

ureter, to suture or tampon the wound, or to resect and suture the ureter if the injury is more severe. In any case drainage should be employed. If the ureter is injured beyond hope of repair, or if there is reflex anuria threatening the life of the patient, nephrectomy should be performed.

The ureter is frequently injured in pelvic operations, being cut or seized in a clamp or ligature. This is espe-

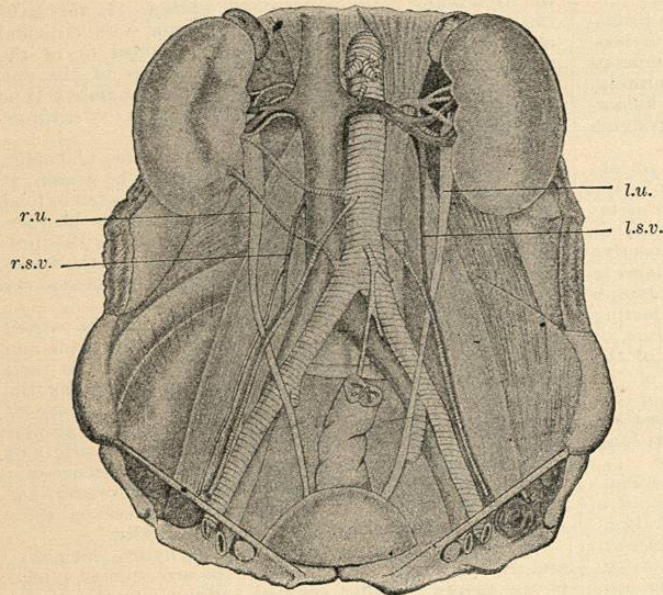


FIG. 4830.—Relations of Ureters. r.u., Right ureter; l.u., left ureter; r.s.v., right spermatic vein; l.s.v., left spermatic vein.

cially the case in operations for carcinoma of the uterus, while the tube is less often injured in operations for carcinoma of the rectum, because the regional lymph glands in the latter disease are not so near the ureters. The patient may die from ureteral infection, or from obstruction to the urinary flow, or he may recover with a urinary fistula. Long-continued pressure during childbirth may cause necrosis of the wall of the ureter and a fistulous communication between it and the uterus or vagina. Many plastic operations have been devised for curing such a fistula. They consist either in the re-establishment of the wall of the ureter, or in its implantation into the bladder higher up. Details of this operation are given in text-books on gynecology. Many operators make it a practice at the close of a difficult pelvic operation to examine the ureters so as to make sure they have not been injured. It is also a good practice in many cases to insert a ureteral probe before operation to serve as a guide to prevent injury of the ureter.

Inflammations.—Ureteritis rarely occurs as an independent disease; it forms a part of the general inflammation of the urinary tract. Gonorrhoeal inflammation of the ureter may give rise to the formation of ureteral valves and strictures. Tuberculosis changes the whole ureter into a stiff, inelastic tube. In acute inflammation the ureter is very tender, and in chronic inflammation it is thickened. Both of these conditions may be recognized by abdominal palpation in not too stout patients, and also by examination through the rectum or the vagina. Any obstruction in the ureter is of the greatest importance, since it may lead to hydro- or pyonephrosis.

There is a disease known as chronic polypoid ureteritis, in which the mucous membrane of the ureter is thickly studded with cysts.

If a renal calculus becomes blocked in its passage through the ureter a suppurative periureteritis may be

produced. The pus which forms around the ureter will soon destroy its wall, giving rise to extravasation of urine.

Obstruction.—The lumen of the ureter may be blocked by a foreign body, such as a calculus, or a blood clot, or an existing inflammation, or the effects of a previous one, or by pressure of a tumor or a focus of inflammation outside of the ureter. The best treatment is of course to remove the cause if possible.

TREATMENT.—An inflammatory condition may be treated by irrigation. Strictures of the lower end of the ureter may be dilated by metal catheters, varying in diameter from 2 to 5 mm. (0.1 to 0.2 in.).

If a ureter is ruptured by traumatism or accidentally cut across during an operation and its ends are freshened and sutured, the continuity of its lumen will in most cases be restored. If the condition is such that owing to damage of a portion of the ureter or a stricture a resection is necessary, suture at once becomes more difficult. Schopf first sutured the ureter in 1886, inserting stitches which did not puncture the mucous membrane. Bovée suggested the idea of cutting the ends of the ureter obliquely so that the resulting scar should not be a circular one. D'Antona invaginated the central end of the ureter into the peripheral one, which he split up to facilitate the operation, and then closed by suture. Van Hook inserted the central end into a lateral split in the peripheral end (Fig. 4840). The peripheral end is ligated above the lateral slit. All of the methods of suture described have been successfully employed. The methods of implantation, as shown by experiments upon animals, give the greatest safety against leakage. Unfortunately these methods may be impracticable on account of the loss of a portion of the ureter. This tube has a certain elasticity, so that direct suture may be possible, even when the loss amounts to as much as 8 cm. (3.2 in.). The nutrition of

the ureter is kept up by two small arteries which spring from the renal artery and accompany the ureter almost to the bladder; hence in isolating the ureter for the purpose of suture, it should not be peeled bare of its sur-

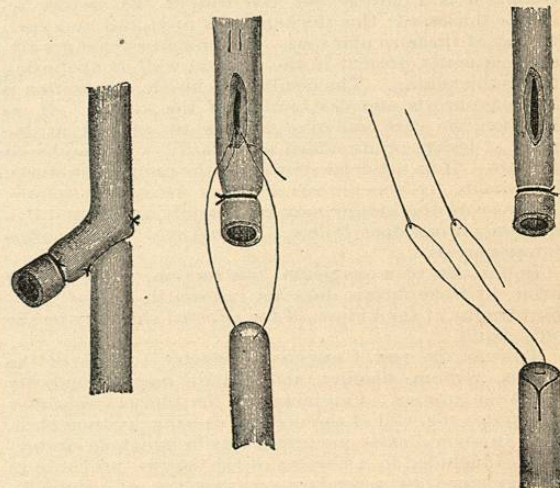


FIG. 4840 Illustrates Different Methods of Reuniting the Cut Ends of the Ureter after a Portion of the Tube has been Resected. (Van Hook's lateral uretero-ureteral anastomosis.)

rounding connective tissue. When the operation is finished, the ureter should be covered with peritoneum or other living tissue and not surrounded with gauze.

If the defect in the ureter is situated at its upper end,

it may be possible to suture the peripheral portion of the ureter into the pelvis of the kidney. If the defect is in the lower portion of the ureter, the central end may be implanted in the upper part of the bladder. Such an implantation, if possible, should be made extraperitoneally. In some cases the sutures employed have been drawn out through the urethra. Witzel and others have implanted the ureter obliquely in the vesical wall so as to prevent the back flow of urine. In most of these cases a catheter has been left in the bladder for a few days.

The ureters have several times been implanted in the rectum or sigmoid flexure, but the success of this operation is a limited one, as most of the patients have died from peritonitis or pyelonephritis or hydronephrosis.

Edward Milton Foote.

URETHANE.—By the simple title *urethane* is understood, in medicine, the body *ethyl urethane* (ethyl carbamate) $\text{NH}_2\text{COOC}_2\text{H}_5$. This compound occurs in colorless tabular crystals, soluble in water, alcohol, and ether. It has no odor and but a mild ethereal taste, producing a sensation of coolness in the tongue. Urethane operates upon the animal system as a quite pure, though not overpowerful hypnotic, without effect upon the peripheral sensory apparatus, and without untoward effects of any kind. It is used in medicine for procuring sleep, and is found fairly efficient in the more tractable conditions of insomnia. Doses of 1 gm. (gr. xv.) commonly suffice, but the drug may be required in two or three times this quantity, and such large doses have been perfectly well borne. The remedy has also been administered by hypodermatic injection. From the uncertainty of its operation, urethane has not established itself as a valuable medicine and is not official in the United States Pharmacopœia. It may be prescribed in simple aqueous solution.

Edward Curtis.

URETHRA, INJURIES AND DISEASES OF THE.—**ANATOMY.**—The urethra under normal conditions is a closed canal, averaging about eight inches in length. It is to be divided, both anatomically and clinically, into two chief parts, the anterior and the posterior urethra.

The anterior urethra is that portion which extends from the meatus to the anterior layer of the triangular ligament. This portion is on the average about six inches in length, and is itself divided into three portions, which have somewhat different clinical characteristics. The first portion extends from the meatus backward for about one-half an inch. It is somewhat wider in its central portion than at either of its extremities, and is therefore known as the fossa navicularis. The constriction at its posterior extremity is occasionally of some importance, as the point of an instrument may become arrested and its further advance prevented until a proper direction is given.

The next, or median portion, extends from the fossa navicularis backward for about three and one-half inches. It is without constriction, and may be regarded as representing the calibre of the urethra, and should in health permit the introduction of a No. 26 F. sound without stretching.

The portion of the urethra lying behind this median portion and in front of the triangular ligament is known as the bulbous urethra, or bulb. It is a more distensible and roomy portion of the urethra, and under pathological conditions or in old people may be dilated so that a pocket occurs just in front of the triangular ligament. This portion of the urethra is important because, owing to its distensibility, the floor is here readily pushed downward by an instrument advancing along the urethra until it lies below the level of the opening in the triangular ligament, and the instrument is then arrested because its point comes sharply against the ligament, and false passages are here of common occurrence. It is also to be remembered that in inflammatory conditions of the urethra the disease is apt to remain longer in this region, possibly owing to the fact that it is the most dependent

portion of the fixed urethra and infectious materials gravitate into it.

The deep urethra, or that lying between the anterior layer of the triangular ligament and the urethral orifice of the bladder, is from one and three-quarters to two inches in length on the average. It is divided into two portions: that lying between the anterior and posterior layers of the triangular ligament, or the membranous portion, and that lying behind the posterior layer of the triangular ligament and surrounded by the prostate or the prostatic urethra. The membranous portion, as its name betokens, is easily distensible, and prone to injury both from instruments and from external violence.

The prostatic urethra, or that portion lying within the prostate, is interesting chiefly as containing the orifices of the ejaculatory ducts and of the glands of the prostate. It is divided at the centre of the floor by a median elevation known as the verumontanum. This contains a furrow in its anterior portion into which open the ejaculatory ducts, and it is known as the sinus pocularis. It is believed to be the homologue of the uterine cavity in the female. On either side of the verumontanum lie the prostatic sinuses, so called, into which open the ducts of the prostatic follicles.

While the anterior urethra may be artificially considered as a straight canal, it is not so under normal conditions. The posterior, or bulbous portion, is more or less fixed in the perineal tissues, having in the erect position an almost antero-posterior direction, though rising somewhat in its anterior portion. With this the penile portion makes a sharp angle, owing to the pendulous position of the anterior urethra, and the angle so formed is commonly known as a penoscrotal angle. It is important as being commonly the seat of sensitive granulations following inflammatory diseases of the urethra, and of so-called spasmodic stricture and strictures of large calibre.

Glands of the Urethra.—The anterior urethra is plentifully provided with small glands situated in the submucous layer and opening into the urethra by ducts running forward. These are known as the glands of Littre, and are of prime importance in inflammatory conditions of the urethra.

Cowper's glands lie between the layers of the triangular ligament on either side of the membranous urethra, and open by ducts of considerable length into the bulbous portion of the urethra.

The prostatic follicles or glands, above referred to, lie among the muscular fibres of the prostate gland.

INJURIES OF THE URETHRA.

The pendulous portion of the urethra is, owing to its great mobility, little liable to injury, though it may, of course, be injured by cuts, stabs, or crushing accidents involving the whole pubic region.

The bulbous urethra is the most liable to accident, and next to that the membranous urethra.

RUPTURE OF THE URETHRA.—**Etiology.**—Injury to the urethra occurs most frequently by falls upon the perineum astride some hard object, as a beam, fence, or chair. Under these circumstances the urethra is forced against the pubic ramus upon either side, the force of the blow rarely being exactly median. The injuries taking place in this way may vary from very slight and trifling lacerations to complete transverse division of the urethra.

It may be mentioned here that another not uncommon form of injury to the urethra is from the careless use of stiff instruments, which tend to leave the urethra in the region of the bulb, especially where inflammatory processes have damaged the mucous membrane. The injury in these cases may vary from slight punctured wounds to complete transverse division, as in one case, seen by the writer, in which violent efforts to pass a silver catheter upon an old man with prostatic obstruction resulted in rupture of the bulbous urethra, with the formation of a large blood clot closely simulating conditions found in traumatic rupture of the urethra. It may in general be said that the amount of injury, particularly that due to

violence, is greater than either the signs or symptoms would indicate, and for this reason a false sense of security may lead to the neglect of patients, with considerable damage to the bulbous or membranous urethra.

Pathology (Clinical).—When any considerable rent has occurred in the urethra, the train of symptoms following is due to the extremely irritating qualities of the urine which infiltrates the tissues. The rapidity with which spreading gangrene may take place from infiltrations of this character is hardly equalled by any process seen elsewhere in the body. The direction in which the infiltration will spread depends upon the anatomical arrangement of the fasciae in this region, and is so characteristic as to require careful consideration. When rupture takes place in the bulbous portion of the urethra, infection will spread to the tissues of the scrotum and then upward through the space between the pubic spine and the insertion of the fascia into the symphysis. It will not tend to go downward on to the thigh, owing to the adhesion of the superficial fascia in the region of Poupert's ligament. Having once gained access to the front of the abdomen through the space above mentioned, it may spread upward to almost any extent. In the later stages the spread may be more atypical, owing to the breaking down of the natural barriers. If the rupture take place in the membranous portion the extravasation will follow the layers of the pelvic fascia, spreading between the fascia and the wall of the pelvis, and possibly reaching the thigh through the space on the inner side of the femoral vessels. If rupture occur in the prostatic urethra the infection will extend into the connective tissue in the pelvis between the fascia and the peritoneum, and pelvic abscess may result. Rupture of the prostatic urethra, except when due to instruments or sharp spicules of bone, in fracture of the pelvis, is almost unknown.

The most characteristic pathological phenomenon of traumatic rupture of the urethra is the formation of a blood clot. This will generally be found in the perineal region between the scrotum and the anus, and will vary from a very small quantity to an amount sufficient to cause a bulging tumor as large as an orange. At first this blood is unmingled with urine, but as the bladder becomes distended leakage will take place, and the size of the tumor may be considerably increased by additions from this source.

Rupture occurs most commonly upon the floor of the urethra, and in the more extensive cases the urethra may be completely divided, with the exception of a small strip of mucous membrane on the upper wall.

The elasticity of the tissues forming the urethra is great, and the tendency of the ends to retract is marked, but not excessive except where complete division of the urethra has occurred, when the retraction may separate the divided ends of the urethra for a considerable distance, the intervening space being filled with blood, urine, and tissue detritus.

Symptoms.—Pain is not a characteristic symptom of rupture of the urethra, and extensive damage may exist without causing severe pain except on micturition. The contact of urine with the raw surfaces is always extremely painful, but with this exception pain may be striking by its absence.

Hemorrhage.—A small amount of bleeding from the meatus is quite characteristic of damage to the urethra. This is usually seen in the form of a few drops of blood, which appear shortly after the injury, and a little intermittent oozing is likely to continue for some time if treatment is not instituted. Hemorrhages of considerable amount are extremely rare, though instances have been occasionally reported.

Retention of Urine.—This symptom is quite characteristic of rupture of the urethra. Generally the patient will be unable to empty his bladder at all, though in the milder degrees the attempt may be successful at first, and later fail on account of swelling which occurs about the injured part. This symptom, taken in connection with the slight bleeding from the meatus and the history of injury, is almost pathognomonic of rupture of the urethra.

Tenesmus.—Where the damage is sufficient to cause retention, tenesmus will always follow after a longer or shorter time. As the bladder distends, leakage takes place into the injured area, and the pain results in violent bladder tenesmus, which is likely to cause an increase of the bleeding from the meatus. This symptom, while constant, is not of great importance, as it will occur only in the presence of other symptoms sufficient in themselves to warrant the diagnosis.

Shock.—In rupture of the urethra uncomplicated by fracture of the pelvis or extensive damage to other tissues, shock is not a prominent symptom, though it may readily occur when the blow causing damage to the urethra has at the same time struck one or the other testicle with sufficient violence to cause the rather characteristic symptoms of shock from this cause. When rupture of the urethra is a complication of extensive crushing injuries involving the pelvis, shock may be a prominent symptom; but in these cases it is a symptom of injury to other tissues rather than to the urethra.

Fever.—The occurrence of fever after rupture of the urethra is not an immediate symptom. It comes only when infection of the blood clot has taken place, and is, therefore, too late a symptom to be of diagnostic value.

Treatment.—When, from the occurrence of any of the above symptoms, rupture of the urethra is suspected, an attempt should be made to enter the bladder with a soft instrument. This may occasionally be successful, but will on the whole do more to confirm the diagnosis than to prove itself of value in the treatment. The instrument will generally leave the urethra at the point of rupture and impinge upon some of the irregularities which the injury has caused. If a stiffer instrument is to be tried, the attempt must be made with the greatest care, the attendant bearing in mind the fact that he will probably fail, and that it is his duty to do no further injury to an already damaged urethra. In general it may be said that, should a soft instrument fail to find its way into the bladder, no further instrumentation should be undertaken until all preparations have been made for any operation which may be necessary to insure success, for to attempt to enter the urethra with a stiff instrument without being prepared to take the consequences should failure result, and resort immediately to a cutting operation, is little short of meddlesome surgery.

If the means for radical operation be not at hand, overdistention of the bladder may be prevented by aspiration above the pubes. This is not to be regarded as a curative measure, and will not prevent the leakage of urine into the damaged tissues, but it may contribute to the comfort of the patient during necessary delay.

The operation of election is perineal section, with evacuation of the blood clot, and if possible union of the divided ends of the urethra. There is a growing tendency among surgeons to do this operation, even in cases in which, under ether, an instrument can be made to pass. This comes from the conviction that the amount of scar tissue following the injury will be less when treated by the open method, and from the very general experience of the intractability of urethral strictures resulting from this accident.

The first step in the operation should be the attempt to pass a full-sized sound. This will probably fail, but in case of success it may be used as a guide to perineal section. If it fails it may still be used as a guide to the point of rupture. The patient should then be placed in the lithotomy position, and a median incision made in the perineum. When the blood clot has been evacuated and the bleeding, which is generally most marked from the posterior end, controlled, search should be made for the ends of the urethra. The anterior end can generally be found without difficulty, as the instrument in the urethra is a direct guide to its position; but the discovery of the posterior portion may be a matter of difficulty, or even impossibility.

We cannot here go at length into the methods of search. If, after a considerable search, the posterior fragment cannot be found, recourse should be had to retrograde

catheterization. For this purpose the bladder is opened above the pubes, as described in the section on suprapubic cystotomy. The catheter is then passed from the bladder into the wound, and the posterior fragment of the urethra can generally be located. This having been done, the further procedure is the same in either event.

It is generally thought wise to attempt to unite the divided ends of the urethra and thereby diminish the amount of scar tissue. This is best done with catgut sutures, which may or may not include the mucous membrane. When the wound has been largely closed two courses are at our disposal: either a large soft-rubber catheter may be passed into the bladder and tied in place, or it may be passed down to the point of rupture and the bladder drained with a perineal tube. In either case no further closure of the wound with sutures is indicated, and a light packing of gauze should be left in position. The rest of the treatment is so similar to that after perineal section for stricture that its further discussion will be unnecessary here.

Rupture of the pendulous portion of the urethra will be accompanied by extravasation into the tissues of the penis, with rapid swelling, oedema, and tissue necrosis, unless relieved. Incision should be prompt and free, the wound in the urethra sutured or not, according to its extent, the external wound packed with gauze and the bladder drained with a catheter.

FOREIGN BODIES IN THE URETHRA.—Foreign bodies in the urethra are of two classes: those introduced from without, either by the patient or by the doctor, and those coming down from above, as, for instance, stones which, having passed the ureter, have become impacted in the urethra and obstruct the passage of urine.

Of the foreign bodies introduced from without there are an immense variety, of which detailed account cannot be given here, and their introduction by the patient is generally due to some mental perversion. Occasionally pieces of instruments or catheters may break off and be left in the urethra. In these cases their presence is at once known and the proper measures can be taken.

Foreign bodies left in the anterior urethra can occasionally be forced out by pressure on the urethra, but such an occurrence is unusual. They may frequently be removed by the introduction of a full-sized endoscope in a good light, the body being seized with proper alligator forceps. In order to prevent it from slipping back along the urethra, which it has a marked tendency to do, the fingers of the left hand should compress the urethra behind it and prevent such slipping. In case removal by the endoscope is impossible, an external urethrotomy over the body is always proper, and the only necessary precaution is to make sure that the body is firmly held in position before the incision is made.

Foreign bodies in the deep urethra can rarely be reached by means of the endoscope. By far the most common of these bodies are urethral calculi which are too large to pass the urethra. In these cases they cannot infrequently be pushed back into the bladder by the use of a full-sized sound, and where this can be done without undue violence it will serve to relieve the retention which always exists. Once they have been pushed back into the bladder, they may be removed by the measures appropriate to stone in the bladder. When, in rare instances, they cannot be pushed back as above described, a small perineal incision or boutonnière can be made, and, with the forefinger of the left hand in the rectum, the foreign body can be grasped with dressing forceps and removed.

INFLAMMATORY DISEASES OF THE URETHRA.

Inflammatory conditions affecting the urethra may be classified under four general headings. These are: 1. Gonorrhœal. 2. Simple. 3. Syphilitic. 4. Chancroidal. **GONORRHOËAL INFLAMMATION.**—The space at our command will not permit us to digress into the interesting discussion of the relation of the gonococcus of Neisser to this disease. Suffice it to say that gonorrhœal processes are always due to the above-mentioned organism, and

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that when doubt of its presence exists the classification cannot be made with certainty. The occurrence of other organisms closely resembling the gonococcus in staining properties and morphological characteristics is now beyond question, and in doubtful cases the question can only be decided by cultures.

Pathology.—The prime characteristic of this organism, as revealed in the varying severity of the inflammations which it causes, is its affinity for mucous membranes. While the gonococci are capable of producing inflammatory processes elsewhere, these inflammations are atypical and do not show the same virulent characteristics as are observed in the urethra. Another extremely important characteristic is the liking of the gonococcus for the deeper layers of the mucous membrane and for the glandular structures lying in the submucous layer. Upon this characteristic depends the extremely unsatisfactory results of treatment, as the gonococcus, once fairly established in the deeper layers, can be reached with difficulty, if at all, and may slumber for months, or even years, in some of these obscure hiding places.

Symptoms.—Acute infection. Where an acute, fresh infection or original infection has occurred, a well-marked period of incubation will always be found, and the absence of such a period should give rise to serious doubt as to the diagnosis. Infections with other organisms of a transient, unimportant character, and so-called "flare-ups" of previous infections, will show little or no period of incubation, but a fresh infection, uninfluenced by previous conditions, will always show a well-marked period of incubation, varying from four to seven days.

The first symptom is as a rule a slight itching or smarting of the urethra accompanied by a moderate mucoid discharge. In ordinary cases this rapidly increases during the following day or two, and the patient has severe burning on urination with a profuse yellow or greenish purulent discharge. In many cases about this time a certain amount of swelling and oedema appears. This is first noticeable around the meatus, and is evidenced by a slight pouting of the urethra. This is followed by oedema of the penis—sometimes extreme—probably due to lymphatic obstruction. The lymphatics, especially upon the dorsum, are often to be seen as well-defined red marks, extending up to the region of the pubes. The glands in the groin at this time are frequently somewhat enlarged and tender. As a rule they do not go on to suppuration, and are in this way to be distinguished from the suppurating glands most commonly seen with chancroidal ulcerations. They are generally more marked upon one side than upon the other, and subside without local treatment.

In the absence of treatment the discharge and inflammatory symptoms continue to increase for from ten days to two weeks. The subsidence without treatment is a slow process, and probably in uncomplicated cases lasts for from six to eight weeks, at which time a certain proportion of untreated cases may be spontaneously cured.

The occurrence of any complications, however, may immensely protract the course of the disease, and there are some cases which have earned for themselves with some justice the title of "incurable."

Posterior Infections.—The disease starts in the anterior urethra, generally in the region of the fossa navicularis, and tends to extend slowly backward by continuity. In many cases it ultimately involves the greater part of the anterior urethra. In a considerable proportion of cases there is extension to the posterior urethra. This extension is frequently due to continuity of the process, but may undoubtedly be favored by the incautious use of instruments, or by injections, and has long been held up as an argument against the use of local treatment during the acute stages. Infection of the posterior urethra opens the way to a great variety of complications which do not belong strictly to the urethra itself; that is to say, prostatitis, seminal vesiculitis, epididymitis, orchitis, and Cowperitis. These do not fall within the scope of this article, and for their discussion the reader is referred to the sections on these conditions.

The distinction between a posterior urethritis and a prostatitis is hardly to be made, and it is probable that comparatively few cases of posterior infection occur without some involvement of the prostate. The symptoms of a posterior infection are quite different from those of an uncomplicated anterior urethritis, and it is frequently possible to decide that the infection has passed the triangular ligament. Thus, frequency of micturition is an almost unfailing symptom, and may vary from a very moderate increase to an almost persistent tenesmus. Pain is likely to be a prominent symptom, and the amount of pus coming with the latter portion of the urine will be found to be increased. Not infrequently the amount of discharge from the anterior urethra decreases at this time, and this has been held as an almost pathognomonic sign of posterior infection; but while it very generally occurs, it cannot be regarded as distinctive, and the reasons for its occurrence have not been satisfactorily explained.

Treatment of Acute Anterior Urethritis.—For many years the effort has been made by surgeons to abort this disease, and from our knowledge of the infectious agent this is theoretically possible. Practically, however, we rarely see these cases at a sufficiently early date, as symptoms sufficient to attract the patient's notice do not as a rule occur until the micro-organism has reached the deeper layers of the mucous membrane and has become relatively inaccessible. Where we have an opportunity to treat a patient, known to have been exposed, before the occurrence of symptoms, we are rarely in a position to postulate that infection would certainly have taken place, and claims of this kind are not therefore entitled to weight. Nevertheless, certain cases may be, if not actually aborted, at least cut short, and it is entirely permissible to attempt to abort cases seen within twenty-four hours of the appearance of symptoms.

The methods most generally employed are the use of antiseptic injections, or irrigations of the anterior urethra, considerably stronger than would properly be used in more developed cases or for any considerable length of time. Solutions of nitrate of silver (one to three or four grains to the ounce), of argonin and protargol (from two to five per cent.), and argyrol (from five to ten per cent.) are among the best. In order to be successful the treatment must be carried out mostly by the surgeon himself.

A fair sample of these methods is the following: A patient seen with a moderate muco-purulent discharge containing gonococci is given an injection in the anterior urethra of a solution of nitrate of silver, two grains to the ounce. This will produce a considerable burning, which will subside in from one-half to two hours. If seen in the morning the patient may be instructed to return later in the day, when an injection of the same solution, about one-half strength, may be given. He may then be given a solution of one of the silver salts of comparatively mild strength—as, for instance, a one-per-cent. solution of protargol—and told to use it himself as an interior injection, twice before the next visit on the following morning. A stronger solution of one of the silver salts, as, for instance, a three-per-cent. solution of protargol, may then be given by the surgeon, while the patient uses his own solution at noon and the stronger injection is given again at night. In the more favorable cases the discharge may be promptly checked and the gonococci will rapidly disappear, and by the end of a week the case may be in the subacute stage and run a comparatively short course.

Most cases, however, will not be proper subjects for this abortive treatment. Treatment is both general and local, and the opinion is gaining ground that both forms of treatment are of value for patients who really want to get well. This remark may seem unnecessary, but there are a considerable number of patients, more especially those seen in hospital practice, who will not give sufficiently regular attention to their disease to make its elaborate treatment worth while. These patients are, therefore, best given general treatment and not subjected to local measures until the acute stage has so far

subsided as to make treatment at very short intervals unnecessary.

General Treatment.—This includes hygienic measures and diet. It is important to advise scrupulous regard for the general health and avoidance of dissipation or excess in any direction. Alcohol must be absolutely interdicted, and we have frequently seen ginger ale do harm. Highly seasoned irritating foods, fatty, fried, or strongly acid foods are also objectionable. Smoking, except to excess, is not objectionable. The drinking of large quantities of liquids—water, or perhaps better, milk—is valuable as a diuretic, and in this connection the use of alkaline diuretics, as the acetate or citrate of potash, is useful. Careful instructions in regard to the infectious nature of the discharge and the importance of personal cleanliness should never be omitted.

Of the drugs known to have a beneficial effect upon the mucous membranes of the urinary tract the following are the chief: balsam of copaiba, oleoresin of cubeb, sandal-wood oil, salol, and urotropin.

The balsams undoubtedly have some effect upon the mucous membranes to which they are conveyed by their solution in the urine.

Copaiba is perhaps best suited to the poorer class of patients, to whom expense is important. It is likely to disagree with the stomach and not infrequently produces erythematous rashes, which promptly disappear upon withdrawal of the drug.

Cubeb is much in the same class with copaiba. It is slightly less nauseating, and in our experience somewhat less efficient.

Sandal-wood oil is the most effective, but most expensive of this group. In order to act properly it must be pure, and on account of its expense it is frequently adulterated. When given in capsules it does not often upset the stomach, and its most common unpleasant effect is pain in the lumbar region. This may be combated by the use of moderate doses of salol, but in some cases it will force the abandonment of the drug.

Salol is regarded as a urinary antiseptic, and is excreted in the urine as salicylic acid and carbolic acid. Urotropin comes much under the same heading, and acts by virtue of the formalin which it liberates. We have personally not seen good results from the use of these drugs in acute urethritis, and do not regard them as likely to appeal to the mucous membranes in the same manner as do the balsams.

Patients who cannot or will not come frequently to see the surgeon may be treated as above described, with advice and balsams, and they will probably get well somewhat more quickly than if left untreated.

Local Treatment.—This consists in the application of antiseptic and astringent solutions to the anterior urethra. It may be done by injection or by irrigation. Injections are given with a small blunt-pointed syringe, holding from one to two drachms, by means of which the anterior urethra is distended without the use of force sufficient to drive the solution into the posterior urethra. Irrigations are carried out with a soft-rubber catheter (which is advanced slowly along the urethra, washing it out continually as the catheter advances) or with a blunt nozzle, through which a considerable stream is injected into the urethra, at first with sufficient force to close the cut-off muscle. After the anterior urethra has thus been irrigated the solution may be allowed to flow back into the bladder, and is then passed, thus thoroughly washing both the anterior and the posterior urethra (Fig. 4841).

The distinctive characteristics of these two methods are that the method of injection uses small quantities and depends upon antiseptic and penetrating properties, while the method of irrigation uses solutions less active and depends upon the quantity used, in part at least, for its mechanical effect.

The solutions used for injection are chiefly the silver salts. These, with the exception of nitrate of silver, are all comparatively modern products and are to some extent still in the experimental stage. Their claims to use-

fulness depend upon the fact that they are organic salts of silver and are not precipitated, as are the inorganic. They thus have greater power to penetrate to the deeper layers of the mucous membrane, and theoretically, at least, are more likely to reach the organisms beneath. There are several of them at present which have each their ardent advocates, and we cannot undertake to discuss their relative efficiency. Argonin and protargol may be used in strengths varying from one-half to four per cent. The citrate of silver should be used saturated, which is about one to four thousand, and the newest candidate for favor, argyrol, may be used in from one to ten-per-cent. solutions. They are all less irritating than the nitrate of silver, and the evidence goes to show that their claims to attention are substantial.

Where injections are to be used they should be given at least once a day by the surgeon himself, and during the acute stage the patient should use a less powerful solution twice or three times more in the twenty-four hours. The number of injections may be decreased as the inflammation subsides. All solutions used in this way should be held in the urethra for from five to ten minutes, as in this way their efficiency is much increased.

The solutions most commonly used for irrigation are permanganate of potassium of strengths of from 1 to 3,000, to 1 to 6,000; corrosive sublimate, 1 to 10,000 to 1 to 50,000; and nitrate of silver, 1 to 4,000 to 1 to 8,000. Irrigation should always be carried out by the surgeon himself, and there can be no doubt that when carelessly used it is capable of doing great harm. We do not believe that it is a procedure which can safely be left to the patient, and think that its greatest field of usefulness is in connection with injections, the irrigation being given by the surgeon and the injection used by the patient. Since these irrigations depend for their efficiency in part upon the quantity used, this should always be considerable, and most authorities agree in advising the use of from one to three pints. If the solution prove irritating to the anterior urethra it should be diluted before it is allowed to flow back into the bladder. The method in which a catheter is employed and the urethra cautiously irrigated inch by inch, from the meatus to the bulb, care being taken to see that a free back flow is kept up, commends itself to us as being less liable to be followed by complications, and we are inclined to think that for practitioners who are not specialists this method is likely to be most generally useful.

Treatment of Acute Posterior Urethritis.—The occurrence of this form of inflammation has already been noted. When this is confined to the urethra itself the process may occasionally be headed off by the use of instillations of nitrate-of-silver (from one to five grains to the ounce), of which solution five to ten drops should be used. As a rule, however, these cases do best when not treated locally during the acute stage. For a further discussion of this the reader is referred to the pages in the article on *Prostate, The*, in Vol. VI.

CHRONIC URETHRITIS.—This name is given to the cases which, with or without treatment, continue for an undue length of time. As a rule the only symptom is a very moderate discharge, most noticeable in the morning, and the more or less constant presence of shreds in the urine. It generally is not a source of annoyance to the patient, except from the knowledge that he is not cured. It is far more to be dreaded as a source of infection than the more acute conditions, as the very mild symptoms lull the patient to a false sense of security or are overlooked through ignorance of the damage which they may cause. The treatment belongs really in the province of the specialist, and obstinate cases are likely to be a source of considerable annoyance to the general practitioner.

Continuance of the inflammation is frequently due to infection of the prostate or seminal vesicles, or to a stricture, and for a discussion of these causes the reader is referred to other sections of the present article. Another not uncommon cause is the so-called granular patches, or

granulations, in the urethra. These are small areas, most commonly found in the bulb or at the peno-scrotal angle, where the infection has persisted in the deeper layers with more or less destruction of mucous membrane. These patches can best be treated with the endoscope. An instrument should be selected as large as the urethra will accommodate without causing undue pain. This should be passed to the region of the bulb and the obturator withdrawn. Then, with a good illumination, the surgeon should follow the whole course of the pendulous urethra, drying his field from time to time with an applicator, and accurately localize any granular patches which exist. These can generally be distinguished by the different texture of the tissues and by the loss of the normal lustre. It must, however, be admitted that these granulations are more frequently found by those who are expert in the use of the endoscope than by those who use it only occasionally. The granulations should be touched with nitrate of silver, from fifteen to thirty grains to the ounce, and generally after one or two applications marked improvement will be seen.

Another common cause of a slight amount of discharge is to be found in the persistence of infection in the glands of the urethra. These can hardly be reached by local applications, and are best treated by stretching the urethra moderately with sounds or with a Kollman dilator. This should not be done more than once in five to seven days, and the urethra should be carefully irrigated with some mild antiseptic solution after instrumentation. The patient should also be given either one of the balsams or the oil of sandal-wood, which act extremely well in these chronic or subacute cases. The use of astringent washes, as permanganate of potassium, sulphate or sulpho-carbolate of zinc, and the like, is also useful, as the discharge is in part due to hypersecretion of a slightly injected mucous membrane, which will yield nicely to the use of astringents, either by injection or by irrigation.

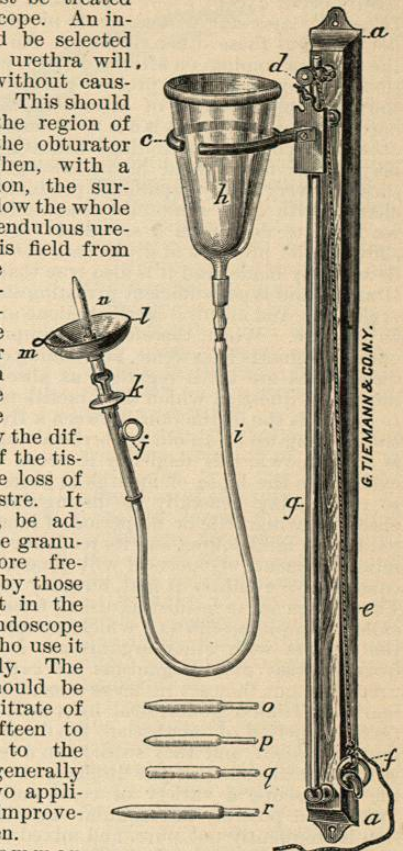


Fig. 4841.—Valentine Apparatus for Irrigating the Urethra and Bladder. The support for the apparatus is attached to the wall or to the woodwork of the room in such a manner that the bottom of the irrigator (h) is nine feet from the floor. The patient sits on a chair eighteen inches high. All irrigations are performed from this elevation; differences in the force of the stream are procured by drawing back or pushing forward the flange (k). a, a, board with brass rod (g); c, collar holding irrigator; d, pulley to raise irrigator for use or to lower it for cleaning and filling, but not for producing variations of force of stream; e, cord for drawing up irrigator; f, ring at end of hoisting cord; g, brass rod, serving as track for metal block which supports collar; i, soft-rubber tube six and one-half feet long; j, ring for fourth finger; l, shield for directing flow from urethra into basin on patient's lap; m, small ring for suspending stopcock when not in use; n, nozzle in place; o, pointed nozzle for normal meatus; p, dome-shaped nozzle for large meatus; q, flattened nozzle for small meatus; r, nozzle for irrigating female urethra and bladder.