

For the introduction of filiform bougies the urethra should first be filled with warm, slightly benzoinated or carbolated olive oil. The points of these fine instruments are often caught, even in the healthy portion of the urethra, by folds of mucous membrane or in the sinuses of Morgagni. When this accident occurs the bougie is withdrawn an inch or more; the tip, bent to form an angle with the shaft, is then rotated in another direction and again advanced. These manœuvres are repeated gently, and, if necessary, many times, until the tip engages in the orifice of the stricture. To determine whether a bougie has entered the opening of a stricture or a blind pocket, it should be slightly withdrawn and advanced: if it be engaged in a stricture, the grip of the latter upon the instrument can be felt plainly by the hand of the operator.

In old and tortuous strictures, with many pockets, lacunæ, and partial false passages (Fig. 26) ready to entangle the point of a filiform bougie, it may be impossible to find the opening with a single instrument. In such a case a filiform bougie is passed until it is caught, when it is held in place and another bougie is passed by its side. In this way the urethra may be filled with a number of these fine instruments, each of which should repeatedly be withdrawn slightly, partially rotated, and again advanced, until one of them engages in the orifice of the stricture and passes into the bladder. The successful performance of the above-described procedure calls for a steady hand, a sensitive and delicate touch, a large amount of patience, and the greatest gentleness in every movement, lest the mucous membrane be damaged by much manipulation. The search may sometimes be continued for

an hour or more, but the production of hemorrhage or of marked irritation at once renders further attempts useless until the urethra has had a rest of at least twenty-four hours.

Relative Value of Steel and of Flexible Instruments.—The polished steel sound, of proper curve, in the hands of an expert, can be introduced into the urethra with less discomfort than can any other instrument, but it should not be used for sizes below 15 or 18, for fear of making a false passage. For the smaller sizes the flexible instruments are safer and better. They may often be used in the larger sizes to advantage. The chief objections to them are that they produce more irritation in the urethra, and therefore more frequently provoke urethral spasm, and that they are less rapidly effective in dilating stricture than the steel sound when the latter is used with sufficient skill and care. They are, moreover, more difficult to clean and less durable. On the other hand, they are not capable of doing so much damage when used by one not specially trained in the proper introduction of the steel sound. The best flexible instruments have a foundation of woven linen covered with a smooth elastic composition. When new and in cool weather, the black French instruments are softer and better than the English, but they do not last so long; in hot weather they often become too limp to be of any use and are easily spoiled, as softening of their outer coating allows them to stick together and become rough. The English (yellow) bougies are firmer and more durable, and, if the softer ones be selected, are the best. If too stiff, they can be made more flexible by placing them in hot water for a few minutes just before using.

All flexible instruments sooner or later wear out or become hard and brittle; consequently they should always be examined just before using, to make sure that they are sound and smooth. This remark is especially true of the soft catheters, made without the woven foundation, which every general practitioner is supposed to carry in his case. It happens occasionally that the tip of one of these old instruments breaks off and is left in the urethra. Fortunately, in the majority of cases, if left alone, the constriction about the piece relaxes after a few hours, and the fragment is washed out during the next urination.

Care of Instruments.—The principles of antiseptic surgery should be followed strictly in the care and use of all urethral instruments. Failure to observe these principles too often results in urethral fever, urethritis, cystitis, epididymitis, prostatitis, abscess, and other disagreeable and dangerous complications. All instruments, immediately after use, should be washed thoroughly with soap and warm water. Antiseptic solutions have little effect upon an instrument covered with oil or vaseline and smeared with pus, blood, or other matter. Moreover, if rubber instruments are allowed to remain covered with oil, vaseline, or fat, they soon become rough and useless. Steel instruments are best sterilized by boiling or by placing them for twenty minutes or half an hour in a steam-sterilizer. Before use they may be placed for a few minutes in a 5 per cent. carbolic-acid solution. Rubber and whalebone instruments should be placed, before use, in a solution of bichloride of mercury, 1 : 1000. Refined vaseline, cosmoline, and albolene are the best lubricants for general use, since they do not become rancid. When desired, carbolic acid (2 per cent.) or

boric acid (3j to ʒj) may be added. As a rule, instruments should be warmed before use in the urethra. This precaution renders their introduction less irritating to the mucous membrane, and the production of spasm less frequent. In the absence of warm water, steel instruments may quickly be warmed by rubbing them rapidly through a towel held in the hand.

Steel instruments should be kept in cases made to fit them, as they are otherwise easily nicked or scratched. The slightest defect, such as a scratch or a rust-spot, in the surface of an instrument may cause urethral irritation, and may, moreover, serve as the lodging-point of infectious matter. Such an instrument should always be laid aside until properly repaired. Rubber instruments should be kept between layers of cotton or in narrow pasteboard trays lined with paper that is thrown away when soiled. In hot weather they should be dusted with finely powdered talc or otherwise separated, to keep them from adhering—an accident that almost invariably roughens and ruins the instrument.

Cutting instruments and the methods of their use are described in connection with the operations for which they are intended. For the benefit of the beginner, a summary of all other instruments necessary in the diagnosis and treatment of stricture is here given. The French scale is used, and in forming sets of instruments every other (odd or even) number may be omitted.

Ten conical steel sounds, Nos. 15 to 33; a corresponding set of short steel sounds, for use in the anterior urethra (convenient, but not necessary); two or three silver catheters, Nos. 18 to 24; a set of bulbous bougies, Nos. 7 to 33 (the larger sizes may be metallic if pre-

ferred); a set of French or English conical, flexible bougies, Nos. 5 to 20, or to 33 if desired; half a dozen soft catheters, Nos. 6 to 20; as many Mercier catheters, and one or two of larger size; half a dozen short and three or four long whalebone filiform bougies; a set of tunnelled conical steel sounds with short curve, Nos. 6 to 18; two or three tunnelled (not conical) catheters, Nos. 6 to 10; a Banks whalebone bougie; and an accurate gauge. If the surgeon is within easy reach of surgical supplies the number of soft catheters should be reduced, as these instruments often deteriorate and become useless after a few months.

Diagnosis.—The instruments of precision furnished the surgeon render the diagnosis of stricture comparatively easy. The chief difficulty at present lies in distinguishing between beginning strictures of large calibre and normal points of narrowing in the urethral wall.

The indications for exploring the urethra are found in the presence of one or more of the symptoms of stricture, already described, appearing a number of months or years after urethritis (usually prolonged gonorrhœa) or urethral injury. Needless instrumentation of the urethra should always be avoided. Though the proper exploration of the urethra is usually attended by no worse results than some discomfort or pain to the patient and some smarting or burning in the urethra at the next micturition, it happens occasionally that the apparently careful and skilful passage of a steel sound through a normal urethra is followed by syncope, shock, urethral fever, epididymitis, prostatitis, etc. If the urethra be diseased, if force be used, if the operator be careless or unskilled, or if his instruments be rough or soiled, these and other yet more unfortunate results of urethral instru-

mentation occur not infrequently. Instruments should not be used in the urethra if there be a decided discharge from the meatus, or other evidences of urethral inflammation or irritation.

Exploration of the urethra for the first time should be begun by the introduction of a blunt steel sound of the largest size that will pass the meatus without stretching the latter sufficiently to cause pain or to produce the characteristic evidence of an over-stretched meatus—namely, a narrow white (anæmic) line at the edge of the orifice and in contact with the instrument. As a rule, if such an instrument pass easily into the bladder, stricture is absent. The exceptions to this rule are considered later. If the instrument meets with obstruction in the urethra and fails to pass, a series of blunt sounds gradually decreasing in size should be used until one is passed. Below size 15, soft instruments should be used. When an instrument has been passed, it should be left in position (unless it is producing pain or irritation) long enough for the fingers to explore the pendulous urethra for external evidences of stricture, which may be found in the form of circular or irregular bands of thickening and induration. In this way valuable information may be gained, and further instrumentation for purposes of diagnosis is often rendered unnecessary.

In many cases, however, accurate location and measurement of stricture is best accomplished by the use of bulbous bougies. An instrument with a bulb corresponding in size to the sound that has passed the stricture is properly prepared and gently inserted down to the anterior face of the stricture, where it is arrested. If the bulb does not pass the stricture, a smaller instrument is selected and passed into the bladder. As it is

withdrawn it is again arrested as its shoulder reaches the posterior surface of the stricture. If the distance of the meatus from the end of the handle be measured and noted when the bulb is arrested, both in entering and in withdrawing, not only the location and calibre but also the approximate thickness of the stricture may be determined. In those unusual cases in which stricture is multiple there is no difficulty in locating and measuring each, if the anterior stricture is of larger calibre than the deeper one. If the reverse is true the Otis urethrometer may be used, though the diagnosis of the deeper stricture is of less practical value, since it does not call for treatment until the stricture in front of it has been dilated.

Several sources of error should always be considered in the use of bulbous instruments. They produce more irritation, and therefore more frequently provoke urethral spasm, than do blunt or conical sounds, and, moreover, they are less effective than the latter in overcoming spasm or in detecting the characteristics which distinguish it from organic stricture. In withdrawing the instrument the shoulder of the bulb, in passing from the prostatic to the membranous urethra, frequently catches on the posterior layer of the triangular ligament and produces a sensation closely resembling that produced by stricture. In the pendulous urethra the shoulder of the bulb may be arrested at one or more points of normal narrowing frequently found in the first three inches from the meatus. The danger of error in diagnosis is lessened if the bulbs be used in connection with the steel sound as above described.

The reasons for beginning with a full-sized steel sound are several: it produces less irritation than any other instrument; often it will easily enter the bladder when

bulbous sounds or smaller instruments fail to pass because of the spasm excited or because of the finer points being caught in some of the folds or sinuses of the urethra; its ready passage may save much unnecessary instrumentation and irritation of the urethra; the introduction of one or more steel sounds in a urethra lessens for a time the sensitiveness of the mucous membrane, so that other instruments which follow produce less irritation and spasm than if used first.

As a rule, the first sitting should be made as short as possible, since strictures—and individuals also—vary greatly in the amount of instrumentation they will endure without unfavorable results. If the introduction of the first sound proves very irritating, as may happen in nervous men, it is often wise to postpone further attempts for a day or two, even though the bladder has not been entered. After locating and measuring the stricture, unless there be urgent symptoms demanding immediate attention, no attempt at dilatation should be made for two or three days, until the irritation which will probably result from the examination has subsided, and the surgeon is given a chance to gain some idea of how sensitive the patient and his stricture are to instrumentation. The patient should be warned that the next urination will probably be attended by some discomfort, and that he may notice a slight discharge from the meatus, or an aggravation of an existing one, for a few days. If indicated, an alkali or one of the balsams may be ordered, while small doses of quinine may be given to lessen the danger of urethral fever.

The general health and habits of the patient should be investigated fully, and necessary corrections should be made. Of particular importance is a careful exami-

nation of the urine. If the latter contains pus, and especially if it is decomposed and indicates the presence of cystitis, the patient should at once be put upon boric acid or salol in 10-grain doses four times a day, to lessen the danger of urethral fever and other complications. The amount of residual urine in the bladder should be ascertained by passing a catheter immediately after the patient has urinated.

The accurate diagnosis of strictures of large calibre may require cutting of the meatus before instruments of sufficient size can be introduced into the urethra. Until recently many surgeons, acting under the impression that the operation was simple and harmless, have cut the meatus frequently and freely, simply as a matter of convenience in searching for possible stricture of large calibre. There is no doubt that the operation is often followed by harmful results. The gaping lips of a freely cut meatus are frequently the seat of a persistent gleet discharge, while the operation may greatly lessen the power of the individual to eject urine and semen from his urethra, so that dribbling of urine after micturition is not uncommon in these cases. If the meatus is abnormally small, and especially if it is rendered so by a thin band of tissue at the lower commissure, meatotomy should be performed to allow the entrance of a full-sized sound. The free division of the meatus, however, to allow the introduction of very large instruments is not warranted unless there be other and more urgent symptoms of stricture than a gleet discharge, or unless the latter has persisted for a year or more notwithstanding skilful and faithful treatment, including the best general and hygienic management. In such a case it is possible that a forming stricture, of a

calibre as yet too large to interfere with the passage of an instrument of ordinary size, is responsible for the discharge, and, after other means of treatment have been tried, exploration of the urethra with instruments larger than will pass the normal meatus is proper.

In such an examination the question at once arises, What constitutes the normal calibre of the urethra, and what size of instrument should pass unobstructed into the bladder? On this point authorities differ, and it is evident that an exact answer to this question cannot be given, since the urethra is not a tube of uniform diameter, but is a closed canal or valve having normal points of narrowing. Dr. Otis maintains that the calibre of the urethra bears a constant relation to the circumference of the flaccid penis. But that such a relation is only approximate is evident when one considers the great variations in the size of the organ under the influence of heat, cold, mental state, etc. Dr. Otis's scale, which is much too large, is as follows: When the circumference of the flaccid penis is 3 inches, the urethra should receive an instrument of the size 30; $3\frac{1}{4}$ inches, size 32; $3\frac{1}{2}$ inches, size 34; $3\frac{3}{4}$ inches, size 36; 4 inches, size 38; $4\frac{1}{4}$ to $4\frac{1}{2}$ inches, size 40. These sizes do not indicate the normal calibre of the urethra, but the limit to which, according to Dr. Otis, the urethra can safely be distended. For purposes of diagnosis and treatment the majority of modern surgeons adopt a scale from four to eight sizes smaller than those named above; they also recognize normal variations in the pendulous urethra.

Many surgeons who adopt the larger scale find and treat a great many so-called "strictures of large calibre" that are really nothing more than simple, normal contractions of the urethra. This unnecessary stretching

and cutting of the urethra not infrequently results in permanent and even distressing deformity.

The diagnosis of stricture should, then, be reserved for a distinct contraction of the urethra, accompanied by a gleety discharge, frequent micturition, dribbling of urine after urination, or other symptoms of stricture.

Prostatic hypertrophy may lead to a careless diagnosis of stricture of the deep urethra, but in the former disorder the obstruction to the sound is situated more than six and a half inches from the meatus; the handle of the sound must be depressed considerably more than usual before the tip enters the bladder; a rectal examination reveals the enlarged prostate; the patient usually is over fifty years of age; and there is a history of gradually increasing frequency of micturition, most marked at night.

Treatment.—The directions already given for instrumentation of the urethra are not repeated here, although their observance forms a necessary and most important part of the treatment of stricture. It should never be forgotten by the operator that the exercise of gentleness, caution, and patience is not only less dangerous but far more effective in the treatment of stricture (with the exception of those cases in which a cutting operation is required) than is the employment of force.

Dilatation.—In the large majority of strictures, either of the deep or of the pendulous urethra, that are not complicated by retention or by other urgent symptoms, gradual dilatation is the most efficient and safest method of treatment. By this method the stricture is dilated during successive sittings by a series of sounds gradually increasing in size. The principles given for the introduction of the steel sound should be carefully studied

and applied. Each sound or bougie should be cleaned, sterilized, warmed, and lubricated before it is used in the urethra. To further lessen the danger of urethral fever during treatment, the patient should take 10 or 15 grains of boric acid or of salol four times a day for thirty-six or forty-eight hours before and for an equal time after each sitting. The general health of the patient should be maintained, and he should fully understand that the success of the treatment, as well as freedom from distressing complications which delay progress, will depend largely upon his living simply and hygienically. Tobacco, alcohol, and other stimulants, sexual indulgence, and severe exercise are especially harmful. Frequent examinations of the urine, and especially of the residual urine, are necessary to keep the surgeon informed regarding the condition of the bladder and of the kidneys.

In *strictures of large calibre* the dilatation is best accomplished by means of conical steel sounds. There is selected a sound of the same size as the exploring instrument that entered the stricture during the examination of two or three days previous; this sound is gently passed through the stricture. If it occasions no distress, it should be allowed to remain *in situ* for five or ten minutes; it is then withdrawn gently and the next larger size is used in the same manner. If the stricture is in the pendulous urethra, a short sound should be used, or the long sound should be arrested before entering the bladder, to avoid unnecessary irritation. Usually the stricture may thus be dilated two or three numbers (French scale) at each sitting; but occasionally the same sound must be passed at several successive sittings before a larger one can be employed. This is a matter that must be decided in each case by the surgeon

in attendance, after watching the effect of instrumentation upon the stricture and upon the individual. Dilatation should be stopped for that day whenever it has been carried far enough to produce a drop or two of blood or to cause decided pain or irritation. When attempts at dilatation are followed by marked urethral irritation, with possibly slight pain in the testicles, and especially if a suggestion of chill or fever has resulted, the surgeon will content himself with slower progress. There is nearly always a temptation to use a little force and haste, but such attempts are usually followed by urethritis, epididymitis, or urethral fever, necessitating the suspension of further dilatation until the new complication is removed. The conical steel sound is not only a powerful lever of the first class, but it is also a wedge, and few surgeons realize, until they have produced a false passage or met with other misfortune, how much force very slight pressure upon the handle may cause the point of such a sound to exert in the (usually damaged) urethra. Slight force may occasionally be necessary in the use of blunt instruments, but if a conical steel sound, properly held against a stricture for a few seconds, refuses to pass by its own weight, it should be withdrawn and a smaller size be substituted.

At each sitting the dilatation should be begun by the introduction of a sound one or two sizes smaller than the largest sound used at the previous visit. It is always best to have the patient urinate in the surgeon's presence before passing the sounds, that the size of the stream and the condition of the urine may be tested, and that the first urination after the operation may be postponed for a few hours.

Valuable information bearing on the treatment of

stricture may be obtained by watching the phenomena following the introduction of a sound into a stricture which is thus stretched slightly. When the instrument first enters, it is more or less tightly grasped, so that some force may be necessary to remove it, but if allowed to remain *in situ* a few seconds or minutes, the stricture relaxes and the sound moves through it easily; the spasmodic element has been overcome and the stricture has been stretched mechanically. As a rule, the stream of urine is increased in size for a short time—possibly twenty-four hours—before congestion, or even inflammation, in and about the stricture-growth follows; the resulting swelling narrows the calibre of the urethra and therefore the size of the stream. At this time there is usually an increase in the discharge from the meatus, with other symptoms indicating irritation or inflammation of the urethra. At the end of three or four days absorption begins; the calibre of the stricture, and hence the size of the stream, enlarges; the urethral discharge and other symptoms improve. This improvement continues from a day or two to a week before contraction again begins.

It is evident to one who stops to consider the significance of the above-described phenomena that after stretching a stricture the next attempt at dilatation should be postponed at least beyond the stage of contraction and irritation; indeed, the best results are obtained when such instrumentation is delayed until just before the stricture again begins to contract. When the same instrument that was used a day or two before to dilate a stricture is reintroduced during the resulting stage of congestion, it passes with more difficulty and produces much more pain and irritation than when passed the first

time. Unless the operator appreciates the situation, he will probably conclude that he has an irritable stricture to deal with. A great many irritable strictures are undoubtedly produced in just this way, as the result of too frequent and injudicious instrumentation. The commonest mistakes in the treatment of stricture are of this character, and beginners especially are inclined to make the intervals between visits for dilatation altogether too short. The results of such over-treatment are slow progress if any, an irritable stricture, a constantly congested and inflamed urethra, and not infrequently more serious complications. In different cases the proper interval may vary from three to ten days, depending upon the character of the stricture, the amount of dilatation accomplished each time, the amount and nature of the reaction, and the general health and habits of the individual. The decision must be based on a careful study of each case, and especially of the phenomena described above. As a rule, the most rapid progress and the best results in dilatation of stricture, when steel instruments are used, are obtained by sittings with intervals averaging from five to seven days.

The treatment should be continued steadily through several weeks until the stricture has been dilated to the normal calibre of the urethra.¹ By this time the symptoms will usually have disappeared, with the exception of traces of the gleet discharge, which will probably disappear as instrumentation is suspended.

The treatment must not end here, however, if it is to result in any permanent benefit, for if left alone the great majority of strictures will at once begin to re-contract.

¹ The question of what constitutes the normal calibre of the urethra is considered in connection with diagnosis.

The patient should clearly understand that unless the calibre of the urethra be maintained by the occasional use of a sound, contraction of the stricture will follow, and his treatment will prove of no permanent value.

To prevent re-contraction a full-sized sound should be passed with sufficient frequency. At first this procedure should be done once in a week or ten days, then once in two weeks, the intervals thus being lengthened gradually until the sound is no longer needed or until it is discovered how long the interval may be made before the stricture begins to contract. A few months of such treatment will render further instrumentation unnecessary in some cases, but usually the introduction of the sound must be repeated, at intervals varying from a week to three months, for several years, or even indefinitely.

With a little instruction the patient should, as a rule, learn to pass the full-sized sound upon himself, thus obviating the necessity of occasional visits to the surgeon during long periods of time, and also lessening the probability of neglect. The patient should be impressed especially with the necessity of keeping his sound clean and aseptic. If such a course of dilatation be faithfully carried out, many strictures disappear entirely, while others, with a little care on the part of the patient, are kept under control and rendered harmless.

That absorption of the stricture-growth during a course of gradual dilatation actually occurs can often be demonstrated by watching the progress of a case in which the growth can be felt by the fingers on the outside and its gradual disappearance be noted.

In strictures of small calibre uncomplicated by retention or other urgent symptoms, gradual dilatation is