The *genital functions* may be variously interfered with. In consequence of the irritation of the parts, frequent erections may take place, or nocturnal emissions occur. In other cases, erection is never perfect, owing to the rigidity of the urethra, or an obstruction to the entrance of blood into the corpora cavernosa; pain may be felt in sexual intercourse, and the semen, instead of being at once ejaculated, slowly dribbles away, or passes backward through the dilated urethra into the bladder; hence, persons with stricture are frequently impotent.

Hæmorrhoids, prolapsus ani, and irritation about the rectum, which is occasionally severe, are often produced by the repeated and violent straining required in emptying the bladder. In a similar manner, hernia is liable to occur, especially in old men.

Retention of urine sometimes supervenes in the early stages of organic stricture, in consequence of congestion and spasm; it may indeed, in rare instances, afford the first indication to the patient that he is the subject of stricture; but in most cases it appears at a later period, when the obstruction to the passage of urine is already very great. It generally follows exposure to wet or cold, a long ride or drive, and, most frequently, a hearty meal, at which alcoholic stimulants have been freely indulged in.

Distension of the bladder, in such cases, may even produce rupture of the vesical walls. If the peritonæum be involved in the rent, the urine gains entrance to the abdominal cavity; the vesical tumor disappears, but the abdomen is tense and swollen, and death soon occurs from peritonitis. More commonly the contents of the bladder are at first effused into the sub-serous cellular tissue, where they may cause extensive gangrene of the surrounding parts, or whence they may afterwards escape into the abdominal cavity by ulceration. In no case of rupture of the bladder from retention, has the patient been known to recover.[1]

Still more frequently, the distension of the bladder produces rupture of the urethra behind the stricture, where its walls are weakened by chronic inflammation and ulceration. In the sudden and extensive infiltration of urine which ensues, no time is given for adhesive inflammation to erect barriers to its progress, as often happens in the slower formation of urinary abscesses, and thus the urine, forced on by the contractile power of the bladder, permeates the loose cellular tissue, wherever it is not limited by the fasciæ. When the rupture takes place anteriorly to the triangular ligament, the effusion, after breaking through Buck's fascia, extends forwards and upwards into the scrotum and over the abdomen; its extent may generally be defined by the swelling and discoloration of the integument, and an emphysematous crackling on pressure, which is due to the mixture of gases with the fluid; the vascular connection between the superficial and deeper tissues is cut off or impeded, and, unless free incisions be

[1] Thompson, op. cit.

made, gangrene of extensive portions of the skin may ensue. Thus, cases are recorded in which the effusion perforated the superficial perineal fascia and extended down upon the thighs, and in which the greater part of the integument from the knee to the umbilicus, including the coverings of the penis and scrotum, sloughed away, and left the testicles entirely exposed and suspended only by the spermatic cords and vessels; yet, even under these circumstances, recovery has been witnessed. A symptom, which is to be regarded as of serious import, is the appearance of a dark spot upon the glans penis, which indicates that the infiltration has gained access to the corpus spongiosum urethræ, and that gangrene has already commenced.

When rupture takes place posteriorly to the triangular ligament, the symptoms may for a time be obscure: as when occurring elsewhere, the patient often has the sensation of something giving way, and experiences temporary relief from his sufferings; if the rent be large enough to allow of the free escape of urine, the vesical tumor subsides, and, the tension of the parts being relieved, the patient may be able to pass water, but the quantity thus evacuated or drawn off is found to be small; soon deep throbbing pain is felt in the perinæum, and the symptoms of general depression set in; and the urine, after burrowing in various directions, may approach the surface.

Causes of Stricture.

A knowledge of the causes of stricture, and the relative frequency of their action, may best be attained from an analysis of a large number of cases, such as is furnished in the following table prepared by Mr. Thompson. It should be observed that 143 of these 220 cases were collated from the records of University College Hospital, London, and 49 from reports by different surgeons in medical journals; occurring for the most part in hospital practice, they represent the worst class of urethral contractions.

Antecedents, or Supposed Causes of 220 Cases of Stricture.[1]

Gonorrhœal Inflammation in	164
Injury to Perinæum,	28
Cicatrization of Chancres or Chancroids,	3
Ditto, following *Phagedæna*,	1
Congenital, including cases in which the urethra may have been small from malformation, and those in which marked irritability of the urinary organs existed from childhood, accompanied by an unusually small stream,	6
Poisoning by Nitrate of Potash,[2] *Lithotrity*, *Masturbation*,[3] of each one,	3
True Inflammatory Stricture, including temporary stricture and retention from sudden acute inflammation, usually caused by some excess, and disappearing by resolution,	8
True Spasmodic Stricture, caused by irritation about the rectum,	2
" " " no cause assignable,	2
" " " caused by undue acidity or alkalinity of the urine,	3
	220

[1] Thompson, op. cit., page 124. [2] Medical Times, Lond., June 22, 1844.
[3] Lallemand, Clinique Médico-Chirurgicale, 1re part, p. 109.

Of the 164 cases attributable to gonorrhœa—
In 90 the disease is reported to have been *chronic* or *neglected*.
In 3 it was attributed by the patient to strong injections.
In 6 the discharge is stated to have ceased entirely and rapidly under treatment; but in five of these, stricture appeared almost immediately after.
In 4 other cases the stricture appeared to be almost simultaneous with the gonorrhœa.
In the remaining 61 there is no report of chronicity, etc.

Of the 164 cases attributable to gonorrhœa—
10 appeared immediately after, or during the attack;
71 " *within* 1 year of its occurrence;
41 " " 3 or 4 years;
22 " " 7 or 8 years;
20 are reported at periods between 8 and 20 to 25 years.

It appears from the above table that gonorrhœa holds the first, and injuries of the perinæum the second rank in the etiology of stricture.

Urethral contractions are favored by the long continuance, rather than the severity, of urethritis. If we omit the 61 cases of the above table in which there is no report of the duration of the preceding gonorrhœa, we find that, in nearly nine-tenths of the remainder, the urethral inflammation, to which the stricture was attributable, was either chronic, or neglected. Inquiries addressed to patients laboring under stricture show that, in the great majority, the urethral contraction has been preceded by several attacks of gonorrhœa; but, whether by one or more, that the last was prolonged for many weeks or months, and terminated in a gleet. We may hence infer that whatever, either in the patient's mode of life or in his constitutional tendencies, prolongs the duration of a gonorrhœa, tends to produce stricture.

Laceration of the urethral walls during chordee, and wounds from the imprudent use of sounds, catheters, etc., require a passing notice. The former may occur spontaneously, or arise from the habit, more prevalent among Frenchmen than Americans, of relieving chordee by forcibly extending the penis; or, as is said, "breaking the chord." Wounds of the urethra by instruments from within evidently have the same effect as from without; in the process of cicatrization which ensues, the natural coaptation of the parts must frequently be lost, and fibro-plastic material endowed with contractile properties be deposited. A distinction, however, is to be made between transverse and longitudinal wounds of the urethra from within. The former only may be said to be likely to produce strictures. Such results do not follow longitudinal incision, made, for instance, in internal urethrotomy.

Much influence in the production of stricture has been attributed to the use of injections. I feel obliged to dissent *in toto* from this opinion, which appears to me to be based upon reasoning *post hoc ergo propter hoc*. When made very strong, or used at an improper stage of the disease, or with excessive force, injections may doubtless act as escharotics, or aggravate the inflammatory action, and thus favor urethral contraction, but this effect pertains only to their abuse.

A chancre or chancroid, like any other ulcer, destroys a certain portion of the tissues upon which it is situated, and this loss of substance is not restored in the process of cicatrization, but the gap is filled with fibro-plastic deposit in the form of granulations, which gradually contracts and approximates the edges of the original sore, or which forms a hard, unyielding cicatrix between them. In this manner venereal ulcers situated upon any portion of the urethral mucous membrane may lay the foundation of stricture. Examples of this kind are most frequently seen in sores upon the margin of the meatus, or in the fossa navicularis. I have now under my care a patient, who has a stricture of the penile urethra at two inches, which followed the absorption of a syphilitic gummatous nodule.

Diagnosis.

The general symptoms alone might be considered sufficient to indicate a case of stricture, but in many instances are very deceitful. There are other affections of the urinary organs the symptoms of which closely resemble those of stricture, and which have often been mistaken for it. Experience, therefore, would show that the greatest care should always be employed in forming a diagnosis. The diseases which are most likely to be confounded with organic stricture are subacute inflammation of the prostate and urethral neuralgia and hyperæsthesia.

Subacute inflammation of the prostate may be attended by nearly every symptom which has been described as belonging to stricture, viz., by frequency and difficulty of micturition, gleety discharge, and pain in the perinæum, above the pubes, and elsewhere. This identity in the symptoms may readily lead to a mistake in diagnosis, which may even be confirmed by a superficial exploration of the urethra, for the prostatic portion of the canal, in this affection, is exceedingly sensitive, and the introduction of a catheter attended with severe pain; if, then, the surgeon yields to the feelings of the patient and fails to make a thorough examination, or, if he employs a fine sound or bougie, the point of which is liable to be obstructed by catching in some lacuna of the mucous membrane, the erroneous conclusions already drawn from the history of the case may apparently be confirmed.

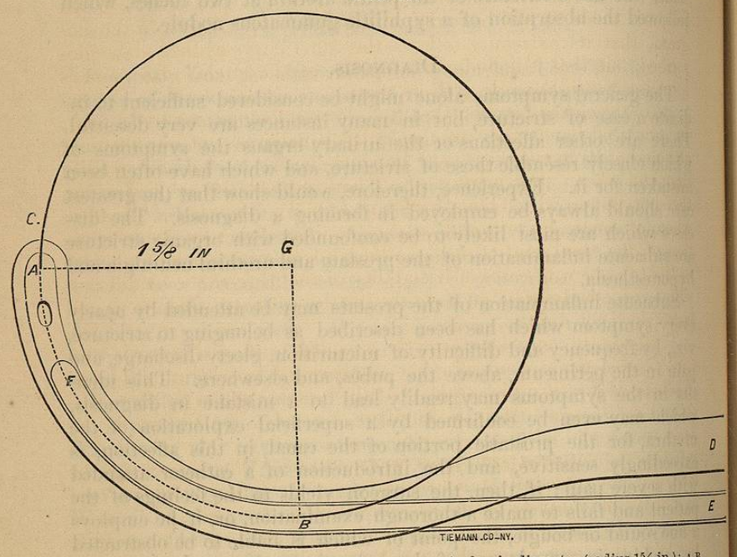
The same mistake may also occur in cases of urethral hyperæsthesia, either when occasioned by sympathetic irritation from stone in the bladder, affections of the rectum, etc., or when, in the absence of any apparent cause, the exalted sensibility can be attributed only to nervous derangement. The diagnosis of a suspected case of stricture can, therefore, be founded only upon a careful and thorough exploration of the urethra, and the instruments required in such examination, and the manner of using them, will now claim our attention.

Exploration of the Urethra.—The instruments requisite for physical exploration of the urethra, and the diagnosis of stricture,

most of which are also useful in treatment, are a set of sounds, solid and flexible catheters, and bougies of various forms. I propose to describe those only which I have found most useful in practice.

Shape and Size of Metallic Instruments.—The degree of curvature of unyielding instruments used in urethral exploration is a matter of no small importance. It would seem desirable that the curve should correspond to the natural curvature of the least movable portion of the urethra itself, which is that portion underlying the symphysis

FIG. 59.



A B represents an arc of a circle three and a quarter inches in diameter (radius 1⅝ in.); A B E, a catheter, with Thompson's curve; F B E, a sound, with the same curve, but shorter; C B D, a large Béniqué's sound, its extremity following the same curve, but including a larger arc of the circle.

pubis. Mr. Thompson has adopted this principle in the construction of catheters and sounds, and his example has of late been very generally followed, since it has been found that experience confirms the deductions from theory, and that urethral instruments with such a curvature are most readily introduced. The sub-pubic curve is an arc of a circle three and a quarter inches in diameter, or, in other words, of a circle described by a radius one and five-eighths of an inch in length, the chord of the arc measuring two inches and three-quarters. The accompanying figure exhibits a catheter and sound so bent as to correspond to this curve.

In order that the precise direction of the point of the instrument may be indicated by the direction of its shaft, it is desirable that a constant relationship should exist between the two. According to the principle of construction here recommended, this is a right angle in the catheter, and, in the sound, a somewhat shorter instrument, an angle of 120°, or a right angle and a third.

Another form of sound, known as Béniqué's, is a very desirable one in some cases. It has a double curve, corresponding nearly to the two curves of the urethra when the penis is not elevated against the pubes, and hence is of the same shape that a flexible bougie assumes when introduced into the bladder and abandoned to itself. When properly made, it will be found on examination, as shown in the diagram, that its extremity follows the same curve as that above described, but that it includes a larger arc of the circle. Its point is likewise at a right angle with its shaft.

As to the choice between these two forms of sound, it may be said: In practiced hands they are generally equally easy of introduction, although I have met with cases, in which the one entered more readily than the other. For many years, I have been in the habit of using the short sound with Thompson's curve for the dilatation of stricture, when, of course, there would be no object in reaching the deepest portion of the canal, and of using a long sound with Béniqué's curve in the treatment of cases of irritability of the neck of the bladder, or whenever it is desirable to have the instrument enter this viscus and be retained for a time.

The greatest confusion formerly prevailed, and still prevails to a considerable extent, concerning the numbering of catheters and sounds. We hear of an "English scale," but there is no such thing as a constant English scale, since the numbers of no two English makers exactly correspond, although they do approximately, and we cannot as yet dispense with the term, however inaccurate. The French, on the contrary, have a definite standard, and if you buy half a dozen *filières* of as many different instrument-makers in France, you will find them all to agree. Besides this recommendation of uniformity, the French scale has also this advantage, that the steps of its gradation are shorter than the English, which is often very desirable in dilating strictures.

The French scale, often known as the *Charrière filière*, progresses by steps of one-third of a millimeter *in diameter*, that is to say: No. 1 represents an instrument one-third of a millimeter *in diameter*, No. 2, two-thirds, No. 3, three-thirds or one millimeter. Given the number of the instrument, and you know its *diameter* in as many thirds of a millimeter.

I have italicized the word diameter, because, in the previous edition of this book, I made the stupid mistake of saying that the number of each instrument represented its circumference in millimeters, and other writers have followed my bad example. If the circumference of a circle were exactly three times its diameter, my statement would have been true, but, of course, it is not. The diameter is to

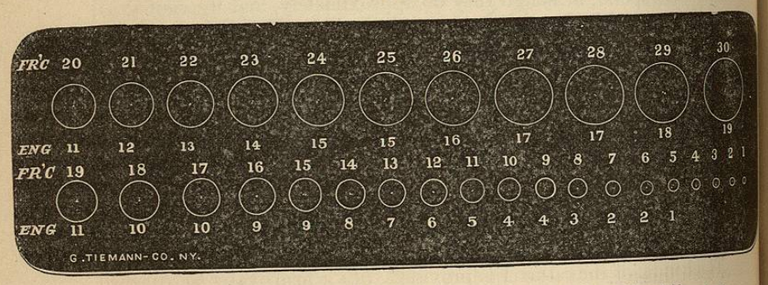
the circumference as 1 is to 3.14159, and, although this fraction beyond the three might be ignored in estimating the circumference of the smaller numbers of sounds, yet its multiplication in the higher numbers makes no little difference. The following table exhibits the diameters and the circumferences of sounds from numbers one to forty inclusive, according to the French scale:

No.	Diameter in millimeters.	Circumference in millimeters.	No.	Diameter in millimeters.	Circumference in millimeters.	No.	Diameter in millimeters.	Circumference in millimeters.	No.	Diameter in millimeters.	Circumference in millimeters.
1	0.33	1.05	11	3.67	11.52	21	7.00	21.99	31	10.33	32.46
2	0.67	2.09	12	4.00	12.57	22	7.33	23.04	32	10.67	33.51
3	1.00	3.14	13	4.33	13.61	23	7.67	24.08	33	11.00	34.56
4	1.33	4.19	14	4.67	14.66	24	8.00	25.13	34	11.33	35.60
5	1.67	5.24	15	5.00	15.71	25	8.33	26.18	35	11.67	36.65
6	2.00	6.28	16	5.33	16.76	26	8.67	27.23	36	12.00	37.70
7	2.33	7.32	17	5.67	17.80	27	9.00	28.27	37	12.33	38.75
8	2.67	8.38	18	6.00	18.85	28	9.33	29.32	38	12.67	39.79
9	3.00	9.42	19	6.33	19.90	29	9.67	30.37	39	13.00	40.84
10	3.33	10.47	20	6.67	20.94	30	10.00	31.42	40	13.33	41.89

It will thus be seen that when Dr. X., who bases his "French" scale on circumferences, tells us that he has divided a stricture up to 30, he has really divided it to less than 29, of the true French scale, and that when he says 40, he should say a little over 38, etc.

Drs. Van Buren and Keyes have proposed a scale, which they have christened "The American (?) scale," and which is intrinsically

Fig. 60.



better than the French scale, since it progresses by *half* millimeters in diameter, and thus avoids the thirds of millimeters of the French scale, evidently an undesirable departure from the metric system. I must, however, object to the introduction of any new scale, when one already exists, that is known and used as a standard by so many surgeons in every civilized country. To depart from this standard on

one's own responsibility is merely to introduce inextricable confusion. Fig. 60 represents the Charrière-filière, with the numbers (expressing thirds of millimeters in diameter) above the openings. For the

Fig. 61.

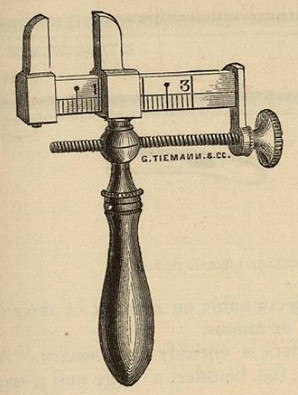
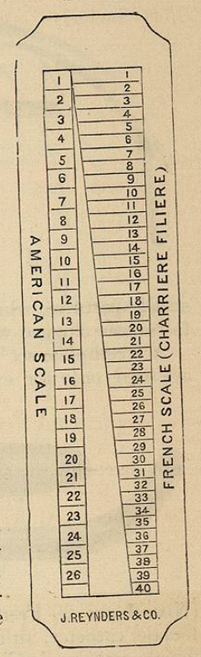


Fig. 62.



sake of comparison, I have added below the openings the corresponding numbers of the English scale, with as great accuracy as I have been able to estimate them.

It should be observed that in the present work whenever the size of urethral instruments is mentioned, the number of the French scale is intended.

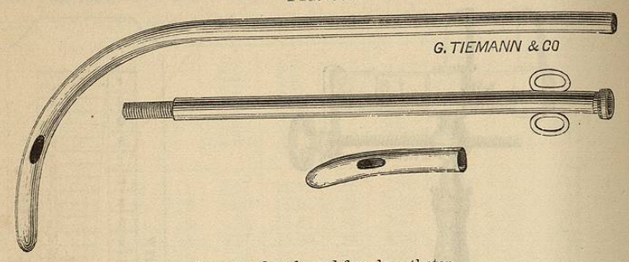
For measuring the diameter of a given instrument, supposing the same to be unknown, we may employ the gauge represented in Fig. 61.

A still more convenient gauge, however, has been invented by Dr. H. E. Handerson, of New York, and is shown in Fig. 62. The catheter, sound, etc., to be measured, is simply to be inserted in the base of the opening and slid towards the apex as far as it will go, when the parallel lines on either side will indicate its size according to both the French and the Van Buren-Keyes scale.

Catheters are conveniently made somewhat longer than the canal they are designed to traverse, and usually measure about eleven inches. The handle of the catheter is provided with a firm oval ring attached to each side, in order that the least twisting of the instrument on its axis during its introduction may be at once manifest to the operator, and also to permit of its being retained as a permanent catheter. The vesical extremity of the instrument has two eyes for the entrance of urine, one situated half an inch, and the opposite one an inch from the extremity. They are often made too large, and allow of the protrusion of folds of the lining membrane of the canal, obstructing

the passage of the catheter, and exciting unnecessary pain. Their edges should be bevelled off with nicety. Instead of these two lateral eyes, the end of the catheter is sometimes pierced with numerous

Fig. 63.

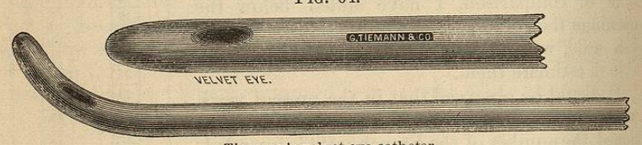


Compound male and female catheter.

small apertures, which are objectionable on account of their liability to become clogged with blood or mucus.

A "complete set" of catheters is entirely unnecessary. As they are used only for evacuating the bladder, a large and a small one

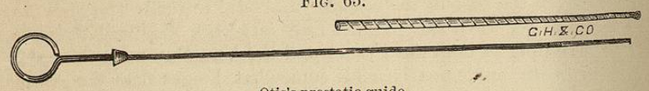
Fig. 64.



Tiemann's velvet-eye catheter.

(Nos. 8 and 20 French), besides a probe-pointed, a prostatic, and a female catheter, fulfil every purpose. The "compound male and female catheter" (Fig. 63) is, however, a requisite for every pocket-case of instruments.

Fig. 65.



Otis's prostatic guide.

Of gum-elastic catheters, those made by the French, with a conical end and a bulbous point (see Fig. 68) are often of value, on account of the ease and safety of their introduction. They are admirably fitted for a patient's own use, since their flexibility renders it almost impossible for him to do himself harm. In cases of enlarged prostate, however, there is nothing equal to the Nélaton catheter, of pure rubber, which is now made in England of superior stability and out-

Fig. 66.