating injections are used for this affection of the urethra, and with similar advantageous results. Though topical applications of this kind often fail, we have still more reliance upon them for the cure of gleet than on any others: and I am convinced that the

want of success oftener depends upon the imperfect mode of applying them, than on their necessary inefficacy. There is reason for supposing that were a gently stimulating liquid kept in contact with the diseased surface for a considerable time, the morbid action of the parts would soon cease, without any other treatment. Surgeons, as yet, have had no means for this purpose but the syringe; and as the patient cannot be always employing this, they endeavour to compensate for the momentary application, by prescribing a stronger injection. This often has a contrary effect to that intended: for the irritation produced may be so great, as to exasperate, instead of alleviating the disease.

To supply the defect, I have used the following method—I fill with the injection a pervious dilator bag, lying in the diseased portion of the urethra. Thus the part is kept constantly moist-

ened with it; and it is plain that every good effect that can be obtained from such a topical application will be procured; with the additional advantage, that the injection is confined almost completely to the diseased part.

Another great and peculiar advantage of the dilator in the treatment of obstinate gonorrhœa and gleet, arises from the support that is given to the diseased parts by its distension in the urethra. Every surgeon is familiar with the beneficial effects of support from bandages in sores, and other superficial diseases accompanied with chronic inflammation; and my experience in the treatment of the disease in question by the dilator, leads me to the belief that the same principle is applicable to chronic inflammation of the urethra, and that a speedier cure will follow it than any other method of treatment.

By this support then from the dilator, by the long continued contact of a gently stimulating liquid oozing through the pores of a bag, and the confinement of this liquid to the diseased surface—while the appropriate internal remedies are administered, the second stage of gonorrhœa will in general be brought speedily to a conclusion, and the habit of morbid secretion or relaxation of the vessels, consequently prevented; or if gleet has already commenced, it may be quickly cut short, and the danger of subsequent stricture removed.

5. In fistulas.

Fistula in perinæo.

We have seen the utility of the dilator in preventing fistulous openings from the urethra after breaches in its substance, from disease, accident, operations, &c. because it prevents the insinuation of the urine through them. It is equally useful when fistula has been formed; for the conti-

nuance of this is always dependant upon some obstruction in the canal, preventing the free escape of the urine by its natural channel. We have already stated the inapplicability of the common catheter to this case.

In fistulous communications between the bladder and rectum.

In those very distressing cases, where a fistulous communication exists between the bladder and rectum, the use of the dilator promises greater chance of recovery than any other expedient, if, indeed, any other exists. A large dilator passed up the rectum beyond the fistulous communication, and there retained by the canula, which supplies it with air, being secured at the anus, with an opening through it, by which the fæces may descend, and from this opening, a silk tube continued, to carry the fæces out per anum, to obviate the possibility of their entering the fistula, would constitute the apparatus. Then by a proper position of the patient's body —by allowing the constant escape of the

urine through a catheter introduced by the urethra—by causing a granulating tendency of the edges of the hole—and by obviating costiveness, it is probable, that nature, thus left unimpeded in her operations, would soon effect a closure of the fistulous opening.

In fistula in ano.

In fistula in ano, I think it is not improbable that the operation of cutting open the sinus might on many occasions be rendered unnecessary, by compressing its sides closely together with the dilator, introduced into the rectum, after perhaps causing a tendency to adhesion, by gently irritating them. The principle of this treatment is often found successful in sinuses differently situated, where such pressure can be applied.

In hemorrhage from the rectum.

6. In hemorrhage from canals.

Its utility in hemorrhage of the urethra has been already explained. In hemorhage from inward piles, or after the

operation of the fistula in ano, the common means surgeons at present use is a sponge, passed into the gut. The dilator is much more readily applied, and precisely as in hemorrhage of the urethra.

In hemorrhage from the nose.

In bleeding from the nose, the present practice of closing the passage into the fauces by a bolster of lint, is often of difficult performance, tedious, and productive of considerable pain. The dilator again is immediately introduced, comparatively without uneasiness, and is as efficient.

In menorrhagia.

In menorrhagia too, it is preferable, from its easy and expeditious application, to the means at present in use.

In inward piles.

For the removal of inward piles, the pressure of the dilator would appear well calculated to turn the course of the blood from the varicous to the neighbouring sound vessels.

7. In prolapsus.

In descent of the uterus, for instance, a short and broad bag dilator, from the facility with which it is introduced and extracted, and its capability of yielding while retained, is preferable to any of the hard irritating pessaries in present use. In prolapsus uteri.

For prolapsus ani, a dilator is often better adapted than any kind of bandage, as it supports the body of the gut, and may be worn in cases where this has a tendency to be protruded in the erect position of the body. In prolapsus ani.

Fig. 1.

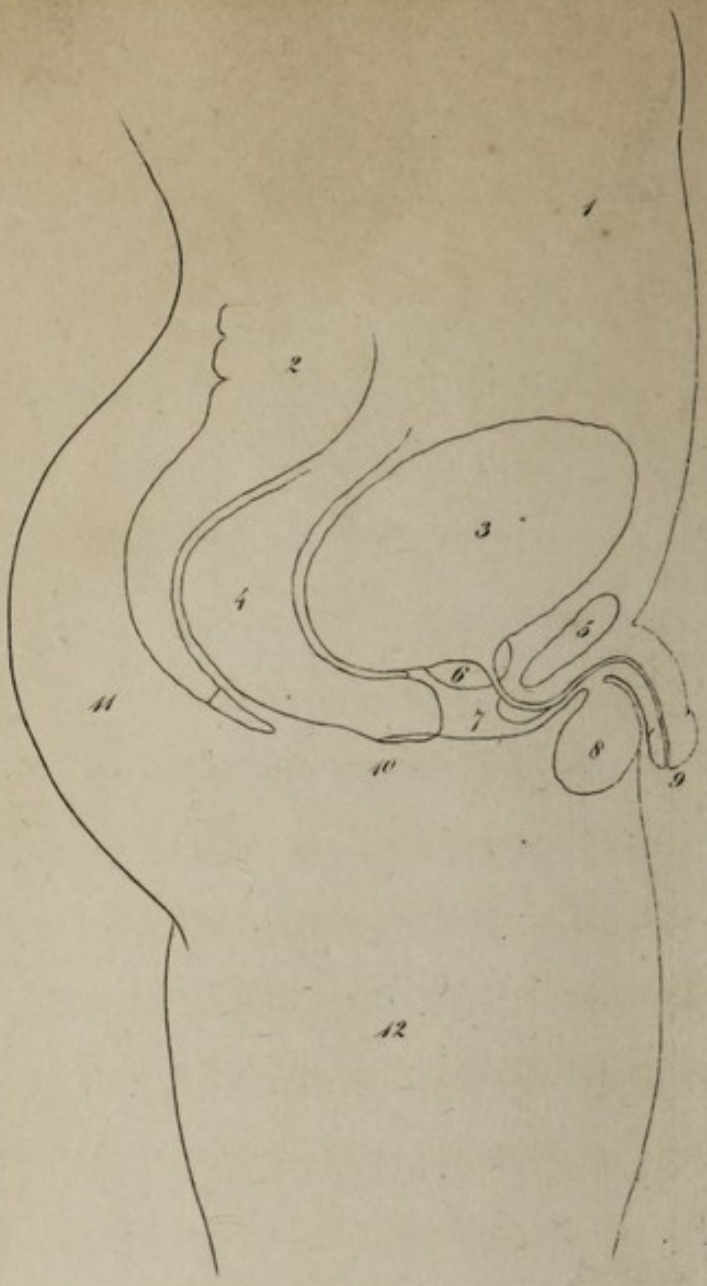


Fig. 2.

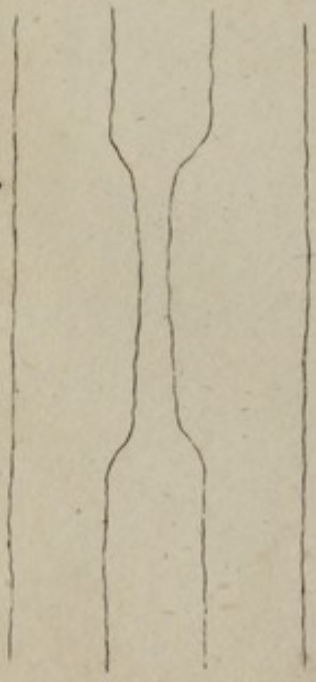
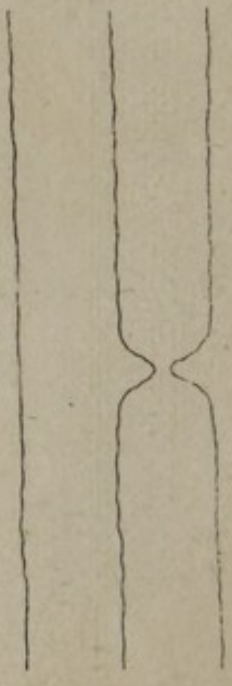


Fig. 3.



EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. Represents a section of the pelvis, and is intended to give an idea of the course of the urethra, and of its relative situation to the neighbouring parts. No correct plate to answer the purpose of this sketch, has as yet been published, nor does this supply the defect; it will, however, in conjunction with the description at the beginning of the essay, afford a tolerably clear notion of parts, a perfect acquaintance with which can only be obtained by dissection.

1. The abdomen.
2. The os sacrum.
3. The distended bladder.
4 The distended rectum.

5. The connecting surface of the left os pubis.

6. The prostate gland.

7. The bulb of the urethra.

8. The scrotum.

9. The orifice of the urethra.

10. The anus.

11. The buttock.

12. The left thigh.

Fig. 2. A section of the penis, with the urethra exposed, to show that variety of stricture which has been called the long or ribband stricture.

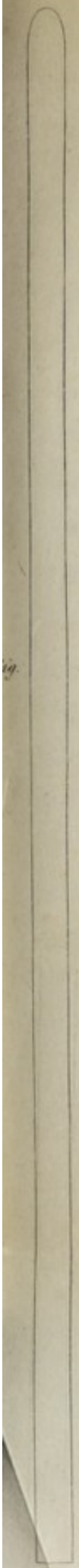
Fig. 3. Represents the short or thread stricture.

PLATE II.

Fig. 1. A middle sized bougie, not yet curved.

Fig. 2. An instrument for ascertaining the sizes of bougies, &c.

Plate 2



ig. 1.

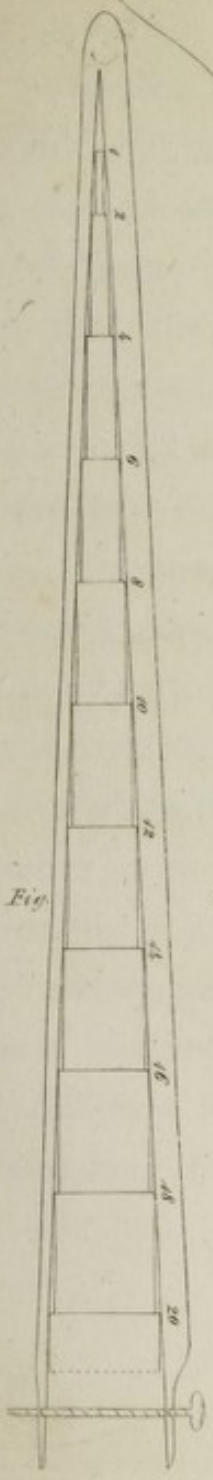


Fig. 2.

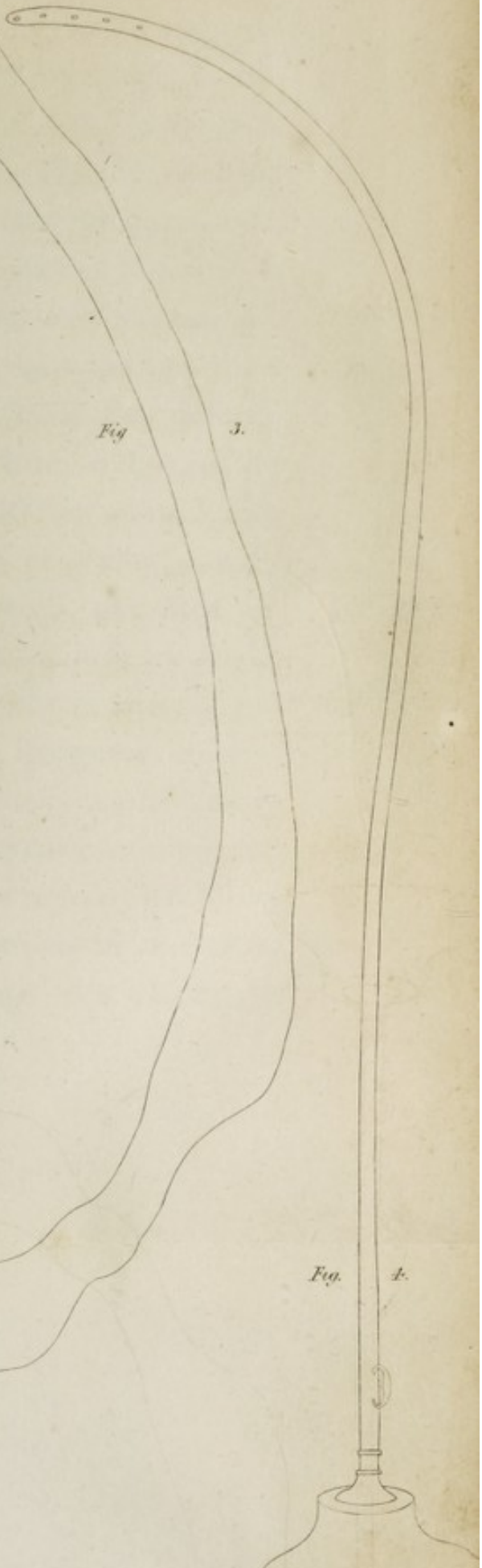


Fig 3.

Fig. 4.

It consists of two straight jaws in contact at one end, and separated at the other, where No. 20 is seen, to the distance of half an inch. The length of the jaws is divided into twenty equal parts, numbered from the junction; and it is evident, that the distance between the corresponding marks upon the two jaws, as measured by any body that fills up the space between them, a bougie for instance, increases a 40th of an inch with each division; thus by observing at what part of the gap the bougie is arrested, on moving it towards the joining, we see its diameter marked in 40ths of an inch, and the number so found, designates its size. In the outline I have only marked every second number, to prevent confusion, and portions of bougies are represented filling up the different situations in the scale, by familiarizing his eye with which, the

Surgeon will soon be able to judge pretty accurately of the sizes without the scale.

Fig. 3. Represents a cast of the urethra taken by injecting wax into it, allowing this to cool, and then cutting it out. As I have copied the scale of dimensions of the urethra (contained in Chap. I.) from Sir Everard Home's work, this illustration is taken from the same.

Fig. 4. Is a small catheter of the usual curvature, having a bag attached to it for the purposes described in the text.

PLATE III.

EXPLANATORY OF THE DILATOR,

(Of which see the Description, page 96.)

Fig. 1. A dilator for stricture of the urethra, the membranous tube being distended with air, with a stop cock and elastic bag attached.

Fig. 2, and 3. Parts of the dilator

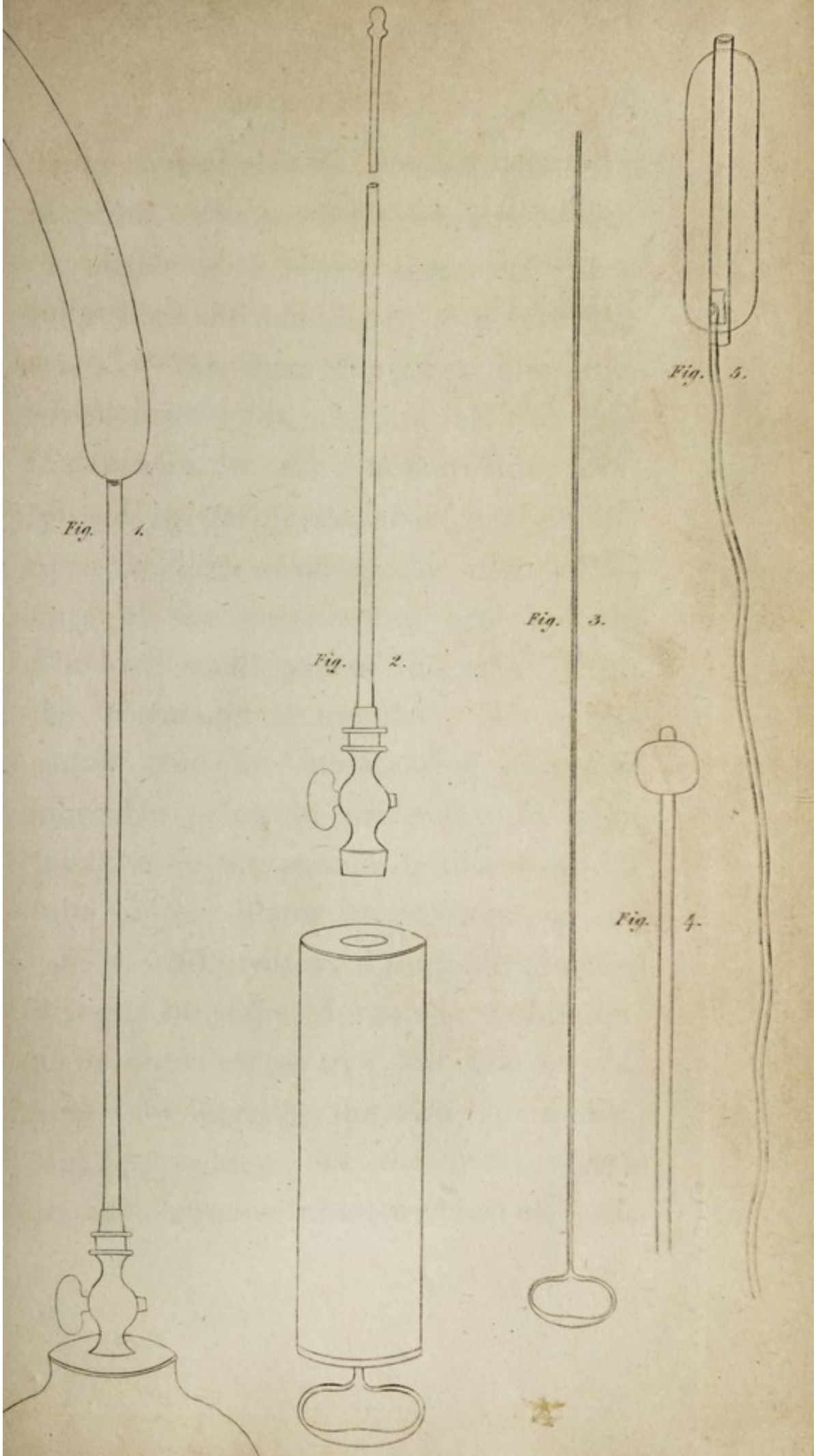


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

shewn separately, to illustrate its construction. The canula is seen upon which the membranous tube is attached, with a little ridge surrounding it, to prevent the tying of this from slipping; a syringe which injects the air through this into the distensible tube; a moveable point (placed in the figure, above the canula) upon the neck of which the other extremity of the membranous tube is tied. The long small part of this point, when the instrument is complete, lies in the canula, and the intention of having a moveable point, in preference to tying the tube on the canula, is this:—As the tube of the dilator lies loosely on the canula while empty, during introduction it would be gathered into a sort of button at its outer extremity; but this is prevented by inserting the wire represented, which, pushing out the point, keeps the membranous tube tense and uniform.

But for the moveable extremity, the same button would be formed behind the stricture on withdrawing the dilator, and might be a cause of difficulty.—By a hole and valve in the moveable point, the dilator may answer the purpose of a catheter.

It is scarcely necessary to apprize the surgeon of the importance of having the dilator tube firmly tied on the canula and on the point, as were any part of the instrument to remain in the canal, the consequence would be very unpleasant. A security against this accident, which some might like, would be to have the narrow part of the point extending as a wire to the outer part of the canula, which being held by the operator, could be easily withdrawn.

Fig. 4. An insulated dilator (see p. 98.) so called, because it may be left as a detached bulb in any part of the canal,

where its presence is required. It consists of a short piece of canula, open at both ends, and surrounded in the usual way by a dilator tube. It is introduced in a collapsed state on the end of any sufficiently stiff instrument, and when in its place, is distended with air, either through a canula which is afterwards removed, or through an exceedingly small silk tube, which is allowed to lie in the urethra. The air when received into the bag is retained by a valve, which is a bit of membrane, or silk, lying over the hole in the wide central canula, by which the air is admitted; and before extraction, the air is again allowed to escape, by opening or raising this valve by a wire. When a removable canula is used for injecting the air, a strong silk thread, affixed by a bifurcated extremity to the silk bag, is used for withdrawing it.

Fig. 5. Is a part of the dilator sound (see p. 139.)

PLATE IV.

Fig. 1, 2, and 3. The apparatus for the new method of applying caustic—represented as applicable to a wide stricture, that the different parts may be the more conspicuous. Fig. 1. shews the canula which is to be introduced close to the stricture, and the caustic is seen issuing from it, preceded by the guiding piece of bougie. Fig. 2. shews the bit of caustic upon the wire, between the two pieces of bougie, as it is prepared previous to introduction. I generally put the caustic upon the wire, by making the latter red-hot, and passing it through. Fig. 3. is a wire with a hemispherical button at one end, to fill the end of the canula during its introduction, and at the other, a dossil of cotton, for absorbing the superfluous moisture at the stricture.

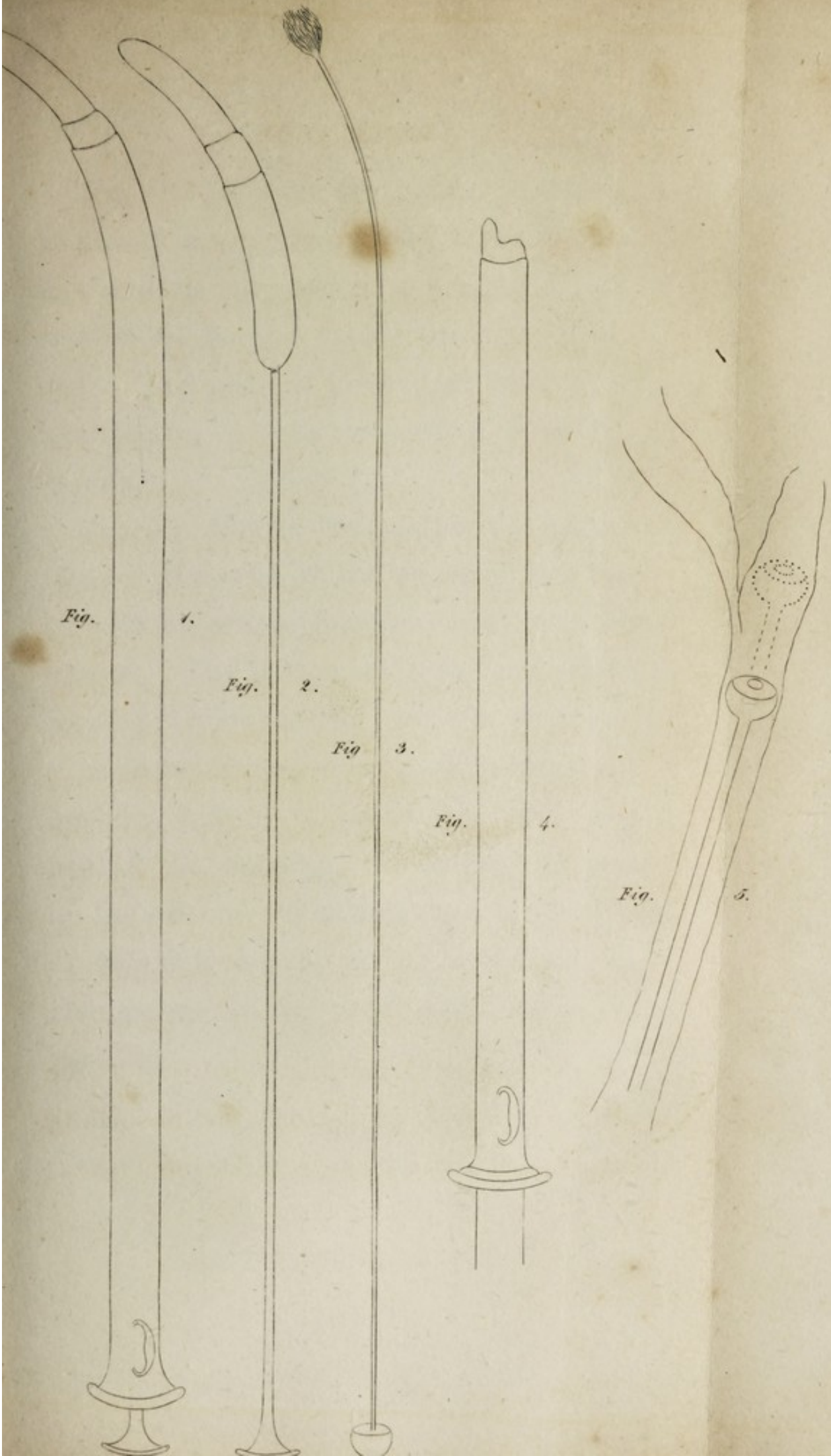


Fig. 1.

Fig. 2.

Fig 3.

Fig. 4.

Fig. 5.

Fig. 4. Illustrates the manner of taking the exact impression of the anterior surface and opening of a stricture, by a very soft ended bougie passed through a canula. The point of the bougie, altered by a stricture, is seen projecting from the canula.

Fig. 5. Shews the method of ascertaining the seat of the opening into the true canal, where false passage has been formed. The button upon the end of the canula, while anterior to the stricture, will cause the urine to pass through the canula; but as it passes on, and gets behind the opening, the urine will pass by the side of the canula, and the length of this introduced, at the instant of the change, marks the exact situation of the opening.

FINIS.

J. Davy, Printer, Queen Street, Seven Dials.