

Preparation for Operation.—The patient is prepared as for any perineal section (p. 201), and the instruments are the same as those employed in external urethrotomy, with the addition of stone forceps (Fig. 114) and scoop (Fig. 115) and a set of litholapaxy instruments.

The Operation.—With the patient in the lithotomy position, a grooved staff is introduced into the urethra and pressed forward towards the perineum.

The operator, seated on a low stool, punctures the perineum in the median line with a sharp scalpel, carrying it into the groove of the staff, making the external incision not more than an inch long. The surgeon's object is to open the membranous urethra, avoiding the bulb, for incision of the latter gives rise to annoying hemorrhage. It is therefore customary to guide the point of the scalpel by a finger (protected by a finger-cot) introduced into the rectum. With this finger the apex of the prostate is felt, and the scalpel is so introduced as to open the urethra just in front of this point, due care being taken not to open the rectum at the same time. Before removing the scalpel a blunt-pointed bistoury or Blizard knife is introduced alongside of it into the groove of the staff. The scalpel is

FIG. 114.
LITHOTOMY FORCEPS.

withdrawn and staff and bistoury together pushed forward into the bladder. A female silver catheter is then introduced through the perineal wound and guided into the bladder along the staff. Immediately a spurt of urine assures the surgeon that he is not in a false passage. The catheter is then replaced by a grooved director and the staff removed. The surgeon then endeavours to introduce his finger, guided by the director, into the bladder. Any constricting bands are cut through. When a free passage has thus been made the director is removed. In the class of cases to which this operation is most appropriate the surgeon will now be confronted by a hypertrophied prostate or a contracted neck of the bladder. This must be dealt with according to his experience (p. 313).

When the finger reaches the bladder it usually comes immediately



FIG. 115.
LITHOTOMY
SCOOP.

upon the stone. This, if quite small, is extracted by the stone forceps; if large it is crushed and the fragments removed by forceps (Fig. 114) and scoop (Fig. 115), great care being exercised in the removal of angular pieces; or the entire stone may be reduced to fragments small enough to pass through the tube of the aspirator. A short, straight aspirating tube of large calibre (31 French) is useful for this purpose, and my tube for last fragments. Incision of the prostate, which forms part of the old operation for stone, is quite unnecessary, unless that organ is hypertrophied and requires incision for its own sake. Such incision allows much larger stones to be taken away whole; but it is preferable to crush large pieces and to remove them by the scoop or the aspirator. The crushing is effected by a strong lithotrite. Stones too large for such a lithotrite should be removed by suprapubic lithotomy. The operation is terminated by a nitrate-of-silver (1:4,000) wash, and a perineal tube is introduced (p. 204). The after-treatment is the same as for perineal prostatectomy (p. 306). There are no special dangers or complications connected with the removal of the stone. It is not always easy to crush or extract a stone lodged in some pocket tightly surrounded by a spasmodic bladder, and it is especially difficult to remove the last fragment behind a hypertrophied prostate. But if the prostate is dealt with at the same time, adequate drainage is assured, and any dust left behind may be expected to come away during the ensuing days with the irrigations.

SUPRAPUBIC LITHOTOMY

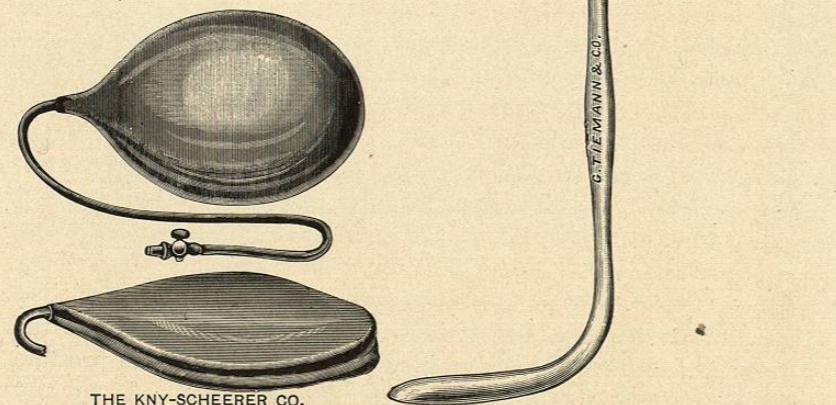
If in any case it is advantageous to see the whole bladder (cases of tumour, ulcer, or sacculæ), or if the stone is too hard to be crushed and too large to be handled by the perineal or the urethral route, the suprapubic operation should be performed.

The patient is prepared as usual by shaving, soap poultice, catharsis, and urotropin. The surgeon, his assistant, and the instruments are prepared as for any major operation.

Instruments.—The only special instrument employed in this operation is the colpeurynter (Fig. 116). This inflatable rubber bag is greased, introduced into the patient's rectum (after he is on the table), and inflated with some 300 c. c. of air or water. By this means the bladder is distinctly elevated out of the pelvis, and the space on its anterior wall uncovered by peritoneum is thus increased. But the assistance thus rendered is not often material. The practised surgeon can reach the bladder without the aid of the colpeurynter, and hence this ingenious device is little used. Several recorded

cases of rupture of the bowel because of overinflation have not added to its popularity.

To the usual armamentarium of scalpels, forceps, scissors, retractors, sutures, etc., a catheter and a lithotomy forceps should be added. I employ a special retractor (Fig. 117) for the upper angle of the wound. Watson's lateral retractors I have never used.



THE KNY-SCHEERER CO.
FIG. 116.—THE COLPEURYNTER.

FIG. 117.—RETRACTOR FOR SUPRAPUBIC CYSTOTOMY.

The Operation.—The patient lies on his back. A slight elevation of the hips, or even a full Trendelenburg position, is sometimes useful for the purpose of bringing the contents of the pelvis up towards the abdominal wall.

The first step in the operation is the inflation of the bladder. Some 200–300 c. c. of boric-acid solution are injected through a catheter: more if the bladder is dilated, less if contracted. In order to retain this fluid a rubber catheter is tied around the penis. The removal of this should not be neglected lest it cause gangrene.

The Incision.—A transverse incision through the skin and the inner part of each rectus muscle, or even through the whole muscle, is sometimes employed and gives a larger field of operation than does any vertical incision. But it weakens the abdominal wall considerably and perhaps permanently if the wound is left open to suppurate, as it so often is. The vertical incision is, therefore, generally preferred, and if during the course of the operation more space is required, this incision may be made T-shaped by a transverse cut at its lower extremity. For ordinary purposes, then, a central incision about 3 inches long is made in the middle line, terminating at the pubic symphysis. The superficial fascia is cut through with the

skin, the deep fascia more carefully. The sulcus between the recti muscles is sought, but, if not easily found, a central incision is made cleanly through the muscle parallel to its fibres. No separation of the muscles should be made except what is absolutely necessary, for such separation favours the extension of subsequent infiltration. Particularly is it desirable not to poke about with fingers or instruments in the prevesical space behind the symphysis. This is the most dangerous area after the operation, the one in which pus is most likely to form and be a source of complication.

After getting fairly through the muscles, a thin fascia is observed with yellow fat beneath it. This fascia is divided transversely, then the pulp of the finger is placed between the yellow layer of fat and the symphysis, and the fat is rolled upward towards the upper angle of the incision. This layer of yellow fat contains the peritoneum, which is not seen unless adherent, in which case it may be torn into.

Tearing the peritoneum is not an important accident. The wound is quickly sutured with fine catgut and kept out of the way in the upper angle of the incision during the remainder of the operation.

After the fat has been rolled up the bladder is exposed, covered with distended veins. With short-curved needles in a holder, a portion of the bladder is taken up in a broad loop on each side, the silk knotted in long loops, and these are used as retractors. Even though the veins be large they may be disregarded and the bladder boldly cut into between the ligature loops.

As soon as the bladder is opened the fluid gushes from it and it collapses. The penis ligature must now be removed (and the colpeurynter deflated and extracted). Now the bladder is freely opened, the finger enters, finds the stone, and rolls it into a suitable position. With a forceps it is easy to seize and extract any stone or foreign body and to inspect the inside of the organ by using a reflector or an electric light, or by adopting the Trendelenburg position.

The treatment of tumours and prostatic growths through a suprapubic incision has already been considered (pp. 303, 423). No treatment has yet been devised for saccules. Clarke,¹ who has had an unusually wide experience of these cases, states that after lithotomy the sac sometimes contracts down and gives no further trouble; but if its orifice is small and the sac itself large, independent drainage should be provided for it. He suggests the feasibility of perineal drainage, but admits that it has not been employed.

Drainage.—After cystotomy some kind of drainage—be it suprapubic, perineal, or urethral—is essential. So long as continuous effectual drainage is established the route chosen makes little difference; but there is, as yet, no general agreement among surgeons as to what route possesses the most advantages. It is generally admitted that the suprapubic wound must not be closed unless the bladder is uninfected. In the majority of cases, therefore, suprapubic drainage must be employed. This usually suffices; but if the suprapubic wound is closed, or if any operation is performed upon the prostate, I habitually employ perineal drainage. Urethral drainage by the retained catheter I do not care for after operation, as such a catheter is too small to discharge clots freely. The perineal opening is no source of danger. I have devised a rapid and practically bloodless method of making it.

A large urethral staff is passed into the bladder. With a finger in the rectum as a guide (its tip placed upon the apex of the prostate), a straight bistoury is plunged into the perineum, passed in front of the anterior wall of the rectum and into the groove of the staff near the apex of the prostate. Now a long silver probe is prepared by having a stout silk thread tied through its eye, which thread is passed through the tip of a red rubber catheter, about size 35 French, and out through its lumen, and knotted inside the lumen so as not to pull through. This probe, a little curved at its tip, is passed along the blade of the knife as a guide into the urethra and bladder. The knife before withdrawal is made to enlarge the urethral wound sufficiently—about 1 cm.—and upon its withdrawal is made to cut and enlarge the perineal wound to about the same dimensions. A finger passed through the abdominal wound easily hooks up the probe, and by the aid of the string and the knot the catheter is drawn through the small punctured wound, which it accurately fits, arresting all hemorrhage by its own pressure.

Closure of the Wound.—When there is no cystitis the suprapubic wound may be closed entirely on condition that continuous drainage be provided through the perineum or the urethra. Many complicated methods of suturing the bladder have been devised, but as they assure no special security they may be dismissed. In suturing the suprapubic wound, or any other wound of the bladder, it is only necessary to avoid passing the sutures through the mucous membrane, to make them close enough and strong enough to close the wound completely, and to test the line of suture by inflating the bladder. The wound if once hermetically sealed to the passage of water or air may be depended upon to remain so. These rules are carried out in practice as follows:

1. Before suturing the bladder a perineal tube is inserted.
2. The bladder is then closed by a continuous suture of catgut or light chromicized gut passing only through the muscular coat.

3. This line of suture is tested by injecting fluid through the perineal tube.

4. Any weak spot is strengthened by an additional stitch and the whole may be further protected by Lembert sutures.

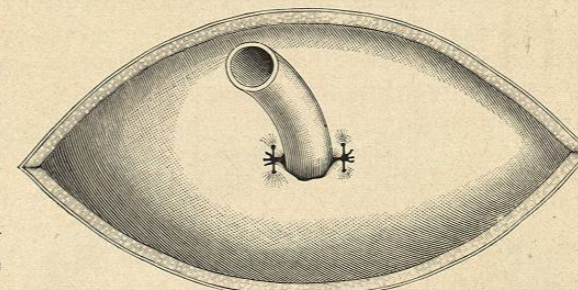


FIG. 118.—DRAINAGE OF THE BLADDER, GIBSON'S METHOD. Tube inserted and stitches employed to diminish size of opening.

5. If there is any doubt in the surgeon's mind as to the possibility of infection or infiltration the abdominal wound is provided with a sufficient number of provisional sutures and packed. At the end of forty-eight hours the packing is removed and the sutures tied.

Otherwise the abdominal wall is closed by a single set of transfixing sutures or in layers.

But in the majority of cases, after all, the surgeon is unable or unwilling to dispense with suprapubic drainage. In infected cases he dares not close the suprapubic wound.

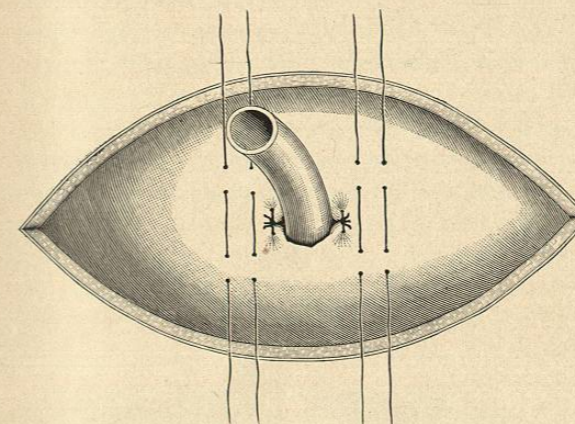


FIG. 119.—DRAINAGE OF THE BLADDER, GIBSON'S METHOD. First set of inversion sutures in place ready for tying.

In clean cases the

advantage of closing the wound is the avoidance of a prolonged convalescence with an annoying, unmanageable suprapubic fistula. A recent suggestion by Gibson¹ will, if it fulfils its early promise, revolutionize our ideas upon this matter. The proposed operation is quite simple, being an adaptation of Kader's operation for gastrostomy. A drainage-tube is placed in the bladder wound, which is sutured close

¹ Med. Record, 1901, lix, 45.

about it (Fig. 118). Two inversion sutures are then introduced above and below the tube (Fig. 119); these are tied and a second row introduced (Fig. 120). The tying of these completes the closure of the bladder wall. As a result the tube is tightly hugged by the bladder so that no urine can escape around it, and the inversion is such (Fig. 121)

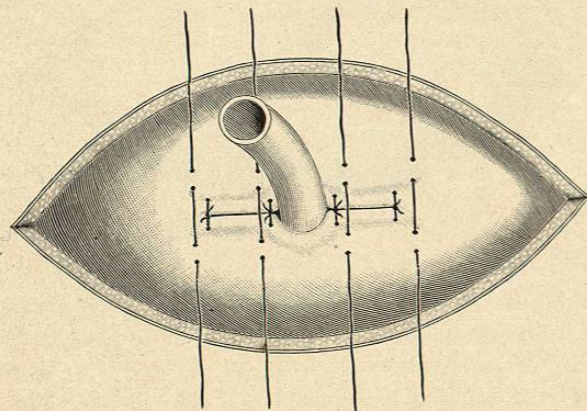


FIG. 120.—DRAINAGE OF THE BLADDER, GIBSON'S METHOD.
First set of sutures tied, second set in place for tying.

that, when the tube is removed, the funnel-shaped opening is rapidly and permanently closed by the intravesical pressure. I have not yet had the opportunity of testing this method thoroughly, but I have seen admirable results from it, not a drop of leakage occurring either while the tube was in place or after its removal. If such results can be depended upon from this method, the necessity of risking a complete closure of the bladder will be done away with; and in those cases where prolonged or permanent suprapubic drainage is necessary, the adoption of such a procedure will also do away with the leakage during the first weeks after operation while the wound is closing down about the drainage-tube. Indeed, the chief objection to suprapubic cystotomy is that, with the old methods it has been impossible in the majority of cases to obtain satisfactory drainage. With the double siphon of Guyon, as well as with the self-retaining catheter of Pezzer, it has been impossible to prevent a great deal of overflow alongside the tube. This overflow is often sufficient to soil the patient's dressings, linen, and bed-clothes many times a day and to keep him, at least for the first few days after

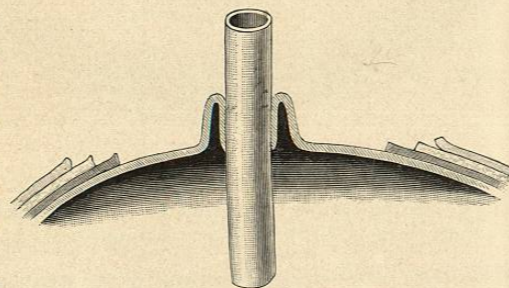


FIG. 121.—DRAINAGE OF THE BLADDER, GIBSON'S METHOD.
Longitudinal section, showing bladder infolded by two sets of sutures.

operation, bathed in a pool of ammoniacal urine anything but aromatic. As suggested by Dr. Gibson, it would be well to use a double tube for drainage, one tube to be kept closed and used only for irrigation, in order that the other—the real drainage-tube—need not be disturbed.¹

A metal tube for continuous drainage (Fig. 92) may be introduced at the time of operation or a few days thereafter.

After-treatment.—The dressings must be changed as often as they become soiled. The bladder should be irrigated at first twice a day, later once a day. If perineal drainage has been employed the tube is removed towards the end of the first week. The suprapubic wound need not be kept open longer than five days unless more prolonged drainage is demanded by the condition of the bladder.

Mortality and Statistics.—I have performed suprapubic lithotomy 19 times with 7 deaths (37%); and 20 perineal lithotomies with 5 deaths (25%). Of the 7 fatal suprapubic sections, 3 were prostatectomies and 3 were performed as a last resort after the failure of litholapaxy. Of the 5 fatal perineal cases, 2 were subsequent to futile litholapaxy. My preference for litholapaxy is almost entirely due to the fact that it is easier for the patient. It requires less preparation, less after-treatment, and insures the sufferer more comfort. But I see no reason why a lithotomy, whether suprapubic or perineal, performed on a comparatively healthy man should prove fatal. All of my patients that have died have been old men with foul bladders and *damaged kidneys*, and this was their weak spot, a weak spot even for litholapaxy. Four of my patients who died were distinctly uremic and 4 distinctly septic before operation. Of the remaining 4, 1 died of pyemia, the remaining 3 of uremia due to the operation; and all of them—not only those who died but a large proportion of those who did not die—were recognised to be in a condition where any surgical interference must be a matter of the gravest moment. But when a patient's symptoms are absolutely unbearable, when they are threatening to terminate his life, there is no choice. Something must be done to relieve him, and the bare chance that he may survive the operation must be taken; for even should it hasten his death, that is better than to leave him to continued misery leading certainly to a fatal termination.

¹ Intermittent siphonage has been found useful by Dawbarn (J. Am. Med. Ass'n, 1901, xxxvii, 1231) and others in order to encourage suprapubic drainage. Better results may be expected from the method, recently introduced in France, of continuous instillation of salt solution through a retained urethral catheter.

FOREIGN BODIES IN THE BLADDER

Besides the foreign bodies¹ which find their way into the bladder through wounds, or come down the ureters (renal calculi), a host of substances have been encountered in the bladder introduced through the urethra. All imaginable articles, such as pins, beads, stones, pieces of straw, heads of grain, glass tubing, pipe-stems, pencils, portions of chalk, wax, etc., have been found in the male bladder,



FIG. 122.—PHOSPHATIC CALCULUS FORMED UPON A TWIG.

introduced there through the urethra under the influence of morbid erotic fancies. In this way substances of every conceivable description which the orifice of the urethra will admit are introduced into the canal and again extracted, until, on some unlucky occasion, the object slips beyond the grasp and remains fixed in the deep urethra or the bladder. The patient's shame will often deter him from seeking relief; the foreign body may create no disturbance at first, and so he flatters himself that everything is all right, until, sooner or later, perhaps long after he has forgotten his boyish folly, symptoms of stone arise, and this when removed is found to have formed upon a nucleus introduced from without (Fig. 122).

Not infrequently, however, a foreign body comes legitimately, as it were, into the bladder; dermoid cysts containing bones, teeth, and hair, may discharge into its cavity. The broken end of a catheter may constitute the foreign body, usually in cases where the individual is himself obliged to have frequent recourse to a catheter. The old-fashioned gutta-percha bougie has fallen into disfavour on account of its peculiar brittleness. Again, substances of all sorts—bone, seeds, etc.—may enter the bladder through fistulæ, while splinters, bullets, and bone may be lodged there traumatically.

The natural history of a foreign body in the bladder is that it

¹ Cf. Poulet, *Foreign Bodies in Surgery*, translation. N. Y., 1880, p. 145.

causes some irritation, becomes surrounded with mucus, and thus becomes a nucleus for stone. In this respect blood-clots, tumours, fragments of tumours, ulcers, and kidney stones act like foreign bodies, inasmuch as they may become centres of stone formation unless they are passed from the urethra.

Treatment.—If the foreign body be a portion of catheter or bougie, the patient will usually hasten to tell his troubles and demand relief. If, however, it be some other foreign body, he will probably demand relief from his cystitis, all the while denying any knowledge of its cause, even after the foreign body has been extracted. When the nature of the substance in the bladder has been learned, an attempt should be made at extraction, to prevent it from becoming a nucleus for stone. If there be much cystitis present, rest in bed, with demulcents and some anodyne, for several days before the operation, is advisable. Anything which will go into the urethra would come out again if it could be correctly seized and drawn upon in a correct line, with its point turned backward; consequently, an attempt should be made to reach all long bodies, such as pencils, and all small bodies by using a small lithotrite or other forceps designed for this special purpose, of which there are several varieties kept by instrument-makers. If the object be seized in a faulty diameter it may be released and caught again. This rule applies to portions of metallic catheters as well. It is exceedingly difficult to catch them correctly; soft catheters, however, are very easy to extract; they become doubled up, and may be withdrawn however caught. The difficulty in seizing a portion of soft catheter is that it cannot be felt on account of giving no click or grating against a metallic forceps; consequently, in the search for such a foreign body, the blades of the lithotrite have to be shut occasionally over different parts of the bladder surface, until the offending body is caught. Care must be exercised, of course, not to catch a fold of the bladder. The cystoscope is of assistance here.

Two substances, wax and glass, demand a special notice. The former becomes so soft at the temperature of the body that not only can it not be felt, but, if seized, can only be taken away piecemeal, and some portion is pretty sure to remain behind. As to glass and other brittle substances, the danger of injuring the bladder in attempts at extraction with forceps renders all such efforts, as a rule, unadvisable. Consequently, for all foreign bodies of wax or glass, and for all such as cannot be extracted after patient effort with the lithotrite, cystotomy should be performed, and this as early as possible, before the foreign body has had time to become encrusted with urinary salts. If for any reason the operation has to be postponed,

the bladder should be washed daily in order to retard calculous deposit upon the nucleus. Dr. Douglas, of Rondout, N. Y., in cutting a patient to extract a piece of glass, fearing that pressure with his forceps might splinter it in the bladder during extraction, devised the ingenious expedient of covering the blades of his forceps with soft molasses candy, knowing that if any of this substance was left in the bladder it would melt and pass away. The device was fully successful.

CHAPTER XXX

ANATOMY, PHYSIOLOGY, AND EXAMINATION OF THE URETER

THERE are many diseases of the ureters, such as simple and tubercular ureteritis, renal colic, and stone in the ureter, that are too intimately bound up with the diseases of the kidney to be dealt with separately. They can only be touched upon in this section of the work, but will receive more generous mention with the kindred maladies of the kidney. As a matter of fact, the chief interest of ureteral surgery centres about the various operative procedures, exploratory and plastic, to which they are subjected, and to these the subsequent chapters will be chiefly devoted.

ANATOMY

The ureter is the excretory duct of the kidney. It is a fibro-muscular tube beginning as the funnel-shaped neck of the renal pelvis and terminating at the lateral angle of the trigone of the bladder. There is normally one ureter for each kidney. Each ureter is from 35 to 40 cm. (14 to 16 inches) long. The ureter is, when empty, a closed tube like the urethra. Its physiological calibre is that of a cylinder about 0.3 cm. ($\frac{1}{8}$ inch) in diameter. The lumen of the ureter is slightly constricted at three points: (1) A distinct narrowing at a point about 2 cm. from its upper extremity, (2) a slight narrowing where it crosses the brim of the pelvis, and (3) a muscular constriction at its entrance into the bladder.

Structure.—The ureter is composed of 3 coats: the fibrous, the muscular, and the mucous.

The *fibrous* external coat runs continuously from the fibrous envelope of the kidney and its pelvis to the bladder. It is a tough, glistening, elastic tissue.

The *muscular* coat consists of an external longitudinal and an internal circular layer of smooth muscle. It is well developed in both the ureter and the pelvis of the kidney. In the calices it thins out