other operation, of like importance, in the whole range of operative surgery.

In my own experience of over nine hundred operations, *not only have I never had a death or a permanent disability of any sort, but I can say to-day that I have never performed the operation as advised in the foregoing pages, either to my own regret or without marked or acknowledged benefit to the person operated on.*

LESSON LIV.

Consideration of the operation of dilating urethrotomy continued—Important in proportion to the degree of difficulty presenting—Subjects of disease of bladder and kidneys most liable to suffer from any operative procedure—Dilating urethrotomy less grave than any other mode of relief—Strictures in the anterior portion of the urethra less liable to cause trouble from operation than those seated more deeply—Greatest proportion of strictures shown to be located in the anterior portion of the urethra—Strictures of large calibre most frequently the cause of trouble—Easy and safe relief to such strictures by dilating urethrotomy—Details of operation in cases of strictures of large calibre—Strictures at or near the meatus urinarius—Mode of operation—Strictures more deeply seated—Mode of operation by means of the dilating urethrotome.

The operation of dilating urethrotomy, like any other legitimate surgical procedure, is important in proportion to the amount of difficulty present and the gravity of the troubles complicating it. In subjects affected with grave disease of the bladder and kidneys, any operation on the urinary apparatus is more or less hazardous. Dilating urethrotomy, however, has been fully demonstrated to be the least so, as in its performance the least degree of injury is inflicted necessary to division of stricture, and besides, in the very greatest majority of cases, it is not necessary to pass any instrument through the deep urethra or beyond the locality of the stricture.

In direct opposition to the statements of authorities who have not examined the urethra by means of the urethrometer, but who have made up their statistics from post-mortem inspection, it will be found that by far the greatest proportion of strictures calling for operation or any treatment, are situated in the penile urethra, and will be found in less frequency the farther we recede from the meatus urinarius. In point of fact, being the result of inflammatory action, stricture will be found most frequent in the anterior portion of the urethra, where inflammations are most frequent and severe.

In my experience, the greatest number of strictures which call for operative measures are the so-called "strictures of large calibre," which produce and prolong urethral discharges, sometimes causing reflex disturbances which result in recurring epididymitis, spasmodic stricture and retention of urine, frequent micturition, painless or otherwise, catarrh of the bladder, neuralgias, abdominal, dorsal, or sciatic, and a legion of possible troubles, mental and physical, which can only be reached efficiently by removal of the strictures.

For all such cases dilating urethrotomy presents a promise of speedy and permanent relief, and as a rule, when properly performed, resulting in a radical cure of the stricture.

The treatment of stricture by dilatation, that is to say, through the introduction of gum-elastic bougies, whalebone, etc., of various kinds and sizes, and steel sounds, long in use and approved by all authorities, has always been open to the objection that the results of such treatment, when well borne, were but temporary, and that once required, such dilatation was necessary throughout the life-time of the patient. There has never been any question but that dilatation of stricture was invaluable for temporary relief, especially in cases where urination was interfered with, or where the circumstances were such, from any cause, that time could not be spared for more radical measures. In point of fact, it is only within a few years that any causes short of interference with the act of urination were considered to warrant other operative measures than through gradual dilatation. It was in 1862 that I first demonstrated to the profession the capacity of stricture of long calibre to perpetuate, even to originate a urethral discharge, and scarcely a year later, the influence of such stricture in causing reflex irritation and neuralgias,* and spasmodic stricture. The possible influence of strictures of large calibre has now come to be gen-

* Paper On Reflex Irritation Throughout the Genito-Urinary Tract, resulting from Contraction of the Urethra at or Near the Meatus Urinarius—Congenital or Acquired. Read before the N. Y. Academy of Medicine, Feb. 19, 1874.

erally accepted, and the propriety of operating on such strictures, with the view of effecting their permanent removal, it may be said is now well established.

The chief cause calling for treatment of strictures of large calibre is a persistent or a persistently recurring urethral discharge. If this is at all inflammatory, it is desirable to defer operation until the discharge has, by rest and sedative injections, come to be painless, or better, until it has for the time entirely ceased. Cases will occasionally present where such discharge is rebellious to all treatment, and continues profuse and more or less painful. In such cases, the inflammatory action usually interferes with the rapidity and completeness of the recovery.

DETAILS OF OPERATION ON STRICTURES OF LARGE CALIBRE.

Arrangements should in all cases be made for the patient to remain in bed from forty-eight hours to a week after the operation. Administration of ether facilitates the accomplishment of the different necessary procedures. With proper arrangement of all preliminary details (such as measuring, and locating, and noting down the different strictured points, arranging instruments, etc.), the operation may usually be done under the first effect of ether. 1st. After having ascertained the normal urethral calibre in a given case, note carefully, in writing, the different points of stricture, the calibre and extent. 2d. If the urethral orifice is not of the full size of the normal urethra, as previously estimated, operative measures should commence by a restoration of the canal at this point. Thus, holding the penis tightly with the thumb and first finger of one hand, introduce a well-oiled, straight, blunt bistoury for a full inch, then testing the density of the tissues (which may vary from slight thickening to dense cicatricial structure) by drawing out the blade under gentle, steady pressure, again introduce, and divide to a point which appears to be sufficient to enlarge the canal to the predetermined proper size.

Now, with a bulbous sound corresponding to this, test the size attained. If the bulb passes in and out with *perfect freedom*, the operation is accomplished. If, however, there is the *slightest hitch*, either in entrance or withdrawal, the bistoury should be re-introduced, and with a forefinger supporting the under aspect of the glans, and make repeated cuts with exceeding care until cicatricial tissue is no longer felt, and the bulb passes in and out without hindrance. In cases when the meatus is situated very low, almost looking downwards (as it does in some cases), this operation is often a most difficult and delicate one, that is, to get sufficient room without making an artificial hypospadias. This of course must be avoided. It is always a misfortune to be obliged to incise the canal superiorly at this point, not only because recontraction is much more likely to occur, but because the certainty of getting through the cicatricial tissue is much less, and subsequent induration and recontraction is more likely to follow. In cutting inferiorly, too, the pocket of the fossa navicularis is obliterated, a very important point in cases of gleety discharge, as it may be held here, notwithstanding the superior incision, and then by still holding the discharge, still fail to afford the relief anticipated from enlarging the orifice.

Where division of the orifice is alone required, respect should still be had to the possibilities of troublesome hæmorrhage resulting. A little pressure between the thumb and fingers will commonly suffice to arrest immediately following operation. Again, hæmorrhage is quite free and persistent, or will come on soon after operation from movement or urination. A couple of narrow pasteboard slips may be laid, one on each side of the penis, and pressure on these made by two or three turns of bandage, the end of which may be split into six tails, brought around and tied with much or little pressure, as required. I always insist upon every patient, whose urethral orifice I divide, securing a nurse or intelligent friend to watch with him for the first two or three nights after the operation. The act of erection occuring during sleep sometimes causes hæmorrhage to

recur, and considerable blood may be lost before the patient awakes. I have seen fully half a pint lost in this way within an hour or two. My friend, Professor Thomas M. Markoe, related to me an instance, where many years ago he was called to see a man who was said to be bleeding from the penis; the man died just before Professor Markoe arrived. On examination it was found that he had bled to death from a division of the meatus urinarius. This was several years before anything was understood about normal urethral calibra, but it is noteworthy, as showing that in certain cases of hæmorrhagic diathesis, serious hæmorrhages may occur from so slight an operation as a division of a contracted urethral orifice. From the fact that occasionally tendency to troublesome hæmorrhage does exist, and we cannot tell beforehand which cases will behave in this way; therefore, all cases should be cared for as if it were a certainty that hæmorrhage would take place and this care should not be relaxed until three days from the date of operation. The after-treatment consists simply in the introduction of a full sized bulb daily or every other day, until healing is complete. If healing is sluggish, it may be stimulated by a little carbolated lotion applied through a film of absorbent cotton. If a diphtheritic pellicle comes on, as occasionally will occur, a powder composed of equal parts of non-saccharated pepsin (Boudault's), and sub-carbonate of bismuth may be sprinkled into the opened orifice, three or four times a day.

In regard to strictures situated beyond the fossa navicularis, or the first inch of the urethra, an entirely different procedure becomes necessary. All strictures beyond this point should be incised on the superior surface of the canal and directly in the median line, The incision should be made to include every fibre of stricture tissue if permanence in results is anticipated. The advantages of the superior incision are chiefly two: First, the tissues in this location are less vascular above, especially when approaching the bulbous portion, and hence the liability of troublesome hæmorrhage is lessened. Secondly, the certainty of dividing through

the entire thickness of the stricture without unnecessary risk is greater. When the stricture tissue is quite thick and approaches the surface of the penis the incision necessary to divide it completely on the inferior wall, would sometimes not only extend into the cellular tissue outside of the urethra and thus perhaps lead to formation of abscess, but might go quite through the integument and result in a troublesome fistula. Any operative measure which would result in complete division of such stricture would make it necessary to put the integument into a state of extreme tension and thus make it so thin that it would be easily cut through. In order to divide any stricture with certainty and completeness it must first be put on the stretch so as to fix and thin the stricture tissue and thus easily sunder it. This is best accomplished by means of the dilating urethrotome. Having then divided the stricture or contraction at the urethral orifice after the manner recommended, examine as to the locality and calibre of all deeper strictures as far back as the bulbo-membranous junction, which is usually not to exceed five and a half or six inches from the urethral orifice. Having located any presenting strictures, take the dilating urethrotome well oiled and the blade in its concealment at the extremity. Place upon the shaft a thin rubber band (once or twice doubled to keep it in place) at just the distance from the heel of the blade which corresponds to the previously measured distance from the extreme posterior border of the deepest stricture. Then, the patient lying on his back on a lounge or bed, and the surgeon standing by the side most convenient, introduce the shaft, again well oiled, into the urethra until the rubber band is one half of its breadth well in the meatus and the dial face of the urethrotome looking squarely upwards. Let the penis now be steadied by an assistant, so that the incision shall be directly in the median line.

LESSON LV.

Description of the operation of dilating urethrotomy continued — Small amount of hæmorrhage usually resulting—Method of arresting hæmorrhage—The cold-water coil—Method of arresting hæmorrhage from the deep urethra—The perineal crutch—Close strictures in the deep urethra best treated by external perineal urethrotomy—Great majority of strictures in the ante-bulbous portion of the urethra—After-treatment in operations by dilating urethrotomy—Treatment of strictures of small calibre—Urethral fever—To prevent this—Necessity of great care in cases of long-standing urethral trouble and in elderly persons—Preparatory treatment—Other accidents occasionally following dilating urethrotomy—Accidents most commonly the result of want of proper care subsequent to operation.

The next step in the operation is to turn the screw at the handle gradually, as indicated by the hand on the dial, so that it marks two millimetres (the blade being just two millimetres in breadth), beyond the previously ascertained normal calibre of the urethra, and draw *the blade* completely through the breadth of the posterior stricture, and push it back again into its place of concealment. Turn the screw button still further, a millimetre or so, and if no sense of resistance is felt, the stricture is probably divided. If resistance is still felt, turn up the screw so as to indicate one to two millimetres more, and again test, and so on until resistance from stricture tissue is not recognizable. If there are more strictures interiorly apply the blade in the same way to each if they are an inch apart, and there be no lessening of the normal calibre between them. If, however, they are nearer together than an inch, or there is even slight contraction of the canal in the interspace, draw the blade through all at once, and push it back as before, and test by turning the screw as previously described. If the strictures are so numerous or so dense that dilatation is difficult, remember that the instrument is not intended as a divulsor, but only to put the strictures on the stretch sufficiently to fix and thin them, but without damage to the instrument. Therefore, when dilatation is in this way hindered, pass the blade

through the strictures and turn up farther. If again unduly resisted, repeat this proceedure until the hand on the dial indicates a dilatation fully two millimetres above the previously estimated, or ascertained normal calibre of the canal. In such numerous and resistant strictures they are likely to be of unusual thickness, and hence the incisions must be correspondingly free. After division, turn down the screw button until the hand on the dial indicates that the instrument is half closed, and withdraw, in this way preventing any engagement of tissue between the bars.

The withdrawal of the dilating urethrotome is usually accompanied, or immediately followed by a gush of blood, perhaps three or four drachms, and then slight oozing for some little time after; rarely, however, requiring especial measures, except winding the penis snugly in a folded towel, or a three-inch bandage. If considered desirable, the penis may be drawn up and pasteboard splints applied conveniently as far back at three and one-half inches, in the same way as recommended in hæmorrhage from the meatus, or, in addition, an open end, soft or gum-elastic catheter may be introduced into the urethra to a point just beyond the posterior cut portion, before the bandage is applied. A straight tube is better than a solid bougie, as it permits urination without removal. The cold-water coil is also of value in arresting slight hæmorrhage.*

The Cold-Water Coil in Inflammation of the External Male Genital Apparatus, and as an Antiphlogistic after operations on the Penis.—The apparatus which I have designated the "Cold-Water Coil" is formed of a line of the small-sized India-rubber tubing of one-sixteenth of an inch calibre, and six or seven yards in length. At the middle portion this tubing is coiled upon itself, so that, by half a dozen turns or more, it presents sufficient capacity to loosely encircle the entire penis or scrotum.

This coil, with the length of tubing proceeding from it, forms an apparatus through which, on placing one extremity of the tubing in a bowl or tumbler of ice water, exhausting its contained air (by suction, or by drawing the tube through the finger), a siphonic current is established through the coil. The discharge-pipe being placed on a lower plane than the water-supply, the current may be kept up until the vessel is emptied.

The rapidity of the flow can be regulated either by raising or lowering the end of either tube, which is the simpler plan; but the more convenient one is by a tapering, double silver tube, attached to the discharge-pipe, a sponge being fitted to the inner tube. This sponge, when the inner tube is pushed down into the smaller end of the outer tube, becomes compressed and gradually obstructs the flow of water, until not a drop will exude. This contrivance may be regulated so that either a free stream can pass, or that the single drops shall follow each other, more or less rapidly, with the regularity and precision of a timepiece.

By means of this arrangement, I have been able to apply cold to the penis or scrotum continuously and conveniently both to the patient and to myself. The coils of tubing are retained in position by a band of cotton or linen cloth. A ready method of constructing this apparatus is by placing a strip of thin cloth, six inches in length and two in breadth, lengthwise, upon a large speculum or a four or six ounce vial. The tubing, taken at the middle of a piece six or seven yards long, is wound around the vial, and, after the requisite number of turns are made, the projecting ends of the cloth are doubled over and stiched to the under layer between the turns of tubing, If, after completion, the turns are found too small, they may be readily enlarged by drawing the tubing through the cloth to any desired extent.

I have found this simple contrivance of essential service in the acute form of gonorrhœa, reducing inflammatory action promptly, and thus giving relief to painful micturition and erections.

It has proved of great value in keeping down inflammation and in preventing erections after the operation of circumcision. I habitually use it for the same purpose in operations for stricture, and with results more prompt and satisfactory than those hitherto attained by any medication or application with which I am familiar.

*Reprinted from the *New York Medical Record*, January 9th, 1875.

Firm pressure with the fingers on the urethra, just behind the posterior edge of the cut, and a closure of the meatus with the fingers of the other hand is a ready method of arresting a sudden gush, which may come on urination or in consequence of an erection. This is rare, however. The worst that can happen should always be anticipated in every case, and be thoroughly prepared for; but in the very greatest majority of cases the hæmorrhage needs but little more than the folded towel, except *watching* for the first three or four days, not forgetting to keep in mind the liability to erections and consequent tendency to hæmorrhage during sleep, and especially after operative interference of any sort. If the bleeding comes from so far back that it becomes difficult of control on this account, as in the vicinity of the bulb, it may ooze into the bladder. The perineal crutch can be readily extemporized, and with a graduated compress in the perineum the crutch so arranged that its foot will bear against some firm point

at the foot of the bed, and the opposite end press against the compress. This has the advantage of elastic bandages sometimes used as being easily arranged and controlled by the patient allowing the weight of his body to bear upon the crutch, when necessary to arrest the bleeding, and easing up on it when it has ceased. This may be readily made by cutting a broom-handle of the proper length, and tacking across one end a small bit of wood slightly concave to fit the perineum. If necessary, the bladder may be emptied of clots by means of an ordinary pint syringe and a large flexible catheter. This process may be facilitated by mixing a drachm of pepsin with two or three ounces of water, and injecting this into the bladder. The solution of the clots are in this way speedily effected, and the bladder may then be easily emptied. On account of the liability to free and possibly dangerous hæmorrhage after division of

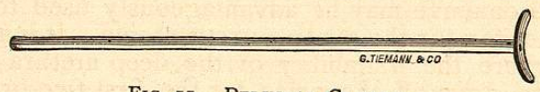

FIG. 11. PERINEAL CRUTCH.

stricture in the deep urethra, and the difficulty of controlling it, I do not advocate division of strictures with the dilating urethrotome beyond the bulbo-membranous junction. Strictures beyond this point, which are not readily dilatable to full size of urethra by means of steel sounds, are best and most safely divided by external perineal urethrotomy.

Reference to statements previously given, show that strictures beyond this point are rare, most of the alleged strictures in the deep urethra being spasmodic in character. After-treatment of cases where dilating urethrotomy has been performed consists simply in ordinary means of reducing irritation by rendering the urine bland, and the introduction of a full-sized sound on the second day after operation, simply beyond the site of former stricture, and on no account passing it into the bladder. This to be continued every second day, until healing has taken place. This usually requires from 10 to 12

days. If all goes on favorably the patient may usually visit the surgeon at his office after the fourth or fifth day, especially where the incisions have not been extensive. In the introduction of sounds, or in fact of any urethral instruments, no force should be used. Simply let the instrument, well oiled, follow down the canal almost if not quite by its own weight; gently turning it this way and that, as a fold of mucous membrane arrests its progress.

Strictures of small calibre, or those too small to permit the passage of the urethra-metre (18 to 20 millimetres circ.), may be gradually brought up to this size by gradual dilatation, introducing soft or gum-elastic bougies of increasing sizes once in three or four days. If the stricture is very dense and irritable, and urethral chills or other troubles are caused by attempted dilatation, a division of the stricture tissue with the urethrotome of M. Maisonneuve may be advantageously used to prepare the way for the dilating urethrotome. It is a good plan, where the irritability of the deep urethra is not great, to draw off the urine for the first two or three days after operation. The occurrence of urethral fever is thus often prevented, when it might otherwise occur.

Urethral fever is not by any means common after an operation by dilating urethrotomy in the anterior urethra, but seems to occur more frequently when the patient urinates over the cut surface soon after operation.

In persons of highly nervous temperament the predisposition to urethral fever is the rule, and any slight mechanical interference may give rise to it. Malarious antecedents increase in a marked degree the probability of its occurrence. The presence, likewise, of any disease, acute or chronic, of the deep urethra, prostate gland, bladder or kidneys, is a very great and unmistakable predisposing cause. I, therefore, hold that the previous recognition of any of these conditions is of the highest importance in the treatment of urethral stricture by any method, and, further that, *in cases of long-standing urethral trouble, and in all elderly persons, the passage of any instrument through the urethra into the bladder should never be attempted without a preliminary ex-*

amination of the patient's urine to determine the state of the bladder and kidneys.

The predisposition to urethral fever in persons as above described, suggests that all possible precautionary methods should be used to prevent this accident whenever, as is sometimes the case, surgical interference becomes imperative. To this end *rest* in the recumbent position for a day or two is of value. Hot sitz baths, temp. 110, for 3 or 4 minutes morning and night. Muriated tincture of iron and tonic doses of quinine in persons of debilitated habit. Immediately previous to the proposed operative procedure I am in the habit of administering 5 to 10 grains of quinine (preferably 10) in pill or capsule, or instead of this, a suppository composed of ten grains of the bisulphate of quinine and a quarter of a grain of the acetate of morphine. It is not from the fact that urethral fever in such cases is more likely to occur, and with possibly greater severity, than in healthy persons, that this predisposition is important, but because when it does occur, the danger of the reflex irritation extending to the ureters and kidneys, and inducing a suppression of urine, is greatly increased, and that suppression so induced is frequently and rapidly fatal.

In cases of rise of temperature, after operation with or without distinct rigors, I am in the habit of administering 5 grains of quinine every 6 hours, and a drop of aconite every half hour or hour, until the fever subsides, which is usually within 24 hours. Slight swelling of the penis, due to a localized inflammation of the spongy urethra at the point of incision, occasionally occurs. I have seen three cases of this sort out of over 1000 operations. This subsided in these cases within a few days without other treatment than weak carbolic injections, 5 grains to an ounce and the use of the cold-water coil. Dr. Bevan of Baltimore, in his report of 200 cases operated on, comprising 446 strictures, reports the occurrence of 4 peri-urethral abscesses. I have never met with such an accident. Acute urethritis sometimes results from the previous existence of an irritating purulent discharge.

Such an accident contra-indicates the use of sounds, until they may be introduced without especial pain.

Inflammation following the operation sometimes gives rise to chordee, and may continue, leaving a curvature persisting for several weeks or months after the wound of operation has healed. I have, however, never seen a case where the plastic exudation causing it was not finally absorbed. Two cases have come to my knowledge, where the frequent passage of sounds (daily) was kept up, notwithstanding an acute inflammation was present, and where curvation resulted which gave great annoyance for over a year. One where the introduction of sounds was daily practised for six weeks, with so great

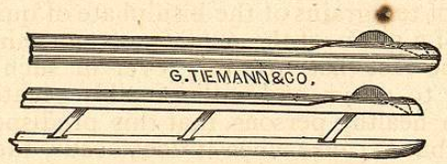

FIG. 12. AUTHOR'S DILATING URETHROTOME FOR DIAGONAL DIVISION.

pain that ether was required to effect it, and yet this case finally recovered. In the other, operated on a little over a year ago, aggravated in the same way, the curvature still persists. Such rare cases, evidently due to gross error in after-treatment, cannot legitimately count against the operation, when well and judiciously performed. Several cases of persistent curvation of the penis resulting solely from gonorrhœal inflammation and consequent stricture have come under my notice, and which have been reduced by the operation of dilating urethrotomy by cross section of the constricting band with an instrument especially devised for this purpose dividing the stricture diagonally.