Modern Surgery - Chapter 36. Diseases and Injuries of the Genito-Urinary Organs - Diseases and Injuries of the Bladder

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Diseases and Injuries of the Bladder

useless when employed by a novice. In using a cystoscope the mucous membrane may be burned with the lamp. This causes inflammation, and if an eschar forms it will be cast off, exposing a granulating surface. Schmidt calls attention to this injury, speaks of the condition as ulcér cystoscopîcum, says it is in the fundus, has the shape of the instrument, and heals in from fourteen to twenty-one days ("Jour. Amer. Med. Assoc.," July 19, 1902).

Disinfection of Catheters.—Metallic instruments are cleansed by boiling. Soft-rubber and elastic catheters can be sterilized by mechanical cleansing with soap and water and boiling for five minutes. The common custom of immersing a soft-rubber or elastic catheter for five minutes in a 1:2000 solution of corrosive sublimate is a useless waste of time, as such a procedure will not sterilize an infected instrument. Of course, a catheter coated with varnish or resin cannot be boiled in water or placed in steam. The best method of sterilization for woven or varnished catheters is formalin vapor. Catheters, after being cleansed mechanically, should be placed in a glass cylinder the bottom of which is perforated like a sieve. This jar is placed for twenty-four hours in the vapor of formalin. After sterilization the instruments are kept ready for use in a glass cylinder containing calcium chloride (R. W. Frank, in "Berliner klin. Woch.," No. 44, 1895). Before using, the catheters are washed in sterile water. Guyon prefers to scrub catheters with soap and water, dry them outside and inside, and place them in the vapor of sulphurous acid for forty-eight hours.

DISEASES AND INJURIES OF THE BLADDER.

Retention of Urine.—By this term is meant an inability to empty the bladder. The retention may be complete, not a drop emerging, or it may have been complete, a dribbling setting in after a time, due to paralysis of the bladder, which viscus becomes unable to contain more fluid, expulsion of the overflow from the ureters being produced by atmospheric pressure. This condition is known as the engorgement, the overflow, or the incontinence of retention. There may be partial retention from enlarged prostate, a portion only of the urine being voided. Retention may be caused by (1) obstruction, resulting from urethral stricture, hypertrophied prostate, inflamed prostate, occluded meatus, impacted calculus, urethral tumor, rupture of the urethra, perineal abscess, complete phimosis, fecal impaction and pressure from a large tumor, or by (2) defective expulsion, resulting from paralysis, disease or injury, atony, reflex inhibition, shock, muscular weakness of fevers, and the action of such drugs as belladonna, opium, or cantharides.

Symptoms.—In acute retention there is an agony of desire to urinate, the patient making acutely painful straining-efforts, during which feces are often passed. There are severe pain and aching in the abdomen, thighs, perineum, and penis. All the symptoms rapidly increase, a typhoid state is inaugurated, and death closes the scene unless relief be given. If retention is from time to time alleviated by the passage of a little water, the symptoms are slower in evolution and are less intense, and the case is said to be chronic. Some cases of gradual onset, due to atony, are very insidious, the patient feeling no particular pain and complaining only of the dribbling, which is
really the overflow of retention, and is not a sign that the bladder is success-
fully emptying itself. In any case of retention the bladder rises above the
pubes, and there is found a pyriform, elastic, fluctuating mass in the hypo-
gastrium, which mass is dull on percussion and gradually enlarges until the
bladder is evacuated or incontinence sets in. The flanks give a clear percus-
sion-note, and the tumor is more prominent when the patient is erect than
when he is recumbent. Long continuation of obstructive disease, producing
partial retention with or without attacks of complete retention, disorganizes
the kidneys. Acute and complete retention may induce rupture of the ure-
thra or urinary suppression.

**Treatment.**—Place the patient upon his back, keep him warm, and if
instrumentation does not rapidly succeed, give an anesthetic. Never attempt
to use a catheter when the patient is erect. To do so may cause serious or
possibly fatal shock. Be sure that every instrument is aseptic. In **organic
stricture** try to pass an elastic, olivary-pointed catheter (Fig. 557, a). Do not
use any force until the neck of the catheter engages in the stricture. Then
an experienced operator may warily use a certain amount of force, but never
much. When the instrument enters the bladder, draw off but half of the
urine, withdraw the instrument, wait a few hours, insert it again, and then
empty the bladder and wash out the viscus with warm boric-acid solution. To
draw off all of the urine at once is dangerous, because the sudden relief of the
pressure upon distended veins leads to bleeding from the mucous membrane
and hemorrhage into the bladder-walls. After the bladder has been emptied
the patient is wrapped in blankets, a bag of hot sand or of hot water is
placed against the perineum, and a hot-water bag is laid upon the hypo-
gastric region; when he recovers from the effect of the anesthetic he is
given suppositories of opium and belladonna, and tablets of salol and
boric acid are administered for several days. If it is found impossible
to insert a rubber instrument, make an attempt to carry a filiform bougie
into the bladder. Fig. 555 shows filiform bougies. If the stricture is
known to be organic from previous history, at once insert a filiform bougie. On this bougie, after it has been inserted, Gouley’s tunneled catheter can be threaded (Fig. 554) and carried into the bladder. Instead of carrying in the catheter, we can simply leave the filiform bougie in place, and fasten it. The filiform bougie will act as a capillary drain, and in a few hours will empty the bladder. Then insert another bougie beside the first, and so on for several days, using also opium, ordering rest in bed, and making no attempt to dilate the stricture forcibly until retention has ceased and inflammation has subsided. If no bougie can be passed, aspirate or perform cystotomy (suprapubic or perineal). In *spasmodic stricture* hold a good-sized metal catheter firmly against the face of the spasmed area; relaxation will occur and the instrument will eventually pass. Fig. 558 shows the proper curve of a metal instrument. An individual who has an organic stricture which has given but little trouble may develop attacks of retention because of inflammatory edema of the mucous membrane and spasm of the urethral muscles. These attacks are temporary, and an instrument can usually be inserted when employed as above directed. In *inflammation* give a hot hip-bath and suppositories of opium and belladonna, and then use a hot sand-bag to the perineum and a hot-water bag over the hypogastrium. If these fail or if the symptoms are urgent, pass a soft catheter. In the *occluded meatus of the new-born* incise with a tenotome. In a *congenital cyst of the sinus pectoralis* pass a steel bougie, which will rupture the cyst. In *complete phimosis* split up the prepuce. In *impacted stone* try to pull out the calculus with urethral forceps; if this fails, cut the urethra, or, in rare cases, push the stone back into the bladder. In *fecal impaction* scrape out the rectum with a spoon. In *enlarged prostate* try to pass an instrument of woven silk (Fig. 559) or an ordinary Nelaton catheter (Fig. 556) strengthened by the insertion of a filiform bougie nearly to the beak. If, however, the hypertrophied tissue enters markedly into the urethra, Mercier’s coude catheter is used (Fig. 557, b), or his double-elbowed instrument (Fig. 557, c). If all the above instruments fail, a metal instrument with a large curve may be employed, but it is a dangerous tool and one capable of inflicting grave injury. In *retention from expulsive defect* use a soft catheter (Fig. 556). Cases of retention after catheterization require warmth, confinement to bed, the administration of laxatives, free action of the skin, and the use of such drugs as salol, boric acid, urotropin, and quinin to asepticize the urine. In a few cases no instrument can be inserted in the bladder. In most of such cases aspirate—which may be done several times if necessary—and in a day or two, when swelling and congestion abate, an instrument can be passed. A small asepticized trocar or aspirator-needle is pushed into the bladder, the trocar or needle being inserted in the median line,
just above the pubes, and taking a course downward and backward. The parts are first prepared antiseptically, and the puncture is dressed with iodoform and collodion. Only half the urine is withdrawn at a first aspiration. Rectal puncture is now obsolete. The perineal incision is the one usually employed for retention. It may be done with or without a guide. In prostatic retention, not relievable by a catheter, make suprapubic drainage or do prostatectomy.

**Congenital Defects of the Bladder.** — **Exstrophy of the Bladder (Ectopia Vesicae).** — Exstrophy of the bladder is a condition of defective development commoner in males than in females. The anterior abdominal wall having failed to close, the anterior wall of the bladder being absent, and the arch of the pubes not having developed, epispadias exists, and in many cases the testicles do not descend into the scrotum. In this condition the posterior wall of the bladder projects into or beyond the gap in the abdominal wall; the urine constantly flows and renders the condition of the patient dreadful.

The only treatment which offers hope is operation, and operation often fails. If possible, operate when the patient is about five years of age. Various operations have been suggested for this condition, viz.: covering with skin-flaps; implanting the ureters into the rectum (Maydl, Albert, Roux, Simon, and others); division of the posterior ligaments of the sacro-iliac joints, bringing the arch of the pubes forcibly together, the patient wearing a support until the parts become firm, when the defect is closed in by flaps (Trendelenburg); or loosening the ureters from the bladder, drawing them down, and attaching them to the end of the penis (Sonnenberg).

**Diseases and Injuries of the Bladder.** — This viscus is so deeply situated, and the abdominal walls are so elastic, that it is rarely injured when empty. If the bladder be full and the abdomen be tense—which is common in alcoholic intoxication—force applied upon the abdomen may injure the bladder.

**Contusion of the Bladder.** — In this condition there are noted vesical hematuria, tenesmus, severe cystitis, and an impediment to the flow of water because of clots. Hemorrhage may be very severe and sepsis may arise, even causing death. When contusion exists retention is relieved by means of a clean soft catheter; if this fails because of occlusion of the eye of the catheter with blood-clot, there must, from time to time, be passed through the catheter from a fountain-syringe a solution of sodium bicarbonate in cooled boiled water. Gross's blood-catheter can be used, or the evacuator of Bigelow may be employed. The patient is put to bed, a hot-water bag is applied to the hypogastrium, morphin is administered in moderate doses, the bladder is washed out several times a day with boric-acid solution to disintegrate and remove blood-clots, and the urine is diluted and rendered aseptic by the stomach administration of salol, boric acid, and the free use of bland fluids. Hemorrhage usually ceases on relieving distention; if it does not, some more radical measure must be employed (see Hematuria).

**Wounds of the Bladder.** — Besides being contused, the bladder may be injured by bullets; by stabs or punctures through the abdomen, the vagina, or the uterus; or by penetration by a fragment of a fractured pelvic bone. The symptoms of such conditions are those of rupture of the bladder (q. v.).
In any intraperitoneal wound at once open the abdomen, suture the wound in the bladder-wall, irrigate the peritoneal cavity, and drain the bladder by means of a retained catheter, a perineal section, or a suprapubic cystotomy. In an extraperitoneal wound drain the wound by a tube, and drain the bladder by a retained catheter, a perineal section, or a suprapubic opening.

**Rupture of the bladder** occurs in three forms: (1) intraperitoneal—a rupture involving the peritoneal coat; (2) extraperitoneal—a rupture of a portion of the bladder not covered by peritoneum; and (3) subperitoneal—a rupture of the mucous and muscular coats, the urine diffusing under the peritoneal investment. The causes are of two kinds, predisposing and exciting. 

**Predisposing** causes are: distention of the bladder; drunkenness; ulceration; degeneration or atony of the bladder-coats. **Exciting** causes are: obstruction to outflow of urine (by stricture or enlarged prostate); external violence; falls upon the feet and the buttocks, as well as upon the abdomen; lifting; straining at stool, in micturition, or during parturition; and the forcing of injections into the bladder. A distended bladder may be ruptured by a concussion. The most usual cause of the injury is a crush which forces the bladder against the sacral promontory (Alexander, in "Annals of Surgery," Aug., 1901). This accident is commoner in men than in women (10 to 1), and is rare in children.

**Symptoms, Diagnosis, and Treatment.**—The symptoms are not always definite, and every characteristic one may be for a time absent, the patient seeming in some rare instances to possess the power of retaining his urine and of voiding it. As a rule, however, there are found some or all of the following symptoms, following an accident or occurring during the progress of a causative disease: collapse; excessive desire to urinate; inability to do so; a catheter, when used, brings away pure blood or a very little bloody urine; the catheter occasionally slips through the tear into the cavity, and more bloody water comes away. In some reported cases clear water has been withdrawn. If a measured amount of boric-acid solution is injected, it is improbable that all
of it can be withdrawn by the catheter, although in some cases it may all come away (Alexander, in "Annals of Surgery," Aug., 1901). Injecting fluid fails to lift the bladder into the hypogastric region so as to be recognizable on percussion. Severe hypogastric pain and rectal tenesmus come on after a temporary sense of relief from retention. Shock is so severe that death may ensue; if reaction follows, there is delirium, often septicemia and peritonitis; extensive infiltrations of urine may occur. In intraperitoneal rupture general peritonitis is certain to arise, but its appearance may be postponed for several days if the urine is healthy. In these cases the extravasation is noted as a simple swelling, probably on one side only. In extraperitoneal rupture the urine may infiltrate the perineum, the scrotum, the thighs, and under the integuments of the abdomen and the back, and may soon induce sloughing. In subperitoneal rupture peritonitis is apt to arise.

In doubtful cases pump air or hydrogen into the bladder. To insert air a bicycle pump can be used (Brown), or a Davidson syringe (Keen). Keen's directions are to insert a catheter, empty the bladder of urine, and connect to the catheter a disinfected Davidson's syringe, a mass of absorbent cotton being fastened over the distal end of the syringe. Air after it has filtered through the cotton is pumped into the bladder; an unruptured bladder will rise above the pubes as a pyriform tumor, tympanitic on percussion. A ruptured bladder will not so rise. In intraperitoneal rupture the air will pass into the general peritoneal cavity and distention will occur. In extraperitoneal rupture injection will produce emphysema of the extravesical connective tissues. On removing the syringe the air rushes out again if the bladder is unruptured, but little if any comes away if it is ruptured. Alexander considers gaseous distention unreliable, and claims that it adds to shock and disseminates infection. His rule is the wisest to follow; that is, in a case of suspected rupture of the bladder, make a suprapubic incision and inspect the prevesical space for signs of extraperitoneal rupture. If extraperitoneal rupture is not found, open the belly and explore.

Treatment.—In extraperitoneal rupture after incision down to the bladder insert a drainage-tube. In intraperitoneal rupture, place the patient in the Trendelenburg position, expose the bladder by incision, and suture the opening in the viscus.

Results.—In intraperitoneal ruptures if operation is not performed the mortality is 98 per cent. If it is performed the mortality is 49 per cent. In extraperitoneal rupture without operation there are 11 per cent. cures and with operation 30 per cent. (see Daniel N. Eisendrath, "Jour. Amer. Med. Assoc.,” Oct. 25, 1902; Samuel Alexander, “Annals of Surgery,” Aug., 1901).

Atony of the bladder is a condition in which the expulsive power of the bladder is diminished or lost because of impairment of muscular tone. The bladder is very thin, and the muscles are flaccid and often the seat of fatty degeneration. Sometimes the viscus is very large and sometimes it is very small. A slight degree of atony is physiological after middle age. The causes are senility, distention from true paralysis, chronic overdistention from obstruction, and acute overdistention.

Symptoms.—In atony of the bladder the patient passes water frequently (a symptom probably existing for some years), and especially at night; he may even do so while asleep. The stream, when voluntarily passed, has no
Vesical Calculus, or Stone in the Bladder

projection, but drops at once from the end of the penis. Residual urine exists for years and may at any time set up cystitis, and retention with incontinence is apt to occur. This condition is not vesical paralysis resulting from a lesion of the nervous system.

Treatment.—In treating atony of the bladder measure the residual urine: if it amounts to four ounces, use a soft catheter night and morning; if it amounts to six ounces, use the catheter every eight hours; if it amounts to eight ounces, use the catheter every six hours (J. W. White). The patient should be taught how to use the catheter and how to keep it sterile. (For methods of disinfecting catheters see article on page 953.) The bladder is from time to time washed out with gr. iij to the ounce of boric-acid solution at a temperature of 100° F. Strychnin, electricity, ergot, and urotropin may be ordered.

Vesical Calculus, or Stone in the Bladder.—The salts normally in solution in the urine may deposit as calculi and may be imprisoned in any portion of the urinary tract. The commonest calculi are those composed of uric acid, urates, calcium oxalate, and fusible phosphates. The formation of uric-acid and urate calculi is explained under Renal Calculus (page 939). Vesical calculi are usually renal calculi that have passed the ureter and become enlarged by new accretions. Phosphatic calculi may be formed in the bladder when chronic cystitis causes and maintains an alkaline urine. Uric-acid calculi are smooth, round or oval, and hard, but easily broken. On section they present the color of brick-dust and are marked by concentric rings. Their nuclei are dark by comparison. They are soluble in dilute potassium hydrate, and with effervescence in nitric acid. They are combustible, and leave scarcely any ash. Urate of sodium and urate of ammonium often occur together in stones, and these calculi are not in rings, are not so hard as the uric-acid stones, and are fawn-colored on section. Oxalate-of-lime stones are round, with many projecting nodes like the mulberry, hence the term "mulberry calculus." They are very hard, and section shows the color to be brown or green and that they possess wavy, concentric rings. This form of calculus is soluble in hydrochloric acid. Fusible calculus, which is composed of magnesic ammonic phosphate with phosphate of lime, constitutes the commonest form of phosphatic stone and of large stone. It is light, soft, smooth, and white, and shows no laminae on section. Some rare forms of stone are composed of xanthic oxid, cystic oxid, calcium phosphate or carbonate, and magnesium ammonic phosphate (triple phosphate).

A stone may be formed having layers of different substances; for instance, there is often found a uric-acid nucleus surrounded by phosphates, the latter surrounded by some uric acid or urates, and these again by phosphates. In some cases oxalate of lime alternates with uric acid, urates, or phosphates (Bowlby). Bowlby states that the alternating uric-acid and phosphatic layers are due to the altering reactions of the urine; that when the urine is acid uric acid is deposited on the stone, but when cystitis makes the urine alkaline the stone receives a phosphatic coat.

Anything that favors the formation of an excessive urinary deposit may cause vesical calculus, and among such causes are defective digestion, failure in processes of oxidation, excess of solids and nitrogenous elements in the diet, deficient exercise, etc. If to the urinary condition established by the above
factors catarrh of the genito-urinary tract is added, pus or mucopus in the concentrated urine may induce stone. Children are predisposed to uric-acid stones, and old people to phosphatic stones. In an old man with enlarged prostate and chronic cystitis a stone forms rapidly about any accidental nucleus. The nucleus may be phosphate-crystals glued together by mucus, a blood-clot, uric-acid gravel, or a foreign body. Stone is rare in females because of the shortness, the large diameter, and the ready dilatability of the urethra. Stone is very rare in the negro. Gout, rheumatism, lithemia, enlarged prostate, vesical atony, urethral stricture, and catarrhal inflammation of the kidney, the ureter, and the bladder are predisposing causes.

Symptoms.—In not a few cases the vesical symptoms are antedated by an attack of nephritic colic. The severity of the symptoms of stone in the bladder depends more on the roughness of the stone than on its size. A small, rough calculus will produce intolerable anguish, whereas several large, smooth stones will cause but moderate pain. A patient with stone in the bladder complains of frequency of micturition, particularly in the daytime, the desire being sudden, uncontrollable, and invoked or aggravated by exercise. This symptom is more positive in youth than in old age. Pain of a sharp, burning character is experienced at the end of micturition, due to the contraction of the empty bladder upon the stone or stones. The usual seat of this pain is the under surface of the head of the penis, a little behind the meatus, and the pain may continue for some time. By pulling on the penis to relieve this pain the prepuce often becomes pendulous. This pain varies in severity, being worse during cystitis and after exercise; it may be absent in encysted stone, it may even almost disappear, and it is always worse in the young than in the old. Stone in chronic cases of atony and in cases of vesical paralysis causes neither marked pain nor frequency of micturition.* Attacks of cystitis in a man with calculus are spoken of as attacks of stone. When a stone is small it may during micturition roll into the urethral orifice, and so cause a sudden interruption of the flow of water, the stream again starting when the patient changes his position. This symptom is rare in the old, the stone in them dropping into the sac back of the prostate and below the urethral orifice. Hematuria may or may not be noted; it is most usual after exercise, and occurs at the end of the urinary act. Pus or mucopus will be observed if cystitis occurs. Priapism occurs in some cases. Pain of a reflex nature may be felt in the rectum, in the perineum, or in some distant part.

The above symptoms, even if all are present, do not prove that an individual has a stone in the bladder. To prove the presence of a stone, it must be touched with a sound and the contact must be felt and heard. To sound a patient, have the bladder well filled with water, and place him recumbent with the knees drawn up. Never sound a person while he is standing, because of the danger of syncope. In an ordinary case in a male use a sound

with a very slight curve (Fig. 560); in a man with hypertrophied prostate use a sound with a short and decided curve. The caliber of a stone-sound is No. 13 of the French scale. The instrument is carefully boiled and anointed with lubrichondrin. Examine the entire bladder systematically, and be sure a stone is present only when contact with the sound is both heard and felt. The stone may be hard to find, or it may elude the instrument entirely when it is encysted, when it rests in a diverticulum, when it is fixed to the roof or anterior wall of the viscus, or when it is crusted with lymph or blood-clot. In doubtful cases always insist on a second examination, giving ether if the first was very painful. Occasionally a small stone will be found by using a Bigelow evacuator, the current causing the calculus to knock against the tube. Examine for stone in females with a straight sound, and in cases of uncertainty dilate the urethra and explore the bladder with the little finger. In many cases stone in the bladder may be detected by means of the x-rays. A stone, when it is detected, should always be measured by an arrangement like a lithotrite. The composition of the stone is assumed from an examination of fragments which pass by the urethra or which adhere to the measure. Remember that the outer layer of a calculus may be soft phosphate and the inner portion may be the harder uric acid, urate, or oxalate.

Treatment.—In people predisposed to stone (for instance, by lithemia) the physician should foresee the danger and essay to antagonize it. Insist on the urine being kept dilute by the freest use of water and of milk, and reduce to a minimum the amount of alcohol, meat, sugar, and fat which is taken. Let the patient live chiefly on green vegetables, salads, bread, fruit, eggs, fish, poultry, weak tea or coffee, water, milk, and, if desired, a little red wine. Continued purging does harm by concentrating the urine, though a laxative may be employed when indicated. Moderate open-air exercise is of immense importance, sunshine and fresh air being Nature's correctives for a condition of imperfect oxidation power. If the urine be very acid, use piperazin, gr. xv to gr. xx daily, liquor potassii citratis, phosphate of sodium, or borocitrate of magnesium. If the urine be phosphatic, order mineral acids and strychnin, or what seems to be very efficient, urotropin. Urotropin is given in gr. v capsules four times daily. If the urine be filled with oxalate, use the mineral acids with an occasional course of phosphate of sodium. Travel and rest at the seaside or at some Spa are often of service in all forms. Always endeavor to prevent cystitis, and treat it promptly when it does occur. When a stone is once formed it is an idle dream to think of dissolving it. An operation must be done. The operation selected depends upon the age, the state of the bladder and the prostate, the dilatability of the urethra, the kidney condition, the size and composition of the stone, and the number of calculi present (see Operations on the Bladder).

Cystitis.—Inflammation of the bladder is, as a rule, a complication of some other disease of the genito-urinary tract, but it may arise from cold and wet. Traumatism from a catheter, the presence of a stone, the spread of a urethral inflammation, pus infection, the existence of tuberculosis or cancer, and the use of such a drug as cantharides, may produce it. It appears not unusually during an exanthematous fever or in conditions of vesical paralysis; it often follows retention, frequently accompanies enlarged prostate and urethral stricture, and sometimes arises from concentration of urine
or accompanies bladder growths. Acute cystitis causes discoloration and swelling of the bladder-walls, and there is present a catarrhal discharge which is mixed with urinary elements, serum, mucus, often pus and epithelial debris. Ulceration, sloughing, or false-membrane formation may occur. Chronic cystitis is an inflammatory condition always due to bacteria. We frequently speak of a chronic cystitis as due to stone in the bladder, hypertrophy of the prostate gland, or tumor of the bladder. These conditions do not cause chronic cystitis, but act by rendering the bladder vulnerable to micro-organisms. Among the causative organisms we may mention the bacillus coli communis, the gonococcus, the bacillus tuberculosis, the bacillus typhosus, and the various pyogenic bacteria (Leonard Freeman). These bacteria may gain entrance on instruments; or by way of the ureter, urethra, the lymph-vessels, and possibly in rare instances by the blood.

In chronic cystitis there is an enormous production of thick, sticky mucus and the urine becomes alkaline. The excessive secretion of mucus and the great number of bacteria convert the urea into carbonate of ammonium, and this product, being irritant to the bladder-walls, makes the inflammation worse. In chronic cystitis the bladder is contracted and has very thick walls, and the mucous membrane is thick, edematous, congested, and filled with large veins. The bladder may be ulcerated or encrusted with urinary salt. The urine contains bacteria, triple phosphate, pus, blood, and mucus, the blood emerging with the last drops of water. Pyelitis may arise as a result of chronic cystitis.

**Symptoms of Acute Cystitis.**—Great frequency of micturition, with the passage at each act of a very small quantity of urine; the desire to urinate is almost constant, and there is intensely painful straining (tenesmus). The pain is acute and scalding, and may be felt above the pubes or in the perineum; it often runs into the loins and the thighs and radiates over the sacrum. Pain above the pubes indicates involvement of the fundus, and pain in the perineum and in the head of the penis points to inflammation of the bladder-neck. The urine, at first clear, loses its transparency, becomes full of thick mucus, and often contains a little blood or pus. The patient not unusually has some fever. A rectal examination causes violent pain. If ischuria takes place, there will be a chill and high fever, and anuria may occur or vesical rupture may ensue.

**Treatment.**—In treating acute cystitis endeavor to remove the cause. By allaying an irritation or removing an obstruction the bladder will often become able to empty itself of retained urine, which urine causes congestion of the bladder and thus renders infection probable or may be itself filled with bacteria. If cystitis arises from the administration of cantharides, put the patient in bed and give him liquor potassii citratis. If it comes from the use of a clean sound, order rest in bed, suppositories of opium and belladonna, diluent drinks, and ammonii benzoas or lupulin. If the inflammation is septic (as from the use of a dirty sound), or is very acute, put the patient in bed, keep him warm, and use a hot sand-bag to the perineum and hot fomentations or poultices to the hypogastrium. Hot hip-baths may be used. The hips should be elevated and the bowels should be emptied by the administration of salines and by glycerin enemata. An exclusive milk-diet is desirable. The patient should drink copiously of sweetened water containing a
Symptoms of Chronic Cystitis

Symptoms of Chronic Cystitis.

Symptoms of Chronic Cystitis.—This condition may be a legacy from acute cystitis or it may appear without any acute precursory phenomena. There will be found frequency of micturition, but not so great as in the acute form. There will be slight tenesmus, and moderate pain from time to time, running toward the head of the penis. Constitutional symptoms arise only when kidney-damage has become pronounced or sepsis has occurred from absorption. The urine is ammoniacal, fetid, and turbid; it is filled with viscid, tenacious mucus or with mucopus; it contains a great excess of phosphates, and occasionally clots of blood. The condition of chronic cystitis with the production of immense quantities of thick mucus is often called "chronic catarrh of the bladder." Chronic cystitis may eventuate in the formation of stone or in the production of serious disease of the bladder, the ureters, and the kidneys. It often occasions retention.

Chronic Tuberculous Cystitis.—Chronic cystitis may be due to tuberculosis. Primary tuberculosis is very uncommon. Most cases of vesical tuberculosis are secondary to renal tuberculosis or to tuberculosis of the prostate, seminal vesicles, or epididymis. Some cases come on suddenly,
many tubercle bacilli being found in the urine. In many cases no tubercle bacilli are found. The tuberculous products caseate and ulcers or fibrous organization take place. A cystitis for which no cause can be found, and which is accompanied by pyuria and severe and lasting pain, is possibly tuberculous. Pyuria is usually present, but in some cases the urine is perfectly clear. In some cases the patient has painful paroxysms of varying duration and feels well between the attacks. The urine seldom contains the bacilli of tubercle. Finding tuberculosis, if of the kidney, prostate, vesicle, or epididymis, increases the probability that tuberculous cystitis exists. The diagnosis is made by the cystoscope. Tuberculous ulceration is most common in the trigone and about the inner orifice of the urethra. A tuberculous ulcer is small. The adjacent mucous membrane is not inflamed, but contains grayish-white nodules (Louis E. Schmidt, in "Jour. Amer. Med. Assoc.," July 19, 1902).

Treatment.—In treating chronic cystitis remove the cause, if possible (get rid of a stone, evacuate residual urine frequently, dilate a stricture, and remove a tumor). For chronic cystitis certain remedies are taken by the mouth. Water is drunk in large amounts, also iron spring-water (Marienbad, etc.). Salol and boric acid, gr. v of each four times a day, are very valuable. Salol in fluid extract of triticum repens does good; so does chlorate of potassium, gr. x daily. Either borocitrate of magnesium, quinin, or salicylate of sodium with benzoic acid may often be used with benefit. Alum, tanaic acid, uva ursi, copaiba, cubeb, buchu, and turpentine have all been recommended, and possibly may be of some benefit. Urotropin is useful in many cases. This drug prevents the development of bacteria in the urine (Nicolaier), and antagonizes the tendency to sepsis and urinary poisoning. It is given in 5-grain capsules, from four to six being given daily. Whatever remedy is used, see that the bowels move once a day, and that the skin is active. Champagne and beer must be avoided. If residual urine gathers, a soft catheter must be regularly employed. If it is possible to introduce a catheter of considerable size, catheterization may be all that is needed in the case. In some cases of chronic cystitis the retention of a catheter from three to five weeks is of the greatest service. If the case is very severe, the bladder must be washed out daily with peroxid of hydrogen (25 to 40 per cent. solution), nitrate of silver (1 : 8000), boric acid (5 to 10 per cent.), carbolic acid (1 : 500), corrosive sublimate (from 1 : 5000 to 1 : 20,000), or permanganate of potassium (1 : 4000). If nitrate of silver or permanganate of potassium is used, first rinse out the bladder with distilled water. If any other agent is used, first wash out the bladder with either boiled water or distilled. The daily injection of a 2 per cent. solution of ichthyol may prove useful. Some surgeons occasionally employ, at intervals of a number of days, strong silver solutions (30 or 40 grains to the ounce). If a strong solution is used, after the drug flows away wash out the bladder with a solution of common salt. The bladder is usually washed out by attaching to the free end of a soft catheter, the other end of which is in the bladder, a tube which is connected with a graduated bottle, the force being obtained by elevating the reservoir (fountain irrigation). The bladder can be irrigated without using a catheter, the resistance of the compressor muscle of the urethra being overcome by the pressure of a column of water. The reservoir is raised to the height of six feet. The patient sits
in a chair. The tube of the reservoir has upon it a clamp to control the flow, and in its end a large bulbous tip which will fill the meatus (Valentine's instrument). The tip is inserted into the urethra, the clamp on the tube is loosened, and the patient is directed to take a deep inspiration. In a short time the bladder fills with water, the tube is removed, and the patient empties the viscus naturally. In some cases it is necessary to wait quite a while for the column of water to tire out the muscle. If the fluid will not enter, direct the patient to make efforts as in micturating, the pressure of the fluid on the anterior surface of the cut off muscles being kept up. If this fails direct him to urinate, and then the surgeon makes another attempt to get the fluid to enter. After a little practice a patient learns how to admit the fluid.

In tuberculous cystitis Collin advises the instillation of 30 minims of the following mixture into the bladder and posterior urethra: 5 gm. of guaiacol, 1 gm. of iodoform, 100 gm. of sterile olive oil. About 30 minims of this are injected once a day. If the cystoscope discloses an ulcer and the kidney is tuberculous, it is useless to operate on the ulcer until operation has been performed on the kidney. Sometimes curetting through a cystoscope is useful. In other cases the bladder must be opened, curetted, and drained. In ordinary non-tuberculous cystitis he uses a 1 per cent. solution of guaiacol carbonate in oil.

If the ordinary methods of treatment fail to cure chronic cystitis, if the bladder resents catheterization and irrigation, if in spite of irrigation the urine does not become clear, and if there are evidences of infection of the patient and breaking down of his general health, drain by perineal or suprapubic cystotomy and through the incision wash the bladder frequently and thoroughly. If the persistent cystitis is due to stricture which dilatation fails to cure, perform external perineal urethrotomy and employ perineal drainage.

Ulcer of the Bladder.—May be due to injury, cystitis, tuberculosis, malignant tumor, or gonorrhea. A form of ulceration particularly common in anemic women is a solitary, punched-out ulcer (Louis E. Schmidt, "Jour. Amer. Med. Assoc.," July 19, 1902). Ulcers may be single or multiple. Perforation may occur.

A perforation may occur into the peritoneal cavity or into the perivesical cellular tissue. In the former case, after the onset of marked hematuria, there are shock, abdominal pain, and peritonitis. In the latter case there is extravasation of urine or abscess-formation.

Tuberculous ulcer is discussed on page 964.

Schmidt ("Jour. Amer. Med. Assoc.," July 19, 1902) points out that gonorrheal ulceration is apt to be multiple, and causes severe pain and bloody, turbid urine. As a rule, when the bladder is ulcerated, the urine contains blood, blood-clots, or tissue débris, but the urine may be clear when there is a tuberculous ulcer or solitary ulcer (Schmidt, in previously quoted paper).

Diagnosis is usually made by the cystoscope. In some cases it is made by exploratory suprapubic incision.

Treatment.—If there is one ulcer, or if there are a few ulcers, curet through an operating cystoscope (Schmidt), use irrigations, and keep the urine aseptic. In widespread ulceration perform suprapubic cystotomy, curet the diseased mucous membrane, and insert a drainage-tube. In some cases of malignant
Tumors of the Bladder.—Tumors of the bladder may be either innocent or malignant; the latter being the commonest. Innocent tumors which may arise from the bladder are papillomata or villous tumors, mucous polypi, and fibrous polypi; malignant tumors are sarcoma (rare) and carcinoma (encephaloid, rare; epithelioma, common).

Symptoms.—The innocent tumors rarely cause cystitis or irritation, though by obstructing the ureters or the urethra they may induce disease of the kidneys. Often hemorrhage is the only phenomenon produced by a papilloma or a mucous polyp. Malignant tumors cause cystitis, and the urine contains mucus, blood, and pus. Innocent tumors are felt with difficulty with the sound, but malignant tumors are easily felt. In some cases a tumor can be detected by a bimanual examination (a finger in the rectum and the fingers of the other hand on the abdomen). Make a careful study to determine whether or not a growth has infiltrated the prostate, the seminal vesicles, the rectum, or the perivesical tissues. The bleeding in bladder-growths is apt to be profuse, and it occurs intermittently. Bleeding follows the use of a sound. There may be difficulty in starting the stream in micturition, or there may be interruption or "stammering" of the stream. The urine should be examined microscopically to see if it contains villi, portions of fibroma, colonies of cancer-cells, or fragments of epithelioma (White). A cystoscope should be employed in order to reach a diagnosis. In doubtful cases exploratory suprapubic cystotomy is advisable.

Treatment.—Complete extirpation has been performed by Bardenheuer and others. It is usually done in two stages, in the first operation the ureters of a man beingtransplanted into the rectum, the ureters of a woman into the rectum or vagina. About three weeks later the bladder is removed. The complete procedure has been carried out successfully at one operation (Tuffier and Dujarier, "Rev. de Chir.," April, 1898). The operation of complete extirpation is of questionable value. As a rule, a surgeon contents himself with suprapubic cystotomy, removing the growth (Fig. 567), and if removal is not possible, with drainage. The perineal operation only enables the surgeon to reach and remove growths of small size, pedunculated growths, and growths near the neck of the bladder. (See Operations on the Bladder.) Chismore has suggested the removal of polypoid growths by means of Bigelow's evacuator. When the growth catches in the eye of the instrument it is torn off by slight traction and gentle rocking, and the suction which is being made carries it into the reservoir. Henry Morris lays down the following rule: "When an infiltrating growth is felt, per rectum or per vaginam, or with the sound, to be involving a large surface of the bladder-wall, to be infiltrating its coats, especially in the neighborhood of the ureters and neck of the bladder, no operation whatever should be proposed unless the hemorrhage is copious or the symptoms of cystitis severe, and then an incision for palliative purposes only should be made" (Treves's "System of Surgery").

Operations on the Bladder.—Lateral Lithotomy.—Lithotomy is the removal of a stone from the bladder. Lateral lithotomy is an operation which is every year becoming less popular, but which is still employed by many famous surgeons, especially for stone in children. This operation
 Operations on the Bladder

should not be performed if the stone is over two inches in its short diameter; it is rarely justifiable if the stone weighs three ounces or more (Cage); and it must not be performed for encysted stone, or on a person with a deep perineum, a narrow pelvic outlet, or an enlarged prostate. For one week before the operation keep the patient in bed, wash out the bladder daily with hot boric-acid solution, and administer salol and boric acid by the mouth, gr. v of each four times a day. The night before the operation give a saline, order a hot bath, and have the perineum, the scrotum, the buttocks, and the inner sides of the thighs cleansed and dressed antiseptically. In the morning an enema is to be given. At the time of operation the bladder should contain several ounces of boric-acid solution. The instruments required are a lithotomy knife, a straight probe-pointed bistoury, a grooved staff, a stone-sound, stone-forceps and scoops, a tenaculum, an aneurysm needle, a fountain syringe, curved needles and a needle-holder, hemostatic forceps, a tube with chemise (Fig. 125), a Paquelin cautery, a Clover crutch, and a lithotrite.

Place the patient upon his back, anesthetize him, and find the stone by sounding. If the stone is not discovered by the sound, do not operate. Place the buttocks so that they project beyond the edge of the table, introduce the staff into the bladder, flex the legs and thighs, and fasten the patient in the lithotomy position with a crutch. During the first incision the handle of the staff is held toward the belly; after the first cut the staff is set perpendicularly and is hooked up under the pubes. An incision is made, starting just to the left of the raphé of the perineum and one and a quarter inches in front of the edge of the anus, and passing downward and outward to between the anus and the ischial tuberosity, but one-third nearer the former than the latter. In the adult this incision is three inches long. The first incision is superficial and does not reach the staff, but it is this incision which may cut the rectum. After making the first cut the nail of the left index-finger feels for the groove of the staff, the staff is hooked up, the knife is entered into the groove and is pushed into the bladder, and as it is withdrawn the wound is enlarged. As the knife enters the bladder there is a gush of fluid. The finger follows the knife and stretches the wound, the staff is withdrawn, and the stone is felt for and extracted with forceps. Liston showed years ago the value of keeping the finger in the wound. This maneuver retains some water in the bladder, and as a consequence causes the stone to rest at the lowest part of the viscus, and when the forceps are introduced they at once come upon the stone. In withdrawing the stone make traction in the axis of the pelvis, and do not rotate the calculus until it is entirely out of the prostatic urethra. Wash or scrape away débris or incrustation from the wall of the bladder, see that no other stone is present, syringe out the viscus with warm salt solution, insert a tube, apply antiseptic dressings around the tube, and put on a T-bandage. The end of the tube which is external to the dressings is fastened to the tails of the T-bandage. A rubber cloth is put on the bed, under the body and legs, and the patient's buttocks rest upon a mass of old linen, the scrotum being raised on a pad. The knees are bent over pillows. Change the linen as soon as it becomes wet. Remove the tube in forty-eight hours. The urine begins to come by the urethra from the eighth to the twelfth day. In children the incision is not so long, it is dilated with forceps instead of with the finger,
and no tube is required. In lateral lithotomy the prostatic and membranous portions of the urethra are opened, the prostate gland is partly divided with the knife, and the wound is dilated with the finger. One objection to the operation is that it is possible to cut the rectum, and another is that inflammation may occlude the ejaculatory ducts.

**Suprapubic Lithotomy.**—This operation is the removal of a stone through an opening above the pubes. It is in many instances the preferable operation. The mortality of this operation is higher in children than that of lateral lithotomy; in adults and in individuals beyond middle life the mortality is decidedly less than is that following the lateral operation. It is used for the removal of multiple calculi, for very hard stones, for stones above one and a half inches in diameter, for calculi in men with enlargement of the prostate, for foreign bodies incrusted with sediment, when the perineum is deep, when the pelvic outlet is narrow, for encysted stones, for calculi associated with a vesical tumor, and when the urethra will not permit the use of a lithotrite. The patient is prepared as for lateral lithotomy, except that the pubes are shaved, and the lower part of the abdomen and the upper part of the thighs are disinfected. During the operation the penis is wrapped with a piece of antiseptic gauze. The instruments required are a scalpel, a probe-pointed bistoury, scissors, a tenaculum, blunt hooks, hemostatic forceps, retractors, dissecting forceps, a dry dissector, an electric forehead-light, a rectal bag, a brass syringe or a bicycle pump, a sound, rubber tubing, rubber catheters, stone-forceps and scoops, a bladder-tube, curved needles and a needle-holder, and a graduated glass jar for injecting the bladder.

In performing the operation place the patient in the Trendelenburg position. It is necessary to distend the bladder and raise it in order to have the prevesical space uncovered by peritoneum. Have an assistant oil the rectal bag and push it above the sphincters. Draw off the urine with a soft catheter, wash out the bladder with warm boric-acid solution (gr. iij of boric acid to $\frac{3}{2}$ of water), and inject the bladder with the same solution. In a child under the age of five inject three to four ounces; in an adult inject ten to twelve ounces. Withdraw the catheter and tie a tube around the penis to prevent the escape of fluid. After injecting the bladder with fluid, if the viscus is not well lifted, inject the rectal bag with water and clamp its tube with forceps. In a child inject from two to four ounces of warm water into the rectal bag; in an adult inject ten ounces. Bristow suggested the injection of air into the bladder. Some surgeons simply inject air by means of a catheter and a brass syringe or a Davidson syringe. If air is injected, a rectal bag is not used, and the patient is placed on his back rather than in the position of Trendelenburg. The best method of injecting air is that of F. Tilden Brown, by means of a bicycle pump. A catheter is introduced, the bladder is washed out, the catheter is fastened to a bandage, the bicycle pump is attached, the operation is proceeded with, and when the transversalis fascia is exposed the bladder is filled with air, the soft catheter is clamped, and the bladder is opened.* Make a three-inch longitudinal incision in the median line of the hypogastric region, terminating over the symphysis. When the prevesical connective tissue is reached, cut it. If the peritoneum should appear, push it up. Hold the wound-edges apart with retractors. The large veins are

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seen, giving the bladder a blue color. Avoid these veins if possible, but even if they should be cut bleeding will usually cease when the bladder is opened and the rectal bag is removed. Clamp bleeding vessels; catch the bladder transversely with a tenaculum at the upper angle of the wound; open the viscus in the middle line above, and cut toward the pubes; catch the edges of the bladder with hemostatic forceps, and remove the tenaculum. Explore the bladder, remove the stone or stones, scrape away incrustations, ligate bleeding vessels outside the bladder, and irrigate the viscus with hot saline solution. Introduce a tube into the bladder, and attach to its external end a long tube to siphon off the urine. The bladder can be drained very satisfactorily by Keen's siphonage apparatus (Fig. 56t). Suture the muscles and fascia at the upper part of the wound. Dress with dry antiseptic gauze and a rubber-dam, the dressings and binder being split to go around the tube. Catch the urine which siphons over in a bottle containing some antiseptic fluid. Change the dressings as often as they become wet. Take out the tube in four or five days, and allow the wound to heal by granulation. The patient may get up in two weeks. Many Continental surgeons advocate immediate suture of the bladder after incision. Albert, Vincent, Bassini, DeVlaccos, and others advocate immediate suture. The suture material should be silk or catgut. After suture a catheter is kept in the bladder to drain the viscus. Immediate suture may be employed in patients of any age, but should not be used if the urine is very septic or if pyelonephritis exists. In some cases the attempted closure will fail; in others it will only partially succeed; in many it will prove successful; but even if it only partially succeeds it will tend to prevent dissemination of urine in the prevesical cellular tissue. The chief causes of death after suprapubic lithotomy are septicemia, secondary hemorrhage, cellulitis, peritonitis, and suppression of urine. J. W. White estimates the relative mortality of suprapubic and lateral lithotomy as follows: In children the suprapubic operation gives a mortality of 12 per cent., the perineal of 3 per cent. In adults the suprapublic gives a mortality of 12 per cent., the perineal from 8 to 12 per cent. In old men the suprapubic gives a mortality of 25 to 30 per cent., the perineal 30 to 40 per cent.

**Crushing of Vesical Calculi.**—This is now done in one sitting, the old operation of Civiale, which required repeated crushings, being obsolete.

**Litholapaxy** (Bigelow's operation, or rapid lithotrity) is the operation for removing a stone from the bladder in one sitting by thoroughly crushing
the stone and completely washing away the fragments. This operation is wonderfully successful if done by an expert. Few of us do it sufficiently often to learn how to perform it with great rapidity, certainty, and safety. It is the best operation in most cases, if performed by a very skilful man. It is the operation in the majority of cases for even the general surgeon to select, but the general surgeon will have better results in certain difficult cases after suprapubic lithotomy than after litholapaxy. Sir H. Thompson says this method is suited to twenty-nine cases out of thirty. Litholapaxy should be employed if the bladder will hold at least four ounces of fluid and is in a fairly healthy condition; if the urethra is tolerant and penetrable by instruments; if the stone is not too hard, does not weigh over two and three-quarter ounces, and is not over two inches in diameter. It is not suited for multiple calculi, for large and hard calculi, for encysted stones, or for a patient with marked enlargement of the prostate gland, with vesical atony, or with cystitis. An easily dilatable stricture need not prevent the surgeon doing litholapaxy. The stricture can first be dilated, and later Bigelow's operation can be performed, but firm, gristly strictures demand a cutting operation. If the urethra is intolerant of instrumentation, the patient being prone to febrile attacks when it is attempted, cut instead of crushing. An individual laboring under kidney disease will do better after this operation than after cutting (Cage). In diabetes, locomotor ataxia, and conditions of exhaustion patients are best treated by Bigelow's operation, unless cystitis exists.

The Indian surgeons have had the most admirable results from litholapaxy. It has often been claimed that such results were due to racial peculiarities of the patients and various factors regarding their habits, diet, etc. The fact, however, that some of these very surgeons have returned to England
and repeated their successes in London, shows how large a part masterly dexterity played in obtaining success.

J. A. Cunningham * reports upon 10,073 Indian cases of litholapaxy. The mortality was 3.96 per cent.

Cabot, of Boston, in 116 cases had but four deaths, and two of these were due to pneumonia.

The preparation of the bladder is the same as for lithotomy. Be sure to measure the stone, and to ascertain also whether a lithotrite can readily be introduced and manipulated. The instruments required are a stone-sound, lithotrites (several sizes, Figs. 563–565), an evacuating bulb and tubes (straight and curved, Figs. 562, 566), soft catheters, a glass irrigator to inject the bladder, and instruments in case the surgeon is forced to cut. The patient is anesthetized and is placed upon his back, a pillow is inserted under the pelvis, and he is well wrapped up. The urine is drawn and a measured amount of warm boric acid is allowed to flow into the bladder. This

972 Diseases and Injuries of the Genito-urinary Organs

plan is better than having the patient retain his urine, as in the latter case there is no certainty as to the amount of fluid in the viscus. It is well to introduce at least five or six ounces of fluid, if possible. If the bladder will not hold four ounces the operation is unsafe (Thompson). The lithotrite, preferably the instrument of Forbes (Fig. 565), is now introduced, the handle being gradually raised to a vertical position as the penis is drawn up on the shaft, but not being depressed until the instrument has passed by its own weight into the prostatic urethra. Thompson's plan for catching the stone is as follows: After introducing the lithotrite, let its lower end rest for a few seconds on the bottom of the bladder, so that currents will subside; then draw back the male blade, wait a moment, close the blades, and in almost every instance the stone will be caught. If the stone is caught, press firmly to see that the calculus is well held, lock the instrument, and break the foreign body by screwing. When resistance suddenly ceases the stone has either slipped or has been crushed; if crushed, the blades should have been felt forcing through the stone and the calculus should have been heard to break. When resistance ceases catch and crush again as above directed. Rapid movements with the lithotrite are improper, as they establish currents which are apt to push away the stone. If the above maneuver does not catch the stone, see if the calculus be near the neck of the bladder. Pull the instrument close to the vesical neck, and open it, not by pulling the male blade, but by pushing the female blade. If the operator still fails to catch the stone, or if, after crushing, a large fragment knocks against the evacuator, which fragment cannot pass, conduct a careful search: turn the blades to the right side, open, and close; then to the left side, open, and close; next turn the point around behind the prostate and open, and close. After making a side search with the lithotrite, turn the instrument very slowly, so as to detect the catching of the bladder-wall if it has occurred, and crush the stone in the middle of the bladder with the blades up. After crushing several times, proceed to evacuate. Fill the aspirator with warm saline fluid. Insert an evacuating catheter, its point being in the center of the bladder, let the fluid and fragments run out, and attach the aspirator to the catheter; turn the valve, and compress and relax the bulb so that an ounce or more of fluid is forced in at each squeeze, the compression coinciding with expiration. The débris falls into a bulb, and the pumping is continued until the fragments cease to pass, whereupon the point of the catheter is pushed against the floor of the bladder and another trial is made. If fragments which cannot gain exit are felt knocking against the tube, withdraw the evacuator, crush
again, and again use the aspirator. When no more débris comes away and no more fragments are felt, withdraw the tube and carefully sound the bladder. Keyes advises the operator to seek for a final fragment by listening with a stethoscope while pumping at the bulb and searching the bladder with the tube. This operation will rarely occupy over forty minutes, though Bigelow has protracted it for three hours, the patient recovering. A serious complication is severe bleeding, due to damage done with the instrument or to the presence of a tumor which easily bleeds. The injection of moderately hot water or of adrenalin solution (1 : 10,000) usually checks hemorrhage, but if bleeding is dangerous in amount the operation of litholapaxy should be abandoned and suprapubic lithotomy be performed.

If clogging of the lithotrite with fragments occurs, forcible pushing of the blades together repeatedly will probably amend it; but it will never happen if the surgeon uses a proper form of instrument. A lithotrite with a fenestrated blade will not lock. Forbes's lithotrite is a very powerful instrument, the blades of which will not lock. If the blades of a lithotrite should become forcibly and hopelessly locked, make a perineal section, clear out the blades, close them, and then withdraw the instrument.

After-treatment.—Put the patient to bed, apply a bag of hot water to the hypogastrium, and give him a hypodermatic injection of morphia as he recovers from ether. Give a hot hip-bath every night, and administer liquor potassii citratis in moderate doses every day. If urethral fever occurs, use quinin and morphia, wash out the bladder several times daily with warm boric-acid solution, and tie in a rubber catheter. If retention occurs, use the catheter. If cystitis appears, treat as in an ordinary case. The urine ceases to be bloody in two or three days, and the patient may get up in a week.

Litholapaxy in Male Children.—It was considered until quite recently that a child, because of the small size of its bladder, the small diameter of the urethra, and the readiness with which the mucous membrane is lacerated by even slight violence, was a bad subject for crushing. Lateral lithotomy is known to be eminently successful when performed upon children. The elder Gross did this operation upon 72 children with only 2 deaths. Keegan, however, has persuaded the profession that rapid lithotrity is perfectly applicable to children: He shows that the bladder of a child of even less than two years of age is quite large enough to allow the surgeon to manipulate an instrument; that the mucous membrane is in no danger if the operator be careful, and that the urethra is by no means so small as was supposed. The urinary meatus must often be incised, and after doing this, Keegan states, there can be passed in a boy of from three to six years a No. 7 or 8 lithotrite (English), and in a boy of from eight to ten years a No. 10 or even a No. 14. It is, however, just to state that the operation is more delicate than a like procedure on older persons, and that no one is justified in doing it who has not had considerable experience in adult cases. Furthermore, it should be noted that Keegan's mortality by this operation has been 4.3 per cent., while Gross's mortality from lateral lithotomy on children was 2.67 per cent.

Special points of litholapaxy on male children are as follows: use well-fenestrated lithotrites; have a stylet to punch out the fragments blocking the evacuator; and crush the stone to a fine mass. There can usually be employed a No. 8 lithotrite and a No. 8 evacuating-tube (English scale).
Perineal Lithotrity (Keith’s Operation).—This operation is employed by some surgeons in dealing with very hard or very large calculi in male adults, or in cases in which it is impossible to introduce a lithotrite into the bladder. Keith’s operation consists in opening the urethra from the perineum, passing a lithotrite through the wound, into the urethra and along the urethra into the bladder, and crushing the stone, introducing an evacuator and removing the fragments. In Keith’s operation the incision is median, and opens the membranous urethra. In very large stones, Milton thinks the surgeon should open the bladder as in ordinary lateral lithotomy, introduce a lithotrite through the incision, and crush the stone before extracting it, thus avoiding the infliction of injury upon important structures.

![Thompson's vesical forceps for removing growths in the bladder; for growths close to the neck of the bladder, with separation of the blades, to avoid nipping the neck of the bladder.](image)

Operation for Stone in Women.—If the stone be small, give the patient ether, place her in the lithotomy position, dilate the urethra with the uterine dilator until it admits the index-finger, and remove the stone with the finger, the scoop, or the forceps. If the stone is found to be too large to pass, crush it with a lithotrite and get rid of the débris by the evacuator. Large stones (two ounces) may require suprapubic lithotomy. Vaginal lithotomy is never required. If done, it is very likely to leave as a legacy a vesicovaginal fistula. In female children dilate the urethra, crush the stone, and evacuate.

Cystotomy.—This term means the opening of the bladder, and it is usually applied to an opening made for drainage, for diagnosis, for the removal of stones or tumors, or for the treatment of ulcers. This opening may be done by (1) a suprapubic cut (as in suprapubic lithotomy), (2) a lateral
perineal cut (as in lateral lithotomy), or (3) a median perineal cut (as in median lithotomy).

The operation may be completed in one sitting, or the bladder may be only exposed, the opening of it being delayed for several days until it becomes adherent to the margins of the wound (Senn's operation). Senn's operation prevents infiltration of urine into the prevesical space, and it is advisable to select it if the urine is very foul.

A sinus may persist after suprapubic cystotomy, but usually the wound heals unless it is kept open by some expedient.

The effects of suprapubic drainage are very beneficial in cases of chronic cystitis associated with hypertrophy of the prostate gland, the urine being foul. Drainage causes the urine to become clear and the mucous membrane of the bladder to become normal. If the opening is made as a permanent drain, there will usually be incontinence, as the new channel has no sphincter action (Dandridge). Figs. 568, 569, 570, 571, have tubes for prolonged drainage.

**Suprapubic Cystotomy.**—The operation is employed to allow the surgeon to explore the bladder, to treat an ulcer, to provide drainage, or to remove a tumor. If the operation is for calculi, it is known as suprapubic lithotomy (page 968). After the bladder is opened its interior can be illuminated by the rays of an electric lamp, which appliance is fastened with a mirror to the forehead of the operator. If an ulcer is found, it is scraped with a curet or a spoon. Most cases of tumor require suprapubic cystotomy. It is true that a small single growth at the vesical neck is accessible by median cystotomy, but the area for manipulation is very narrow and the growth cannot be seen. Every large growth, all cases of multiple tumors, and all cases of tumor in individuals with great depth of perineum or with enlarged prostate require suprapubic cystotomy, an operation which allows one to feel and to see the growth, which gives room for manipulation, and which permits thorough exploration of the entire bladder. The patient is put in the Trendelenburg position if water distention is used, but is placed horizontally if air distention is employed. After opening the bladder as for stone
(page 968) hold the edges of the incision apart by means of a speculum (speculum of Keen or Watson) or with retractors, and reflect the electric light into the wound. Growths when seen can be twisted off, a pair of forceps holding the base and another pair being used to twist. Broad growths should be transfixied, ligated, and severed. Some growths (as cancer) are removed piece by piece with Thompson's forceps (Fig. 567), the base of the tumor being scraped. Soft growths are scraped away with a curet, a spoon, or a finger-nail. If bleeding is severe, check it by pressure, by hot water, by a $1:10,000$ solution of adrenalin chlorid, or even by the actual cautery. In some cases the wound is allowed to heal rapidly. In others the bladder is drained for a considerable time. In some it is kept open permanently. Permanent drainage is desirable in some cases of enlarged prostate, and in such cases Senn's tube may be employed (Figs. 568 and 569), or Stevenson's tube (Figs. 570 and 571).

Median Cystotomy.—The same incision is made in the perineal raphe in median cystotomy as for median lithotomy. A grooved staff is introduced and is hooked up under the pubes; an incision is made into the membranous urethra, and is extended backward for three-quarters of an inch, and a finger is carried into the bladder. If searching for a growth, find it with the finger, catch it with Thompson's forceps, and twist it off. Soft growths can be scraped away. Stop bleeding by digital pressure or by injections of hot water or adrenalin chlorid ($1:10,000$). If median cystotomy does not allow access to the tumor, perform suprapubic cystotomy.

Growths in the Female Bladder.—Dilate the urethra as in a case of stone, and scrape, twist, or pull the growth away or ligate it. If the growth is large or if there are multiple growths, perform suprapubic cystotomy.

**DISEASES AND INJURIES OF THE URETHRA, PENIS, TESTICLE, PROSTATE, SEMINAL VESICLE, SPERMATIC CORD, AND TUNICA VAGINALIS.**

**Injuries** of the penis and urethra may arise from traumatism to the perineum or the penis, from cuts and twists of the penis, from the popular "breaking" of a chordee, from tying strings around the organ, from forcing rings over it, from the passage of instruments, or from the impaction of calculi. Violence inflicted upon an erect penis may fracture the corpora cavernosa. The writer saw one man with a glass rod broken off in the canal, he having been in the habit of introducing it at the dictate of morbid sexual excitement. A patient in the Insane Department of the Philadelphia Hospital pushed a ring over his penis, which organ was lacerated into the urethra. These injuries are treated on general principles.

**Perineal Bruises.**—If the perineum be bruised without rupture of the urethra, the perineum and scrotum swell and become discolored; water is passed with difficulty because the extravasated mass of blood in the periurethral tissues occludes more or less the canal; the water is not bloody; and