Fig. 2.

Fig. 1.

M. Brodel, fec.

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DESCRIPTION OF PLATE VI.

FIG. 1.—Appearance of the trigonum and the base of the bladder before treatment.

FIG. 2.—Appearance of the same part of the bladder after treatment with the vesical balloon.

DESCRIPTION OF PLATE VI.

FIG. 1.—Appearance of the stigmata and the base of the bud before treatment.

FIG. 2.—Appearance of the same parts of the bud after treatment with the vesicating balloon

to get up eight to ten times; a week ago she had agonizing pain and several blood clots were passed. There is now a constant dull pain over the bladder, which becomes sharp and cutting during micturition. When the paroxysms come on the patient has an expression of intense suffering.

Upon making a direct examination of bladder the urethra was found congested, the vesical trigonum intensely reddened, the rugæ standing out prominently, and over the surface of the bladder flakes of pus and small blood clots. The intensest inflammation was in the inter-ureteric area gradually shading off toward the fundus of the bladder. Where the inflammation was greatest the mucous membrane was of an angry red color and bled when touched lightly with the ureteral searcher. The capillaries were indistinguishable in the inflamed areas, and a careful search of the bladder failed to reveal the ureteral orifices. In the less congested areas above the trigonum the capillaries were prominent, and at various points small, intensely red congeries of minute vessels were seen. The anterior wall of the bladder in isolated places appeared normal.

The treatment by an application of 10 per cent ichthyol gelatin by means of vesical balloon gave great pain at the time of the application.

October 22: Greatly relieved two hours after treatment, and still feels much better than before the treatment.

October 23: Balloon again applied, still very painful; the bladder appears less congested and the ureteral orifices are faintly visible. Marked improvement in symptoms; urination much less painful. She rose only three times last night. A colored drawing of the bladder as it now appears is shown in Plate VI.

November 10: The bladder has been treated every third day since the last note was made, and now appears almost entirely well. The patient no longer experiences any pain between the treatments and thinks she is entirely well. Advised to remain one week longer.

November 19: Patient discharged to-day. The mucous membrane has assumed a perfectly healthy hue, except a slightly increased reddening around the ureteral orifices. No treatment since the last note. The pain is entirely relieved, and the patient got up but once last night to urinate. The second colored drawing (on Plate VI) shows the present condition of the bladder.

Applications may be made in this way every day or every second day; the improvement is usually marked from day to day, and old cases are sometimes relieved in less than a dozen treatments. Glycerin must be used as the vehicle for the drug injected into the bladder, and to coat the balloon when the bladder is simply to be distended, as vaselin and oils ruin the rubber bags.

Surgical Treatment of Chronic Cystitis.—In obstinate cases associated with great pain relief has often been given by making an opening in the base of the bladder so as to let the urine escape into the vagina, keeping the bladder empty and giving it a complete physiological rest for a period of several months or longer until the cystitis is cured. This procedure has had a warm advocate in Dr. T. A. Emmet, who has repeatedly employed it with success.

But as the constant dribbling of the urine through such an artificial fistula entails all the distressing disagreeable consequences of a fistula from any other

cause; it is to be expected that the field for this operation will be limited to the cases not relieved by the direct plans of treatment just described.

The operation is done in the following manner: The patient is put in the dorsal position with flexed thighs, a sound is introduced into the bladder distended with water, and the base of the bladder well behind the urethra is pushed forward into the vagina into the median line on the end of the sound. The anterior vaginal wall being well exposed by retractors, the operator cuts through the vesico-vaginal septum onto the sound with a narrow-bladed knife; a gush of water shows that the bladder is opened and the sound passes through into the vagina. As the water escapes, the hole is quickly enlarged backward until it is at least 2 centimeters long. The sound is then taken out and the vesical mucosa drawn over the intervening cut surface of the septum and attached to the vaginal mucosa on all sides by a continuous catgut suture; this prevents the fistula from closing spontaneously, as it would do if raw surfaces were left exposed and in contact. The vagina should be irrigated daily, and the external parts protected by a stiff zinc oxide ointment. Clean gauze pads must be kept under the patient at night and fresh ones applied often by day. When the inflammation has subsided, in the course of several months, then the edges of the fistula should be pared and the opening closed.

Tubercular Cystitis.—Tubercular disease of the bladder in women is observed with a frequency which increases just in proportion as careful direct examinations and bacteriological investigations of the urine are made. It is either primary in the bladder or descending from the kidney to the bladder, or again a part of a general tuberculosis.

R. Ultzmann (*Die Krank. der Harnblase*, Stuttgart, 1890, p. 151) states that tubercular cystitis often complicates other inflammatory processes, and more especially those due to gonorrhea, when the gonococci may be found in close association with tubercle bacilli.

T. Rovsing (*Die Blasenentzündungen*, etc., Berlin, 1890) declares that tubercle bacilli can not engender a tubercular cystitis in a sound bladder, not even when there is a retention of urine, but that a direct inoculation into the mucosa or a preliminary suppurative cystitis are necessary factors.

The disease is not often seen in its initial stages, when there is simply an intense catarrhal condition of the bladder. In cases of infection from a tubercular kidney or a tubercular abscess behind the broad ligament discharging into the bladder, the infection is most marked in a path in front of the ureteral orifice of that side, or in front of the sinus opening into the abscess where infected urine meets the mucosa before dilution. In addition to the catarrhal cystitis found here, there are often numerous little scattered whitish nodules having the appearance of tubercles. Sooner or later caseation occurs and the tubercles break down, leaving a deep ragged-edged ulcer; the urine then contains pus and mucus and blood.

The tubercular ulcer or ulcers may advance but slowly; in the worst cases the entire bladder is involved, and the bloody urine is constantly expelled in small quantities with great suffering. The trigonum, the base, and the posterior

walls are oftenest affected. If the disease is left to run its natural course it is always chronic, extending over a period of many years with slow changes. In a more intense form, when the entire bladder participates in the disease, it may terminate fatally in a few months or a year.

The family history may give the right clew to an obscure obstinate form of cystitis, as in the following case occurring in the practice of Dr. L. M. Sweetnam, of Toronto:

The patient, a young woman twenty-three years old, began to have severe pain in the urethra, and died eleven months after the onset of an extensive tuberculosis involving the bladder, the urethra, and the right ureter and kidney; the temperature at one time reached 108° F. In the same family twin sisters died of pulmonary tuberculosis; another sister had tubercular glands in the neck four months after the extraction of some teeth; a fourth sister lost one eye and a nasal bone, and had five or six tubercular skin lesions, a spina ventosa affecting three metacarpal bones, and a tubercular tarsus. A brother, twelve years old, and both parents were healthy. In four cases of tuberculosis of the bladder reported by Dr. Edward Reynolds (*American Medico-Surgical Bulletin*, April 4, 1896) the family history was negative in two and distinctly tuberculous in two.

Diagnosis.—A cystitis occurring in a phthisical patient not exposed to gonorrhea is most likely tubercular too. All cases of cystitis in young persons are open to this suspicion if they are clearly not gonorrheal. S. Bontor (*British Med. Jour.*, 1893, vol. i, p. 1058) reports a case of a tubercular ulcer over the left ureteral orifice in the bladder of a child five years old. Chronic ulcers found in the bladder are usually tubercular.

The diagnosis is made certain by finding the tubercle bacilli either in the urine or in the tissues themselves. When the disease is advanced the bacilli can usually be found in large numbers without any trouble, but in other cases repeated examinations must be made to find even a few of them. The surest way to find the bacilli and so clear up the diagnosis is to expose the diseased area and curette off a little piece of the tissue from the margin of the ulcer; the microscopic examination of this may show the presence of the bacilli when they have been sought in vain in the urine.

In Reynolds's four cases there were a few isolated papules discovered in each case. They were about the size of a grain of rice, slightly oblong, glistening, rounded, and round above the surface of the mucous membrane. These papules were carefully watched, and were found to break down and form tuberculous ulcers.

The tubercular ulcer is characterized by a granulating base, sharp, irregular edges, with small hemorrhagic foci surrounding it. In the most advanced cases the contracted bladder simply appears as a mass of ulcerations with irregular surfaces filled with pus and blood and mucus. When the disease descends from the kidney, the part first affected is that about the ureteral orifice of the affected side.

E. H. Fenwick (*Lancet*, 1891, p. 935) injected tuberculin in a patient with

a tubercular ulcer with the result of bringing on a violent attack of hematuria; others have used the injections with negative results.

Treatment.—The outlook in a case of tuberculosis of the bladder from a therapeutic standpoint is no longer so hopeless as it was before the use of the endoscope. We are able with our present diagnostic methods not only to determine the specific nature of this disease, but to discriminate between the extensive cases and those which remain localized and are more amenable to treatment.

In all these cases the general health demands the most painstaking attention; associated with rest, abundant nutritious food, suitable exercise in the fresh air, and it may be change of climate and scene, we must also depend largely upon such medical agents as cod-liver oil, iron preparations, and other tonics which have been found useful in combating tubercular processes of all kinds.

When the bladder disease forms but a part of a more general infection, or is associated with an extensive lung affection, but little will be accomplished locally in staying the progress of the affection. When the disease is in some neighboring organ, as in a kidney or a uterine tube, and the bladder is only secondarily involved, the original focus must be removed before any results may be expected from the treatment of the bladder, and if the disease is but limited, it may clear up without further assistance.

The direct treatment of a tubercular bladder is either by injection, by topical applications, or by surgery.

As injections, iodoform emulsions (5 to 10 per cent), solutions of corrosive sublimate (from 1 to 5,000 to 1 to 500), nitrate of silver (1½ to 2 per cent), and lactic acid (5 per cent solution with cocain) have been used; good results are to be looked for from the use of iodoform made into an emulsion (5 to 10 per cent) with glycerin, gum acacia, and water. This should be injected into the bladder and applied evenly to the whole surface under moderate pressure by using Clark's balloon as described in the last section. Such treatments continued every two or three days are calculated to yield the maximum effect of local treatment. By the instillation methods above described Guyon has been able out of sixteen cases of tubercular cystitis to cure three, to improve six greatly, and to improve five.

A case of vesical tuberculosis reported by Dr. J. O. Polak, of Brooklyn (*Amer. Gyn. and Obs. Jour.*, January, 1897, p. 41), is a model of clear description and effective treatment.

The patient, a single Swedish girl, twenty years old, during an attack of anemia three years ago began to suffer sharp lancinating pains on urination; she lost weight and had frequent hematuria. In the latter part of April, 1896, she had an unusual vesical hemorrhage with inability to void the urine and a constant intense tenesmus; several ounces of bloody urine were drawn by catheter drop by drop. The temperature was 102° and the pulse 120. On palpation, there was exquisite tenderness all over the region of the bladder and blood dripped from the urethra.

By means of a large cystoscope the bladder was found filled with clots of

blood; after washing and sponging them out, an ulcerated area was detected on the right side near the neck of the bladder, about 3 centimeters in diameter, with raised irregular edges and studded with tubercles; the remaining mucosa was normal. This patch was thoroughly curetted through a cystoscope, and vesical drainage established by a coil of gauze enclosed in gutta-percha tissue.

Three days later the urine still contained pus, blood, and tubercle bacilli. Daily vesical irrigations were used, and a 50 per cent emulsion of iodoform injected after each one.

May 15: A direct examination revealed an area of ulceration with pale, flabby granulations, and appearing as though varnished with a thin coat of serum. A solution of nitrate of silver (80 grains to the ounce) was carefully applied to the dried surface of the ulcer, followed by a daily irrigation with a solution of salicylate of soda. Prompt improvement followed, the bacilli steadily diminished in numbers, and by June 1st the urine was normal.

June 10: By direct cystoscopy a normal mucous membrane was seen, and the place of the ulceration was occupied by a pale cicatrix. After this the patient gained twenty-five pounds in weight.

October 15: No recurrence of symptoms.

Petit (*Injec. contre la tuberculose de la vessie*, *Semaine méd.*, 1892, t. xii, p. 42 [annexes]) uses an emulsion consisting of iodoform, 20 grams, glycerin, 10 grams, and water, 6 grams, with gum tragacanth, 0·25 grams. A teaspoonful of this mixture is added to 150 grams of warm water with 10 drops of laudanum, and the whole is injected slowly into the bladder; half the quantity is allowed to run out in two minutes and the rest to remain as long as possible. This same formula may also be used with the rubber balloon.

Topical Applications.—The means we now have of exposing the tubercular ulcer and of making direct applications to its surface opens up an entirely new field for therapeutic research, since we shall be able to apply concentrated solutions to the diseased spots without risk of injuring the sound mucosa elsewhere. After making such an application the bladder may be filled with water and washed out repeatedly. The application in this way of varying strengths of silver nitrate from a 20 per cent aqueous solution to the solid stick have proved of great value in Reynolds's hands.

Surgical Treatment.—The surgical treatment of such an obstinate affection will prove the most satisfactory way of dealing with it in selected cases. The various surgical methods are curettage, cautery, and excision.

Curettage of the Bladder.—Curettage has been successfully practised by Guyon and others in cases of rebellious cystitis and for tuberculous cystitis. Curettage is an eminently rational plan of treatment for two reasons: in the first place the lesions of both forms of cystitis are as a rule localized in the more superficial parts of the bladder in the mucosa, and hence easily removed without risk, and in the second place the regeneration of the mucosa, even after an extensive destruction, takes place readily.

The procedure is conducted in this way: A sharp curette is used, the patient placed in the lithotomy position, and the bladder thoroughly washed out with a

mild antiseptic solution and emptied. The finger is then inserted into the vagina and the curette directed through the urethra into the bladder, where it is first employed in curetting the base of the bladder, using the finger as a point of counter pressure; at the same time the amount of force employed can be readily estimated; then the curette is next used over the vesical surface behind the symphysis pubis. After cleansing out the bladder the curette is again introduced, and the posterior lateral and superior portions are next attacked. Such is the procedure in the rare cases of aggravated cystitis which has gone so far as to involve the entire vesical mucosa; by making a careful cystoscopic examination beforehand those cases in which the lesions are localized in certain areas of the bladder will also be recognized, and the curettage will then of course only be directed against the diseased portions, sparing the sound tissues any unnecessary insult.

It will now be easy to use the galvano-cautery through the cystoscope in the air-distended bladder, and to continue its use from time to time so as to test the efficiency of this mode of treatment.

The ideal mode of treatment of a tuberculous ulcer, which is not relieved by the simpler plans just detailed, is its exposure and excision, followed by suture. This is easily practicable through a longitudinal suprapubic incision without opening the peritoneum; the bladder is incised parallel to the abdominal wound, and its edges temporarily stitched to the skin surface to keep it from dropping out of easy reach during the operation; then in the more superficial cases of the disease the mucosa may be extensively excised, being cut through a short distance from the affected edges and detached by a blunt dissection. Any little patches of sound mucosa must be carefully left, as they will materially aid in the rejuvenation of the mucosa, acting like grafts on the skin surface.

R. Bardenheuer (*Centralbl. f. Gyn.*, 1894, Bd. xviii, p. 336) has even excised the entire mucosa without interfering seriously with the bladder function. It is a question whether in such cases the new mucosa grows out from the urethral and ureteral orifices, or is reproduced from minute portions left in numerous little depressions. When the disease extends deeply into the vesical walls, the tuberculous area must be cut out and the edges then brought together by interrupted catgut sutures as in the treatment of a vesico-vaginal fistula.

When the tuberculous area is about one of the ureteral orifices, the operator must determine whether the upper urinary tract of that side is affected; if it is not, the area may be excised and the ureter turned into the bladder at a point farther back.

It will be best in these cases not to leave a suprapubic drainage opening. The incision into the bladder through which the operation has been conducted should be sewed up independently of the abdominal incision by using a series of interrupted catgut sutures catching only the muscular walls. The abdominal incision should be closed by interrupted silkworm gut or silver wire sutures, and the bladder kept drained through the urethra for five or six days.

If the sutures in the bladder do not come away in twelve or fourteen days,

and there is any evident irritation from their presence, they may be exposed and cut and taken out through a No. 12 or 14 vesical speculum.

Exfoliative Cystitis.—The expulsion of a part of the whole of the mucous membrane of the bladder sometimes occurs as a form of cystitis (cystitis exfoliativa). This is a disease to which women are peculiarly liable, although it is also rarely seen in men.

There is a clear and excellent account of a case in Nicholas Tulp's *Observationes medicæ* (Amst., 1672, lib. 2, cap. xlviii), under the title membrana lapidescens (membrane turning into stone). Gerbreghta Rotaria, thought to have a calculus, finally passed a large membrane covered with little stones and with a perforation in the middle, so that the urine could escape through it. But some pieces of the membrane remained behind, and until Nature freed her from them she suffered excessively. The fibers of the bladder being relaxed, there was an involuntary escape of the urine, which was finally relieved by tissue-strengthening medicines.

The causes of such a detachment of the mucous membrane are various, the commonest being retroflexion of the gravid uterus, which is found in 50 per cent or more of the cases; other causes are protracted birth (25 to 30 per cent), the pressure made by a myoma choking the pelvis (see A. Gottberg, *Inaug. Dis.*, Kiel, 1892, and Fr. Vahle, *Inaug. Dis.*, Marburg, 1895), retention of urine and in one case the injection of a strong saline solution into the bladder (Begouin, *Jour. de méd de Bordeaux*, t. xxii, p. 158).

The common factor underlying all the various causes is probably the ischemia produced by pressure, for the cutting off or lessening of the vesical blood supply results in an ischemic necrosis with or without an infection.

The detached membrane may be extruded either entire or in small pieces; the mucous surface may be so altered by the necrotic changes that it is recognizable with difficulty, and its surface is often studded with uric acid crystals. Adhering to it are often found more or less extensive portions of the muscular coat, and in the worst cases the peritoneal coat is also involved; in this way three grades of the affection are established (H. Boldt, *Suppurative Exfoliative Cystitis*, *Amer. Jour. of Obstet.*, vol. xxi, 1888, p. 361).

H. S. Cocram reports a case four months pregnant (*Medical News*, Phila., vol. lxiii, p. 633) in which the bladder was distended to within an inch of the ensiform cartilage, the entire mucosa became detached and was expelled, and the openings for the ureteral orifices could be seen in it. The patient was able to leave the hospital in twenty days, and recovered completely.

The clinical history shows frequent micturition and overdistention of the bladder, often with dribbling, associated with a retroflexion of the gravid uterus, or a pelvic tumor, or following a difficult childbirth. Schabert reports a case (*St. Petersburg. med. Woch.*, Bd. xix, p. 373) following the birth of twins. The bladder becomes exceedingly tender, and there is an acceleration of the pulse with fever, and all the disturbances usually associated with a severe septic process.

In a case of my own, where an overdistention of the bladder followed ovari-

otomy, portions of the mucosa were cast off, and the patient had a high fever and became insane; she was put into an asylum, where she died more than a year later from pulmonary phthisis.

The urine, at first turbid, becomes fetid, and in a few days pieces of the membrane are expelled; when the membrane becomes detached and endeavors to escape entire, it may block the internal urethral orifice for a time, causing a renewed retention of the urine. Its expulsion may be brought about with great pain and straining, and after this there is a more or less permanent dribbling of the urine. In some cases, in time the bladder regains its function to an unexpected degree; in others it is never able to hold more than a little urine at a time.

Death may occur from sepsis, or from one of the complicating conditions, such as peritonitis, or pyelitis from an upward extension of the infection, or later from uremia.

The diagnosis is made by recalling the clinical history of the case associated with a cystitis and discharge of the vesical tissue. On examining the base of the bladder by the vagina, it is found thickened and tender, and in cases where the loosened tissue obstructs the urethra the catheter may perforate this and let out a lot of foul urine from behind it. The difference between these septic cases with such a history, and the prolapse of the vesical mucosa occurring mostly in children, is so marked as to need reference only.

The treatment must first be directed to the condition which causes the retention, if it is still active, and, secondly, to the condition of the bladder itself. If the uterus is retroflexed and incarcerated, the patient must be put under an anesthetic, if necessary, in order to reduce the flexion, when it may be kept in place by an appropriate vaginal pack.

If the pelvis is choked by a myoma, an effort should be made to dislodge it into the abdomen. If this can not be done, it will scarcely be advisable to open the abdomen and remove the tumor until the vesical symptoms have subsided.

The bladder itself must be carefully watched to prevent any large accumulation of urine in it, and when the membrane is in the process of detachment and expulsion it is best to assist nature by gentle traction, and cutting off any protruding portions. If the membrane chokes the urethra and prevents the escape of urine, the accumulation will be voided by passing a glass catheter through it.

After the early acute symptoms have passed off, the patient will be greatly benefited by washing out the bladder two or three times daily, using a warm boric acid solution, and the irrigation must be kept up as long as there are pus and bacteria in the urine.

TUMORS OF THE BLADDER.

A variety of tumors are found in the bladder in women, but not so frequently as in men, the proportion being about one to three or four. They may be grouped according to their clinical significance—that is, their tendency to remain

localized or to invade the surrounding tissues, as benign and malignant (see G. Clado, *Traité des tumeurs de la vessie*, Paris, 1895, p. 63).

I. The benign tumors are papilloma, fibroma, adenoma, myoma, dermoid cysts.

II. The malignant tumors are carcinoma, sarcoma.

The malignant group further includes all forms of tumors of a mixed nature except fibro-myomata and all forms of degenerated tumors.

If we bear in mind the several component tissues of the bladder walls—the mucosa and submucosa and the muscular layer—and examine the various neoplasms found there from the standpoint of origin, they may be classified as follows (Küster, *Volkm. Sammlung klin. Vort.*, 1886):

I. Connective tissue tumors of the mucosa and of the submucosa: Papillomata and fibroid polyps, mucous polyps, sarcomata.

II. Tumors of the muscular tissue: Myomata.

III. Tumors of the glandular tissue and epithelium: Adenomata, epitheliomata.

Tumors are furthermore primary when they originate in the bladder, and secondary when they extend to the bladder from other organs. The secondary tumors are naturally of the malignant type; the commonest form is carcinoma of the cervix uteri which advances to the bladder.

Nothing whatever is known as to the etiology of primary vesical tumors. J. Albarran (*Les tumeurs de la vessie*, Paris, 1892) is of the opinion that the chronic irritation produced by the presence of micro-organisms is an efficient cause.

The villous outgrowths covering the interior of the bladder (vesica villosa), in some cases associated with calculus, are undoubtedly the product of mechanical irritation, but these can scarcely be called neoplasms in the strict sense.

Clado has shown that the normal bladder contains villi, which throws light on the frequent association of villous outgrowths with all variety of bladder tumors.

Secondary tumors of the bladder are not usually metastatic in the ordinary sense, but invade it by contiguity of tissue. In men, most of these tumors are furnished by the prostate and the rectum, and in women the enormous frequency of cancer of the cervix uteri is the occasion of the frequent involvement of the base of the bladder. I have seen the most extensive sarcoma of the genital system from the vagina through the uterus and out onto the peritoneum without any bladder affection.

The seat of vesical tumors is found more frequently in certain areas than in others. The places of predilection are exhibited in Féré's table, where, out of 107 cases, there were in the base of the bladder alone, 25; attached to both base and the walls together, 13; on the posterior wall, 17; close to the right ureter, 5; close to the left ureter, 8; anterior wall, 2; anterior and superior wall, 1; right or left lateral walls, 4; multiple tumors, 12; diffuse tumors, 8, etc.

Out of 634 cases of polypi, Fenwick (*British Medical Journal*, 1888, vol. ii, p. 666) found that the tumors were single in 60 per cent and multiple in the remaining 40 per cent.

Albarran (*ut supra*, page 61), in an analysis of 82 cases, found that the tumors were single in 61 and multiple in 21 of the cases, a proportion of about 75 per cent.

One of the most important statistical subdivisions of these tumors, from a clinical and a therapeutic standpoint, is that which is based on the nature of the attachment of the neoplasm to the vesical walls. Albarran (*ut supra*, page 53) found in seventy-eight personal observations of tumors of the epithelial type (in which are included all the commonest forms—the papillomata, cysts, adenomata, and epitheliomata) that they were attached as follows: Pediculated, 28; sessile, 9; encephaloid (infiltrating), 31; cancroid (mammilated, bossed, ulcerated), 10.

No two writers are precisely agreed in their classification of these tumors, and in many of the instances reported the diagnosis has been made purely from the macroscopic appearances, and this accounts for the enormous preponderance of tumors described as "papillomata," which really include fibroid, adenoid, and malignant epithelial growths. Although it is true that a benign growth may exist in the same bladder with a malignant one, or that a benign growth may become malignant, this transition would not be noted so frequently in the literature if careful microscopic examinations were made in all cases.

Papilloma.—As J. Orth (*Lehrb. d. Speciel, Pathol. Anat.*, Berlin, 1889, Bd. ii, p. 214) very properly says, the general name papilloma may be given to the group of pediculated tufted tumors as long as we do not know to which special class the growth belongs; it may be either a benign papillary fibroma or a malignant papillary cancer. We see from this that the term papilloma is often employed simply to describe the form and general appearance of the tumor, without conveying any information as to its real character.

If, on the other hand, we limit the term papilloma to the group of benign tumors, we are met with the further difficulty as to the propriety of the name according as we consider the tumor primarily an outgrowth from the epithelial or from the connective tissue.

If it is a tumor of the submucous connective tissue, covered by the mucosa and pushing out into the cavity of the bladder as it grows, then the proper name is papillary fibroma (Virchow, 1885); this view makes the papillomata one of the group of fibromata which differ among themselves in possessing more or less connective tissue.

Clado, on the other hand, considers papillomata as epithelial growths of the mucosa of an exogenous type—that is, one in which the epithelium is confined to the exterior. This classification groups them with the adenomata and establishes also a certain relationship between them and the epitheliomata, which are of the endogenous (ingrowing) type.

The benign papillomata are made up of a framework of connective tissue, more or less abundant, richly supplied with blood vessels, and covered everywhere with the vesical epithelium. They usually have a tufted, villous, branching appearance, and are so vascular that the name "villous anginoma" has been given to them. Sometimes the interspaces between the prolongations are filled with detritus, when the fungating appearance is lost.

They occur at any age—from six and nine months (Stein) to seventy-seven years (Gaillard)—and may be either single or multiple, and they frequently complicate other tumors.

Clado distinguishes three varieties—the villous, the pediculated, and the coronoid. The villous papilloma appears in the form of filaments growing from the surface of the mucosa, and they are more or less grouped. When the whole bladder is covered by them the name v e s i c a v i l l o s a (Küster) has been given it. These filaments assume a shape like that of a finger or ribbon, cylindrical or conical, and often subdivide once or twice. The pediculated polyps, constituting the commonest form, are grouped on a cylindrical pedicle which may be several centimeters long. In the coronoid form the affected portion of the bladder has the appearance of a number of crests closely applied and looking individually like a cock's comb.

In all benign papillomata the pedicle never passes beyond the limits of the mucosa, however thickened or infiltrated this may become by inflammation, although the base of the growth may sometimes contain muscular tissue. The size of a papilloma varies from that of a pea to a walnut; they are rarely as large as a hen's egg.

Fibroma.—The fibromata or fibroid polyps form a group of benign tumors in which the connective tissue elements are in excess. They are less frequent than the papillomata, which have but a scanty fibrous framework and appear to occur oftener in men than in women.

The tumor is usually pediculated and its surface is smooth or slightly lobulated, and the pedicle is usually a delicate one. When the tumor is sessile and situated within the bladder wall, its connections with surrounding tissue are such that it can be enucleated. Although the pedicle and the mucous surface of the tumor are vascular, the interior is but poorly supplied with blood vessels. The fibromata often enter the group of mixed tumors by undergoing a myxomatous degeneration (see F. Schatz, *Fibromyxoma teleangiectodes vesicæ*, etc., *Archiv. f. Gyn.*, 1876, Bd. x, p. 356).

Adenoma.—The adenoma is a benign epithelial tumor of the glandular type rarely met with; it is sessile or pediculated, and has a smooth, lobulated, or papillary surface. When sessile, the tumor can be easily enucleated with the finger without hemorrhage.

It is difficult, in the light of our knowledge of the histology of the bladder, an organ which is remarkably deficient in glandular elements, to account for the origin of these tumors; for this reason Klebs and others have insisted that these growths must take their origin in the prostate gland in the male. R. Kaltenbach (Langenbeck's *Archiv für klin. Chir.*, 1884, xxx, p. 659), however, has described a papillary adenoma which he removed by a vesico-vaginal incision from a woman forty-four years old, the origin of which Prof. Boström traced to the mucous crypts of the bladder. Von Fritsch has also described a fibro-adenoma of the bladder in a girl three years old; it was covered with a calculous deposit and filled the whole bladder. These cases, of course, show that such tumors do occur in the bladder independently of the prostate.

The adenoma may be either sessile or pediculated, and its surface smooth, lobulated, or villous.

Clado cites exceptional cases where "adenomata" (cylindrical-celled epitheliomata) have relapsed after extirpation, and infiltrated the bladder walls like ordinary epitheliomata. This rare occurrence must be distinguished from the tendency to relapse *in situ* after incomplete extirpation which the adenomata share in common with the simple papillomata.

Myoma.—Myoma is one of the rarer vesical tumors, first described by Virchow (*Die Krankhaften Geschwülste*, Bd. iii, p. 121, myocarcinoma). It takes its origin in the muscular coat of the bladder, and is therefore made up of smooth muscular fibers with more or less connective tissue, and grouped or interlacing as in uterine myomata. The tumor either develops out into the bladder cavity upon a thick pedicle or it remains sessile.

W. T. Belfield (*Wien. med. Woch.*, 1881, No. 12, p. 329) has described a new variety of external vesical myoma occurring in a woman fifty years old. It was ovoid in form, 2 by 1 by 2 centimeters, and attached to the outside of the muscularis by four strands made up of blood vessels and muscular tissue.

J. Verhoogen (*Cent. f. Harn und Sexual-Organe*, 1895, p. 132) describes a like case, occurring in a man aged twenty-three years. The tumor at the operation was found to be about the size of a child's head. It arose from a pedicle, just above the prostate gland, and extended backward and upward, almost filling the pelvis. Microscopically it was found to be a fibro-myoma.

Cases are also described by Felix Terrier and Henri Hartmann in the *Revue de chir.*, Paris, 1895, p. 181.

The mucous covering of the vesical myomata is intensely congested, and the remaining muscular coat of the bladder hypertrophied. Ulceration of the surface is rare.

Cystic Follicles.—Small cysts are sometimes found on the inner surface of the bladder due to an occlusion of the mucous follicles; they appear scattered or in groups, forming little translucent elevations from 2 or 3 millimeters in size up to the size of a split pea. I have observed these in a case of chronic cystitis; on touching a cyst with the point of a knife the contents immediately escape, and the only trace which remains is a slight hemorrhage from the base. This affection has been called v e s i c a l h e r p e s. Malignant tumors also often undergo cystic degeneration.

Dermoid Cysts.—Dermoid cysts of the bladder are so rare that Orth (*ut supra*) says that only one well substantiated observation exists, that of Sir James Paget (*Surg. Path.*, 1853). Albarran cites a case of Boucher (*Soc. anatomique*, 1840) somewhat doubtfully, stating that there was a cyst containing a fatty liquid at the top of the bladder, and communicating with it by a narrow opening.

Outside of these rare observations, cases have been recorded in which dermoid cysts outside of the bladder (see Sänger, *Archiv f. Gyn.*, 1879), or ovarian dermoids, have discharged their contents into this organ, and hairs have escaped by the urethra (pilimiction).

In the group of m a l i g n a n t t u m o r s we find two types of tumors repre-

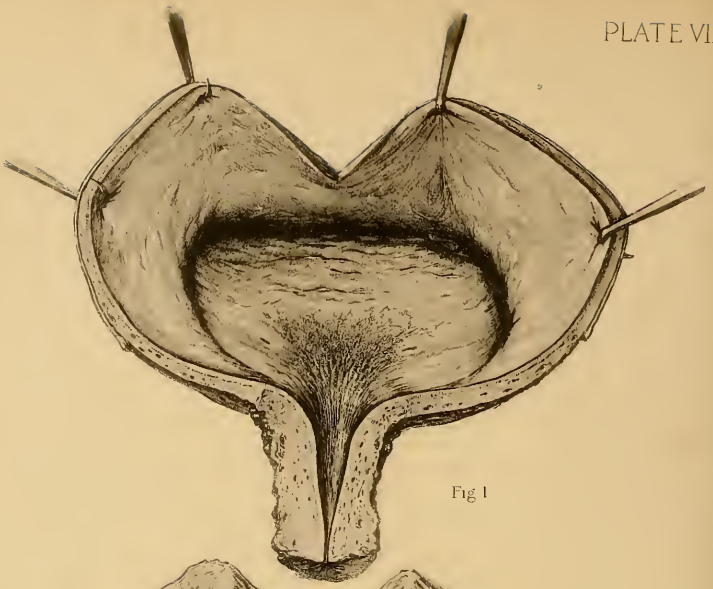

Fig 1

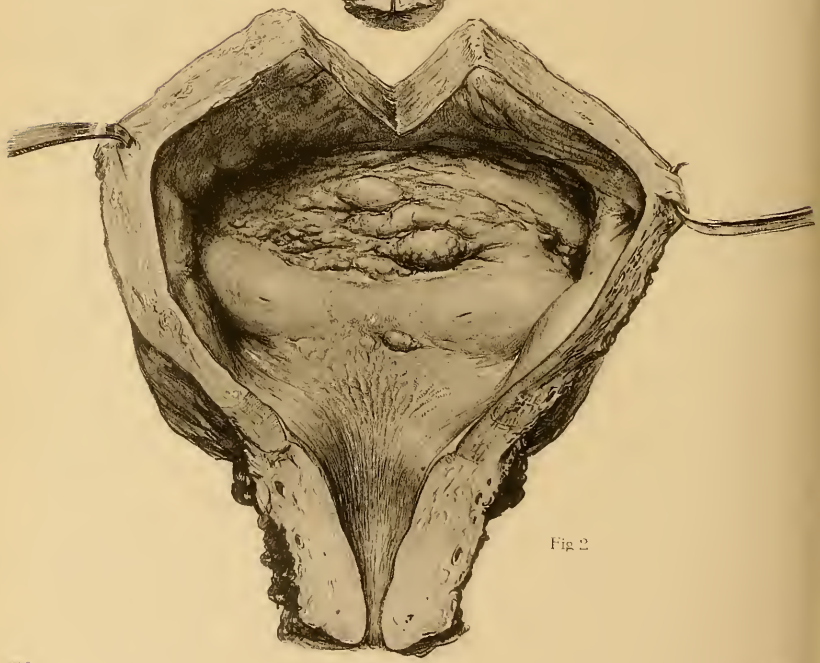

Fig 2

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DESCRIPTION OF PLATE VII.

FIG. 1.—Shows the normal bladder laid open by an incision through the anterior wall. The ureteral orifices are seen as narrow slits at the two posterior angles of the trigonum; the third angle is at the internal urethral orifice. The trigonum is characterized by its increased vascularity between these three points. The longitudinal vesical folds entering the urethral orifice are well shown.

FIG. 2.—Secondary carcinoma of the bladder following carcinoma of the cervix. The carcinoma appears in the form of rounded nodules in the bladder wall, mainly in the vicinity of the cervix. One small nodule is seen in the trigonal area. Note also the thickened walls of the bladder.

DESCRIPTION OF PLATE VII

Fig. 1.—Shows the normal bladder laid open by an incision through the anterior wall. The ureteral orifices are seen at the two posterior angles of the trigonum, the third angle is at the urethral orifice. The trigonum is characterized by its increased vascularity between these three points. The longitudinal vesical folds entering the ureteral orifices are well shown.

Fig. 2.—Secondary carcinoma of the bladder following carcinoma of the cervix. The carcinoma appears in the form of rounded nodules in the lower wall, mainly in the vicinity of the cervix. One small nodule is seen in the urethral area. Note also the thickened walls of the bladder.

sented—the epithelial type, the carcinomata, and the connective tissue type, the sarcomata. The most frequent are the carcinomata, and these are commonest in men as primary tumors of the bladder, while in women they invade the bladder as secondary tumors extending from the uterus.

Carcinoma.—The carcinomata consist of two kinds of tumors, the first made up of the squamous and the second of the cylindrical celled epithelium; they are characterized by a tendency to infiltrate the bladder walls and invade all surrounding tissues. The tumors thus formed are usually multiple, and project into the lumen of the bladder, where they are covered with villosities ("villous cancer"); again others are mulberrylike in appearance. There are often several larger masses with broad pedicles, and a number of small tumors near by.

The infiltrating form of epithelioma without villosities is rarer than the vegetating villous form; the friability of these tumors is especially marked. In some cases the epithelioma can only be shown to have infiltrated the tissues by a microscopic examination (the larvaceous or masked form of Guyon). The surface is less frequently ulcerated in the epithelioma than in carcinoma.

The carcinoma appears in the forms commonly known as encephaloid, scirrhus, or colloid cancer. The ulcerations most commonly observed in the infiltrating form arise either from fatty degeneration or interstitial hemorrhage or gangrene.

The walls of the bladder not involved in the new growth are hypertrophied, partly from the thickening of the muscular coat, and partly from an interstitial muscular sclerosis, the product of irritation (Clado).

Cancer of the bladder exhibits the same tendency as does cancer of the body of the womb to remain localized for a long time in its own viscus, an important fact bearing upon the operative treatment.

These cancers are liable to undergo certain changes; inflammation easily supervenes in the exposed lowly organized tissues, especially after instrumental interference; cystic degeneration is common on the surface or in the walls of the growth, and gangrene may follow interstitial hemorrhages in infected cases.

Sarcoma.—The vesical sarcomata form a group of rare tumors of the connective tissue type, malignant in character.

The first description was given by Guersant (*Arch. gén. de méd.*, 1853, second series, p. 311), and since that time but few cases have been added to the literature. Albarran and Clado out of a large experience have only observed three instances.

McWeeney (*British Med. Jour.*, vol. i, 1893, p. 647), under the title of "Spindle-celled Sarcoma of the Urethra," reports a case which from the description that follows was apparently a pediculated sarcoma of the bladder.

The patient, a woman aged thirty-two years, had suffered from pain on micturition for some months, and was admitted to the Mater Misericordiæ Hospital under the care of Dr. Madden and Mr. Hayes, who found a soft vascular tumor projecting from the urethral orifice, and traceable along the roof of the urethra up into the bladder. On removal it proved to be a typical spindle-celled sarcoma.

Sarcoma appears to occur about one third oftener in women than in men, at almost any period of life from early childhood up to fifty-nine years of age. The tissue in which the neoplasm takes its origin is probably the stroma of the mucosa, which ordinarily contains round, embryonic cells.

The tumors are usually multiple and almost always sessile, varying greatly in size and having, as a rule, a smooth surface; the color is red, violaceous, or even blackish. The parts of the bladder adjacent to the base are usually infiltrated. In women the sarcoma is especially prone to extend out through the urethra, appearing at the external orifice.

Myxoma.—Myxoma is a form of degeneration grafted upon one of the primary forms of tumors; it is always found, therefore, in a mixed form. The commonest are the myxo-fibromata and the myxo-sarcomata.

Such myxomata are usually pediculated and occur in groups; they are commonly found in early life, grow on the floor of the bladder near its neck, and present much the appearance of nasal polyps, but they are more vascular, and are firmer. Owing to their situation, one of the tumors may easily escape from the urethra and appear at the vulva.

The tissue of the myxomatous tumor is made up of embryonic cells and myxomatous cells with anastomosing prolongations; the capillaries are numerous, and elastic fibers are found abundantly. They show a remarkable tendency to return rapidly after removal (see Schatz, *Archiv f. Gyn.*, Bd. x, 1876, on Fibromyxoma).

Clinical History of Vesical Tumors.—In their earlier stages the symptoms of tumors, both benign and malignant, are much alike. As a malignant tumor progresses, the emaciation and constitutional symptoms become pronounced features in the case, but these features may be simulated to some extent by a benign tumor associated with cystitis and hemorrhages.

The earliest and the commonest of all symptoms characteristic of vesical tumors of every kind is a decided tendency to bleeding from the bladder.

Clado has demonstrated by an analysis of a series of cases that a cystitis is the first symptom in 8 per cent of the papillomata, in 20 per cent of the sarcomata and myxomata, and in 25 per cent of the carcinomata and epitheliomata.

In a few cases retention or incontinence of urine are the first indications of the growth.

Hemorrhages from the bladder may appear in the form of urine more or less deeply discolored by blood, or in the form of clots, or it may be discovered only upon making a microscopic examination of the urine (colorless hemorrhage, globulinuria). They appear, persist, and disappear, to reappear without any apparent cause whatever; sometimes the urine remains bloody for years; in other cases a hemorrhage comes on after exercise, or some violent motion, as horseback riding. Little decolorized filaments and irregular clots of blood collecting on the interstices of the tumor and finally washed away by the urine are characteristic of villous tumors. Epithelial cells and fragments of the tumor may be found adherent to such clots.

When a large hemorrhage takes place, and the blood accumulates in the

bladder, the distention may be so great as to reach even as high as the umbilicus.

Frequent micturition is another common symptom due to the presence of a tumor; the increase at first may scarcely be noticed, but later the bladder may require to be emptied every few minutes. When cystitis is superadded, this of course of itself induces both pain and frequency.

Suppression of the urine is brought about mechanically by a pediculated tumor which lies near enough the urethral orifice to cover it and interfere with the flow, or when the tumor is attached farther away from the orifice but has a long pedicle. A tumor so placed as to press habitually upon one of the ureteral orifices will in time cause a hydro-ureter and hydronephrosis of that side. A retention of the urine may be caused by a distention of the bladder with blood clots, and if the pressure from this source continues to increase, the urine may be even prevented from entering the bladder (anuria); the patient under these circumstances suffers from great pain and straining.

Pain is not a common symptom except when clots accumulate in the bladder, or when there is a coincident cystitis, which is one of the commonest complications liable to arise at any time, and exceedingly obstinate, rarely disappearing so long as the tumor remains.

Prognosis.—The ultimate outcome varies, of course, with the nature of the tumor; the benign cases run on for years and do harm by the severe hemorrhages, by the diminished capacity of the bladder, due to the presence of the tumors, or by the cystitis, which may be intense in its character and may travel upward, producing a pyelonephritis.

The malignant neoplasms destroy life in the course of a few years or sooner, according to the rapidity of their growth and to the hemorrhages, cystitis, ulcerations, or gangrene associated with renal infection, pyemia, or peritonitis.

Diagnosis.—The diagnosis of a vesical tumor will be made by (a) a study of the history; (b) examination of the urine; (c) palpation of the bladder; and (d) a direct cystoscopic inspection.

Although the direct examination gives at once a positive diagnostic answer, the remaining means of investigation should not be neglected.

The history is as a rule in no respect characteristic.

The examination of the urine shows the presence of blood; and if there is cystitis, pus and micro-organisms and various crystals, and rarely bits of the tumor. Earlier writers laid great stress on finding these pieces of the neoplasms, and judged from them the character of the disease. The opinion now held is that even when the presence of a tumor may be inferred in this way, no definite conclusions can be drawn as to its nature, not even as to whether it is benign or malignant.

One of the rarest symptoms, only observed in connection with vesical tumors, is the spontaneous coagulation of the urine (fibrinuria) after escape from the body, due to an excess of fibrin discharged with the blood into the bladder.

The use of a catheter to bring away a piece of a neoplasm in its eye is too

uncertain, and the use of a curette, guided solely by touch, is too dangerous to be practiced, now that other simple and safe diagnostic measures are always available.

Palpation of a bladder emptied of its urine may give interesting information by revealing a localized thickening of the tissue when a tumor of a size and consistency sufficient to be felt bimanually is present. Touch is especially valuable in the case of malignant tumors in determining whether the disease has already passed beyond the limits of the bladder. In such a case the examination must be made with especial care through the lateral vaginal fornices to find any fixation on the side of the pelvic walls, and through the rectum to find any enlarged glands on the pelvic walls or between the external and internal iliac arteries, or even up on the common iliac artery.

Direct Inspection.—This mode of investigation at once gives a positive answer to several important queries in the diagnosis: (a) Whether or not a tumor is present; (b) whether the tumor is single or multiple; (c) the seat of the tumor; (d) its size, form, and color; (e) the kind of pedicle; (f) any complicating conditions, such as calcareous incrustations, cystitis, and ulceration.

If examination hurts the patient, it will be best to anesthetize her, and then, after emptying the bladder, to put her in the knee-breast position and introduce a No. 9 or 10 speculum. The examiner, looking into the air-distended bladder in this position, will see pendant any tumors springing from the trigonum or the base. By a minute investigation he will be able to determine in most cases the chances of a successful operation, although it may not always be possible to distinguish with certainty between malignant and non-malignant growths.

In general it will do to recall the fact that the simple papillomata have small pedicles, while the pedicle of a simple epithelioma is much stouter, and in a sarcoma it is quite broad. Any nodules about the base of the tumor will also be detected and regarded with suspicion.

The presence of a cystitis or of any ulceration of the surface of the bladder complicates an operation. When the tumors are found clustered around the neck of the bladder they may be looked upon as certainly malignant.

Operative Treatment.—There is but one way of treating vesical tumors, and that is by eradicating them by operation whenever possible. A palliative plan must be adopted only when the condition of the patient or the extent of malignant disease forbids operation.

The conditions most favorable for operation are general good health, urine clear from infection, albumin, and casts, and a single tumor with a pedicle. In old age and in childhood under five years the tumor is almost certainly malignant and inoperable.

Before proceeding with the operation it is important to gain an exact estimate of the patient's general condition, and to have made one or more thorough cystoscopic examinations for the purpose of studying the peculiarities of the tumor.

The avenues of extirpation are: (a) By the dilated urethra; (b) by a vaginal

incision; (c) by suprapubic incision; (d) by symphyseotomy; (e) the removal of the entire bladder (cystectomy).

The choice of the mode of operation will depend on the size of the tumor and its pedicle, on its seat, and on the presence of such complications as multiple tumors, infection, anemia, and extreme prostration.

The least dangerous ways of operating are by the dilated urethra and through a vaginal incision.

The suprapubic incision is more formidable on account of the risk of opening the peritoneum and urinary infiltration or infection of the loose cellular tissue, and the symphyseotomy is the most formidable of all.

The operation in a particular case may be no more than the severance of a delicate pedicle setting free a tumor, or it may involve the resection of a portion of the mucosa, or a portion of the entire bladder wall, or in extreme cases the sacrifice of the whole bladder.

(a) By the Urethra.—Simon (*Samm. klin. Vort.*, No. 88, 1875, p. 8) has shown that the urethra may be safely dilated to a diameter of 2 centimeters after making two lateral incisions in the posterior margin of the external urethral orifice to keep it from tearing at this its narrowest part. A series of dilators differing 1 millimeter in diameter is then passed in, beginning with a No. 8 or 10 and ending with No. 20. After this the largest speculum (No. 20) may be inserted and the tumor exposed for operation. Through a speculum of this large size we may safely remove most of the pediculated tumors of the bladder, either by the galvano-caustic loop, or by using a delicate, properly bent cautery knife.

In using either of these means to extirpate the growth, it is possible under the control of the sight to adjust the loop or to use the knife so as to effect an amputation close to the bladder; this avoids leaving any of the pedicle behind, and produces also a slight destruction of tissue on the bladder wall itself, sufficient to prevent recurrence of a benign growth.

A tumor removed in this way must be carefully examined microscopically, and if it is found to be malignant the operator must be prepared to resect a portion of the bladder wall through a vaginal or a suprapubic incision as soon as upon inspection there is any evidence of return. Sessile tumors and infiltrating growths can not be treated in this way.

(b) The vaginal route (colpocystotomy) is best when a limited portion of the bladder wall has to be excised with the tumor. It is easier to operate in this way upon the upper portion of the bladder, and when the vaginal outlet is relaxed and the anterior wall naturally tends to drop down; it is awkward and difficult with a tight vaginal outlet.

To make the vaginal incision the perineum is retracted and the cervix fixed with tenaculum forceps; the base of the bladder is then cut through onto a sound introduced through the urethra, and the incision enlarged, if need be, forward to the internal orifice and back to the cervix. The edges of the incision are now drawn apart and the neoplasm, already located cystoscopically, is drawn through the opening into the vagina, everting with it the contiguous portion of the blad-

der wall. If it occupies but a small area it may now be excised piecemeal, suturing step by step; and if the bleeding is free, tying the sutures as they are passed. If the area of excision is a larger one, and if the cut goes deeply into or through the bladder wall, it will be best to transfix the wall in several places at a distance from the field of operation to hold it in place while the extirpation and suturing are going on; by doing this the great risk of hemorrhage and delay from the open wound pulling back into the bladder will be avoided.

If the field of extirpation lies in the neighborhood of the intravesical portion of a ureter, it will be safer to insert a bougie beforehand so as to protect it.

(c) Suprapubic Incision (hypogastric route).—By this avenue tumors of larger size may be safely extirpated and the operation safely controlled throughout when it is necessary to extirpate any considerable portion of the bladder with the tumor.

The important practical questions whether the bladder may be safely sutured so as to avoid the risk of peritonitis after cutting into it on the peritoneal side, and whether any considerable part of the bladder may be removed and the defect made good by proper suturing, can be readily answered by some of the accidents met with in removing large myomatous uteri. I have several times cut into the bladder and closed the incision with interrupted sutures without any ill consequences. In one case I cut off a piece of the bladder as big as the palm of my hand, and closed the defect by interrupted sutures in the muscular coat without any after-effect.

The bladder may be exposed either by a transverse incision, which gives more room, or by a vertical incision in the median line; the disadvantage of the transverse incision is the severance of the recti muscles and the liability of the wound to gap open during the healing. If it is possible to avoid it the peritoneum ought not to be opened on account of the increased dangers of infection, which are greatly multiplied when cystitis is a complication.

The incision begins just above the symphysis pubis and is made 6 or 8 centimeters (2½ to 3 inches) long. The prevesical space is exposed, and the peritoneum is pushed up off the anterior abdominal wall, so as to expose the vault of the bladder; if the pelvis is a deep one and the abdominal walls thick, it is well to fill the bladder beforehand with water so as to bring it within easy reach just under the incision. In a thin patient there is no difficulty in picking it up and opening it. A vertical incision is now made through the muscular and mucous coats of the bladder long enough to give plenty of room to get at the tumor and handle it easily. When the tumor lies deep down in the pelvis and is hard to reach, the steps of the operation will be greatly facilitated by temporarily attaching the sides of the incision in the bladder to the skin of the abdominal incision, so as to hold the whole bladder well up in view and within easy reach.

Superficial tumors covering a wide area may be extirpated by incising the mucosa on all sides and dissecting it up so as to remove it with the tumors. Almost the whole of the vesical mucosa may be taken away and yet it will re-

generate, but wherever little islets or strips of sound mucosa can be left this should be done, as the new mucous membrane starts to grow from these centers. As much of the defect as possible should be covered in by drawing together the remaining mucous membrane with a continuous catgut suture.

When the disease goes deeper than the mucosa it is safe to excise even the entire thickness of the bladder wall, if necessary trenching on its peritoneal portion too. In this way a large part of the bladder, a half or even two thirds of it, may be resected, and the portion remaining will be able in great measure to maintain its function. After cutting through the walls, the rest of the bladder can be loosened from its attachments by a blunt dissection with fingers or a knife handle. On the vaginal side, although adhering more closely, the bladder can be detached in the same way without opening the vagina. All bleeding vessels should be tied at once with catgut.

After resection, the wound must be accurately closed, when possible, by interrupted catgut sutures applied close together, after which the bladder is kept empty from six to eight days by drainage through the urethra. The way in which the sutures are tied will depend on the position of the tumor; when this is situated on the base or on either side they may all be tied in the bladder, but at the vault they should be tied on the outside of the bladder. Each suture tied on the outside should grasp the muscular surface alone; those on the inside should include the mucosa too. When the peritoneum is cut, this should be drawn over the line of sutures to form an additional protection to the abdominal cavity.

If the tumor occupies the site of one of the ureteral orifices it will be easy to extirpate it, first cutting off the end of the ureter, if necessary, and transplanting it into a part of the bladder posterior to the wound. I should do this by puncturing the bladder wall on that side where I wished to introduce it, loosening the ureter and bringing it through the opening. The new ureteral orifice should be cut obliquely and attached to the bladder, in its new position, by four or five fine catgut sutures. The wound made by taking out the tumor may then be closed by interrupted catgut sutures, taking in all layers. After closing the bladder wound perfectly the abdominal wound should be brought together by silkworm-gut sutures through the fascia and catgut through the fat and the skin.

If the wound in the bladder can not be perfectly closed, it is necessary to use a gauze drain above the pubis as well as by the urethra, so as to avoid urinary infiltration of the tissues; when the wound begins to close down to a small opening a rubber tube may replace the gauze.

Sonnenburg (*Berl. klin. Woch.*, 1884, No. 52) describes a resection of the bladder in a woman for a fibro-sarcoma. The tumor on the anterior wall of the bladder was 3 or 4 centimeters in diameter, and had an ulcerated surface. A suprapubic incision was made and the bladder freed and the tumor excised, leaving only a part of the posterior wall and the base of the bladder with the ureters. The peritoneum, which had been opened, was brought together by suture and the bladder drained, both by the urethra and through the abdominal wound,

which was left to close by granulation. The patient survived the operation five weeks.

(d) Symphyseotomy is used to secure a large field of operation where the tumor is situated at the neck of the bladder, but the bladder in women is so accessible by the suprapubic route that it can hardly be necessary in any case to resort to so serious a procedure.

(e) Cystectomy.—The removal of the entire bladder is required when its entire wall is occupied by a malignant growth, but it rarely happens that a patient with such an extensive disease will be in condition to stand such an operation, even if the disease has not extended beyond the bladder.

The following case of cystectomy admirably devised and successfully practiced by K. Pawlik (*Cen. f. Gyn. Beilage*, 1890, p. 113) deserves careful study as a model on which to base any similar attempts in the future; it was conducted by the following steps: Transplantation of the ureters into the vagina; extirpation of the bladder; construction of a new bladder out of the vagina.

The patient had complained of painful micturition and bloody urine, and the removal of a vesical polyp was followed by relief for a time; but later, papillary growths of the bladder, accompanied with hematuria, gave so much distress that Dr. Pawlik determined to remove the entire bladder.

On August 3, 1889, he performed a preliminary operation—the establishment of uretero-vesical fistulæ. Having introduced a Simon speculum into the vagina and sounds into the ureters to mark them out, he dissected them free from the bladder by a vaginal incision 2 centimeters long, tied silk ligatures around them on the vesical side, split them open longitudinally, and then sutured the openings with fine silk sutures into the upper part of the vagina; he then cut off each ureter below the ligature. The discharge from the bladder no longer receiving any urine, was at first a thick, brownish liquid, but later it contained nothing but some mucus.

Three weeks later the bladder was extirpated; after suitably preparing the field of operation he filled the bladder with an iodoform emulsion, and introduced into the ureters elastic sounds with mandarins. He then made an incision 10 centimeters (4 inches) long in the linea alba, extending down to the symphysis pubis, and, without cutting into the peritoneum, he detached the distended bladder easily on all sides, except at the artificial ureteral openings into the vagina. Here there was considerable hemorrhage, which was controlled by tampons. Having dissected the entire bladder free down to the urethra, he finished the operation of removing it by the vaginal route. A transverse incision was made in the anterior vaginal wall just above the urethra, and the emptied bladder was drawn through this opening and severed in the plane of the internal urethral orifice. As the papillomata grew thick about the orifice, he dissected away the mucosa widely around this point.

The urethra was finally fitted into the vagina by suturing its anterior wall to this transverse vaginal incision, and attaching the remaining portion to the lateral and posterior walls of the vagina, which was now denuded around its entire cir-

cumference. This had the effect of converting the vagina into an artificial bladder, and of retaining the entire urethra as its outlet.

The abdominal wound was drained. The suprapubic fistula was long in closing, as was also a fistula behind the urethra, and there was at one time an obstruction of the right ureter. This was, however, relieved, and a quantity of urine escaped. The patient recovered and with a small fistula had good control of the new vaginal bladder, which had a capacity of 400 cubic centimeters.

CHAPTER XIII.

AFFECTIONS OF THE URETERS.

1. Anatomy. 1. The abdominal portion of the ureter. 2. The pelvic portion of the ureter.
2. Physiology.
3. Methods of examining the ureters. 1. Inspection. 2. Palpation. 3. Catheterization: (*a*) instruments used; (*b*) introduction of speculum and location of ureteral orifices: (*c*) introduction of the flexible silk catheter; (*d*) how to secure urine from both ureters at the same time: (*e*) how to obtain uncontaminated urine: (*f*) how to secure urine directly from the ureter without catheterizing: (*g*) catheterization of the ureters without elevation of the pelvis and without atmospheric distention of the bladder; (*h*) points to be observed in securing separated urines: (*i*) analysis of separated urines. 4. Sounding the ureters. 5. Catheterizing the pelvis of the kidney: (*a*) flexible silk catheter; (*b*) introduction of catheter; (*c*) asepsis. 6. Ureteral fever.
4. Congenital affections of the ureters. 1. Ectopic ureteral orifice. 2. Cystic dilatation of an occluded ureter. 3. Congenital flexure of the ureter.
5. Ureteritis and periureteritis. 1. Causes. 2. Symptoms. 3. Prognosis. 4. Diagnosis. 5. Treatment.
6. Tubercular ureteritis. 1. Symptoms. 2. Diagnosis. 3. Operative treatment.
7. Obstruction of the ureter. 1. Causes. 2. Clinical symptoms. 3. Diagnosis: (*a*) palpation: (*b*) catheterization. 4. Operative treatment.
8. Stricture of the ureter. 1. Gonorrheal stricture of the vesical end. 2. Atresia of the ureter: (*a*) of lower end after extirpation of kidney and upper part; (*b*) of lower end after catheterization; (*c*) of renal end. 3. Traumatic strictures. 4. Hydroureter.
9. Pyoureter.
10. Ureteral calculus. 1. Form and situation. 2. Symptoms. 3. Diagnosis. 4. Operative treatment.
11. Prolapse of the ureter.
12. Ureteral fistula. 1. Causes. 2. Diagnosis. 3. Treatment: (*a*) fistula in the lateral wall of the ureter: (*b*) ureteral fistula at the base of the bladder: (*c*) ureteral fistula at the vaginal vault: (*d*) nretero-cystostomy performed seven weeks afrer vaginal hysterectomy: (*e*) extraperitoneal uretero-cystostomy: (*f*) ureterostomy: (*g*) ureterotomy; (*h*) uretero-ureterostomy: (*i*) nephro-ureterectomy.

Anatomy.—The ureters (see Figs. 27–29, Chap. IV) are two symmetrically disposed, flattened, whitish cords lying in the loose connective tissue behind the abdominal and pelvic peritoneum, from 25 to 30 centimeters (10 to 12 inches) long. The left ureter is longer than the right because of the higher position of the left kidney. Each ureter begins funnel-shaped at the renal pelvis, follows an irregularly curved course, and terminates at a little eminence (in the knee-breast posture) in the bladder at the end of the inter-ureteric fold. The diameter of its lumen is about 3 millimeters, and is uniform throughout except at each extremity, where there is a slight narrowing. The abdominal portion is from 2 to 3 centimeters ($\frac{3}{4}$ to $1\frac{1}{4}$ inch) longer than the pelvic portion.

The course of the abdominal portion of the ureter, from renal pelvis to pelvic brim, starts out from the kidney 4 centimeters ($1\frac{1}{2}$ inch) from the median line, curves forward over the psoas muscle and then inward until it reaches a point, at about the middle of its length, from 2·5 to 3 centimeters (1

to 1¼ inch) distant from the median line: here it diverges slightly outward and crosses the pelvic brim 3 centimeters (1¼ inch) from the median line.

Throughout the larger part of its abdominal course it lies upon the great psoas muscle, which it crosses obliquely. It holds no important relationship to any other vessels until joined at about the middle by the ovarian veins and artery. On the right side, above the brim of the pelvis, it lies behind the caput coli and the ascending colon; on the left side it lies behind the sigmoid flexure at the brim, and above this behind the descending colon.

The whole of the abdominal portion of either ureter can be exposed through a lateral incision without injuring any important structure or ligating any vessels, and without opening the peritoneum, by simply lifting up the ascending or descending colon and drawing the bowel toward the median line.

At the brim of the pelvis each ureter lies upon the common iliac artery, crossing it at about 3 centimeters (1¼ inch) from the middle of the sacral promontory: just below this it crosses the common iliac vein as it drops into the pelvis beside the internal iliac artery, and usually behind it.

The ovarian vessels cross the ureter, and leave it at the brim as they enter the top of the broad ligament.

Within the pelvis the ureter pursues a sigmoid course, running at first behind the peritoneum of the posterior lateral pelvic wall, close to the internal iliac artery, and then turning forward and crossing under the uterine artery, and passing through a sort of membranous foramen at the base of the broad ligament halfway between the cervix and the pelvic wall, nearer to the cervix on the left side. Beyond the cervix it runs at first parallel to the upper anterior vaginal wall, which it crosses, to pierce the bladder wall obliquely forward and inward, ending at the ureteral orifice at the trigonum vesicæ.

The landmark for the first part of the pelvic portion of the ureter is the internal iliac artery. The ureter can be found on a rectal examination lying just behind the artery, which it sometimes crosses so as to lie in front of it.

In its relation to the vaginal walls the lower ends of the ureters may be located by the "ureteral folds" seen on the anterior vaginal wall.

Physiology.—The function of the ureters is simply to transmit the urine from the pelvis of the kidney to the bladder. This function is an active and not a passive one. The urine first accumulates in the renal pelvis and enters the ureter intermittently, where it is caught and carried down by a peristaltic wave about 2·5 centimeters long, which travels the length of the ureter every ten to twenty or thirty seconds. As the wave passes, there is a distinct vermicular movement, at first a contraction then a lengthening of the ureter, which moves forward under its peritoneal cover. I have seen this phenomenon repeatedly in the course of operations. I have also excited the wave movement by light tapping or by lifting the ureter up, pinching, and dropping it: this act may also excite a reverse peristalsis. Each ureteral contraction is signalized at the orifice of the ureteral catheter by the sudden expulsion of a few drops of urine, or if the caliber of the catheter is quite small, by a jet lasting two or three seconds. An observer watching the vesical orifice of the ureter with the patient

in the knee-breast position sees little jets of urine spurting out every few seconds. The inner coat of the normal ureter is not sensitive to the contact of the flexible silk ureteral catheter as it is introduced.

METHODS OF EXAMINING THE URETERS.

The ureters can be examined by inspection, palpation, catheterization, and sounding.

Inspection.—But one portion of the ureters, the vesical orifices, can be seen by a cystoscopic examination without a preliminary operation. When the patient is in the knee-breast position a distinct ridge is often seen on the vesical mucosa extending from each ureteral orifice out to the pelvic wall, which corresponds to the lower extremity of the ureters. I have exposed and examined the vaginal portion of the ureter by an incision extending from the vault halfway down through the antero-lateral vaginal wall. By separating the edges of the incision, the ureter will be found in the loose cellular tissue just above the vagina, close to the pelvic wall. It can be located with greater ease if a bougie has been placed in it beforehand, converting it into a hard cord easily distinguished.

The posterior pelvic and lower abdominal portions on either side can readily be inspected, when the abdomen is opened, by drawing the sigmoid flexure toward the right side to expose the left ureter, and by lifting up the caput coli and drawing it also to the right to expose the right ureter. The ureters appear as whitish, flat cords, often with a little tortuous artery coursing down them, beneath the peritoneum, and lying close to the inner side of the ovarian vessels at the brim of the pelvis. If not seen, the ureter can be found by picking it up just above the brim of the pelvis with the ovarian vessels and the adjacent cellular tissue; the ovarian veins collapse at once on pressure, and the artery is small, but the ureter forms a distinct flat cord readily recognized by touch. This cord is easily followed by touch and sight down over the pelvic brim, and then, by holding it out from the pelvic wall and floor, a sort of meso-ureter is formed, and it is traceable as far forward as the uterine artery.

If there is much fat in the abdomen it is sometimes hard to find the ureter. In such cases I pick up a fold of peritoneum overlying the common iliac artery near its bifurcation and incise it for 2 or 3 centimeters ($\frac{3}{4}$ to 1 inch). By drawing apart the edges of this incision and getting rid of the fat and then looking closely, the ureter will be found beneath. If necessary to trace it farther it may be held up and the peritoneum split up or down, laying it bare.

The abdominal portions of the ureters can be laid bare for inspection by incising the peritoneum reflected over the ascending and descending colon on the outer side, where there are no vessels; then, by displacing the colon toward the median line, the ureter is exposed on the psoas muscle.

I have also inspected the entire abdominal portion of the ureter through an incision beginning in the flank in front of the quadratus muscle and extending down just above and parallel to the brim of the pelvis as far as the anterior superior spine. This can be done most conveniently when the kidney is removed

and detached from everything but the ureter. By pulling the ureter so as to make it tense, its course is easily followed by the finger down in the loose cellular tissue. It will be important to do this in tubercular disease of the kidney to see if the ureter is involved too, or in the case of a suspected stone in the ureter.

Palpation.—The whole pelvic portion of the ureter is accessible to palpation in two ways—either by the vagina or by the rectum.

By the vagina the ureters are most accessible to palpation at their lower extremities, from the bases of the broad ligaments beside the cervix down to the terminus in the bladder. To palpate the ureter the bladder and rectum should be empty, and the patient lying on her back with flexed thighs. The index finger is now carried high up into one of the vaginal fornices, pushing it upward and outward toward the pelvic wall, which is then gently stroked downward and backward. The ureter feels to the finger tip like a flat cord which is constantly slipping away. The cord is palpated again and again, each time bringing the finger nearer the outlet, and so tracing the course of the ureter down the pelvic wall to the point at which it passes between the anterior vaginal wall and the bladder.

Sometimes the ureter will be found lying close to the pelvic wall, and at others in the loose cellular tissue several millimeters distant. When the ureter is out of easy reach it can be better felt by a bimanual examination, the upper hand pressing down through the abdominal wall. By this manœuvre the abdominal hand displaces the organ slightly, and at the same time offers a plane of resistance against which the ureter can be readily palpated by the vaginal finger. In advanced pregnancy, where the head is low in the pelvis, the ureters are markedly displaced and can be felt with extraordinary distinctness against the child's head.

In palpating its lower extremity the ureter is distinguished by its direction, its size, its consistency, and its mobility. It may be confused with an obturator artery pursuing a course parallel to the vagina, but the artery is small and round, and it will be felt to pulsate. The obturator nerve also lies parallel to the course of the ureter above, but it may be traced down to the obturator foramen, and produces pain in the leg on pulling it. The sharp tendinous arch of the levator muscle may also be mistaken for the ureter, but a closer palpation will correct this source of error, as well as the impression at first produced by strands of the internal obturator muscle.

The ureter lies loosely in its cellular bed, and so can be sometimes displaced downward 1 or 2 centimeters, and if a hand rests over the abdominal portion at the pelvic brim in a thin patient, when a finger draws down the vaginal end and lets it snap back, like a cord of a bow, the impulse may sometimes be felt at the brim of the pelvis.

The normal ureter can only be palpated with certainty through intact abdominal walls at the pelvic brim when the walls are extremely thin. I have felt them distinctly through the lax umbilical ring immediately after childbirth. A diseased ureter, usually extremely sensitive, can be readily located by the pain on pressure at its point of transit from the abdomen into the pelvis.

To make this examination the patient lies on her back with shoulders raised on a pillow and thighs moderately drawn up, and the large bowel and bladder must be empty. The examiner stands on the side he wishes to palpate and begins by making a gradually increasing deep pressure through the abdominal walls until the promontory of the sacrum is found; 3 centimeters (1¼ inch) to the right or left side of this point and a little below it is the point at which the ureter crosses the pelvic brim. By making deep pressure through the semilunar line over the brim at this point in an oblique direction from above downward, and sliding the fingers up and down, the patient will at once complain of pain and possibly of a desire to urinate if the ureter is inflamed. A large diseased ureter—tuberculous, for example—will feel through a thin abdominal wall like a stout cord rolling under the fingers.

The abdominal portion of an inflamed ureter above these points may be traced by following the line of tenderness developed on making deep pressure.

By the rectum the ureter can be felt from the pelvic brim to the pelvic floor through the empty bowel; the left ureter is the most accessible. The pelvic floor is invaginated by strong pressure and the finger carried up to the bifurcation of the common iliac artery, from which point down the internal iliac artery is easily followed. Guided by these landmarks, the finger palpates carefully behind and close to the internal iliac artery until a flat yielding cord (the ureter) is detected, which can be traced at first downward and then forward. A ureter whose walls are thickened can be still more readily found and palpated. If the ureter is not found in this way, it can be palpated with perfect ease throughout its whole pelvic course by first placing a hard-rubber bougie or a catheter within it.

In abdominal operations, when the broad ligament is opened, if the ureter is not marked out by a catheter lying in its lumen, it may be found by touch alone by separating the anterior from the posterior layer of peritoneum and carrying the thumb and forefinger deep down to the pelvic floor, and gathering up the cellular tissue and letting it slip out between the fingers; after a few efforts the ureter will be distinctly recognized, and then easily traced in its course into the anterior part of the pelvis.

Catheterization.—The most important means of investigation at our command is catheterization, by which we may establish the existence of a stricture, a hydroureter, a pyoureter, or a calculus of the ureter, or secure evidence of disease of the kidney above, or settle the question as to whether one or both ureters are involved; catheterization also gives precise information as to the extent and location of the disease.

We are able by catheterization to receive directly from the ureter the urine discharged from the kidney without contamination with the surface of the bladder and urethra and before mixture with the urine from the opposite kidney. By catheterizing both ureters and leaving the catheters in, the urine from both kidneys may be collected separately, throwing the bladder for a time entirely out of use. Catheters may even be left in place for several hours, or even in exceptional instances, as suggested by Dr. F. Henrotin, for three or four days.

The utmost pains must be taken throughout to avoid the introduction of septic matter into the ureter by the catheter.

The best way to catheterize the ureters in women is under an atmospheric distention of the bladder, secured by posture, and a direct inspection of the ureteral orifices through a cystoscope.

The following instruments are required:

A conical urethral dilator; several specula with obturators, Nos. 8, 8½, 9, 9½, 10; a light; a head mirror; an evacuator; long recurved mouse-toothed forceps; a ureteral searcher; flexible ureteral and renal catheters; a metal ureteral catheter; hard-rubber bougies; and a series of dilating catheters.

A description of the urethral dilator, various specula, light, mirror, evacuator, forceps, and searcher, used also in examination of the bladder, has been given in Chapter XII.

Flexible Catheters.—Flexible catheters which readily follow the curves of the ureters and do not injure them during introduction are used to drain the urine from the ureters; they can easily be carried beyond the pelvis into the abdominal portions even as far as the kidneys; with their use also there is no liability of hurting the patient or of the catheter slipping out during the subsequent manipulations necessary to put the patient in a satisfactory position in the bed, when the catheter is to be left in for any length of time.

Two kinds of flexible catheters are made, ureteral and renal, differing only in length, the former 30 centimeters (12 inches) and the latter 50 centimeters (20 inches) long. These catheters are made of woven silk, many times coated with varnish and rubbed down until they have a highly polished surface. The end of the catheter is blunt, conical, with a large oval eye 2 centimeters (¾ inch) from the tip. Both kinds are made in diameters which run from 1¾ millimeter to 3 millimeters. The following sizes are furnished: 1¾, 2, 2¼, 2½, 2¾, 3. The name of the size specifies the diameter in millimeters.

It is possible in almost all cases to introduce a catheter into the ureter through one of the plain cylindrical cystoscopes without anesthesia and without any or but slight dilatation of the urethra. The bladder should be distended with air by the knee-chest or elevated-dorsal posture and illuminated by a simple reflected light (see Chapter XII).

A wire stylet is necessary to give the catheter the needed stiffness during its introduction into the ureter. The catheters should be kept dry and straight. If they are bent they tend to crack and blister and little scales rise which cut like a knife. After use each catheter should be thoroughly cleansed by forcing through it with a syringe a warm bichloride-of-mercury solution (1 to 1,000) followed by warm water. After septic cases it must be sterilized by boiling two minutes in pure water, after which it should be laid away in sterilized towels or cloth in a warm place and kept quite straight four or five days until thoroughly dried, when it may be put away in a case until wanted for further use. It is especially important to make sure that no particles of dirt are left in the lumen of the catheter; macroscopic particles can be detected by the interference with the flow of water from end to end, as well as by holding the catheter up to the

light and inspecting its lumen in this way. It is my habit to preserve my catheters in bulk in a simple stout glass tube 2·5 centimeters in diameter plugged at the ends with cotton. A little sterilized soapstone powder keeps them from adhering to one another. In addition to this I keep a case of catheters of different sizes ready for immediate use in which each one is enclosed in a glass tube 1 centimeter in diameter and a few centimeters longer than the catheter, and plugged at both ends with sterilized cotton. In a warm house the catheters will be stiffer for use if they are laid in the refrigerator for an hour. A convenient way to carry these tubes about is in a case made of two pieces of canvas stitched together lengthwise so as to form a series of compartments, each one of which accommodates a glass tube. The case is stiffened at the sides by a piece of stout wire sewed in the edges, keeping it from bending and breaking the tubes.

The Metal Ureteral Catheter.—A metal catheter is sometimes useful when the ureter is strictured at its lower end or when its canal is tortuous. Under these circumstances a flexible catheter may refuse to enter, but a metal catheter can be carried through the constriction and up a twisted canal guided by the sense of touch.

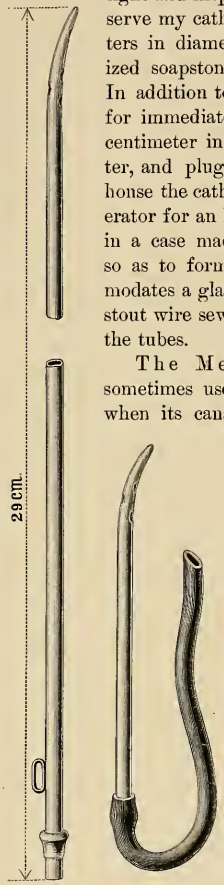


Fig. 234. — Left-hand Figure, Long Metal Ureteral Catheter for the Lower Part of the Ureter.

Used chiefly in stricture of the vesical end of the ureter. The short metal catheter with the rubber tube is often used to collect the urine from one side when a long flexible catheter can not be carried up to the kidney. A catheter ½ to 1 millimeter smaller in diameter than that shown in the figure is usually used.

The catheter is 29 centimeters (12 inches) long and 2½ millimeters in diameter, slightly curved, and with a small, blunt, olive point at its ureteral end. Three oval eyes, 2 by 1 millimeter, back of the point afford a free exit for fluids. The outer end of the catheter is slightly curved to carry the fingers clear of the lumen of the speculum during the introduction; a plug attached by a chain keeps any fluid in the ureter from escaping until the catheter is introduced.

Dr. Reynolds, of Boston, has had a flexible metal catheter made of block tin.

Ureteral Bougies.—Solid metal bougies, 30 centimeters (12 inches) long and shaped like the metal ureteral catheters, are often serviceable in testing the permeability of the lower end of the ureter, or in recognizing a calculus in its pelvic portion, or in locating and dilating a stricture in the ureter not far from the bladder. I have had a series of these bougies made 2 millimeters in diameter, with a bulbous enlargement about 7 millimeters back of the point, varying in size in the different numbers of the series from one which is but slightly larger than the shaft of the bougie itself up to one 4 milli-

meters in diameter. I have tested whalebone and found that, on account of its elasticity, it does not make a good ureteral bougie. The best bougies are made of hard rubber 2 millimeters in diameter and 50 centimeters (20 inches) in total length. There is a slight narrowing below the end which is rounded off into a point shaped like an olive. The handle, large enough to be taken conveniently between the thumb and forefinger, is 6 centimeters (2½ inches) in length and passes easily through the No. 8 vesical speculum. This bougie easily adapts itself to the curves of the ureter and can be pushed on up into the pelvis of the kidney without danger. It becomes more flexible when warmed.

The ureteral and renal catheters are also made without any eye for use as flexible bougies; these are the safest in performing hysterectomy, on account of the liability of the hard rubber to break when bent suddenly and sharply.

I have also had a long hard-rubber bougie made with a little notch running lengthwise at the tip on two sides, intended to catch and hold the dental wax with which the end is coated when the bougie is used as a searcher for a renal calculus. If a calculus is present and the bougie comes in contact with it, the shining impressionable surface of the wax is scratched, and the scratch marks can be seen under the lens of a low magnifying power. A silk renal catheter tipped with wax detects the stone equally well, and so serves the double purpose of bougie and catheter.

Fig. 235.—Shows End of Elastic Bougie tipped with Wax.

Dilating Catheters.—The dilating catheters are used to dilate ureteral strictures near the bladder. They are nickel-plated metal tubes, 25 centimeters (10 inches) in length, slightly curved at the tapering conical point, which is well rounded and blunt so as not to hurt the ureteral wall. The slight curve, which is shown in the picture, facilitates the introduction through a stricture. There are four eyes, arranged in pairs, one eye below the other on opposite sides of the catheter, and located within 2 centimeters of the end. The outer end of the catheter is curved in an opposite direction from the curve of the point, so as to keep the fingers out of the way during introduction. At the outer end there is a little bulbous enlargement to hold rubber tubing slipped over it; a plug and chain are attached to keep the catheter closed until introduced. The sizes vary in diameter from 2½ to 6 millimeters, the difference between the sizes being half a millimeter.

Introduction of the Speculum and Location of the Ureteral Orifices.—The bladder is first emptied of its urine by voiding it in a sitting or a standing posture. The evacuation is more complete when it is so voided than when drawn by catheter in the dorsal posture. The patient is then placed on a table in the knee-breast or elevated-dorsal position, the labia separated, and the urethral orifice exposed and cleansed with a boric acid solution to avoid carrying surface contamination into the bladder on introducing the speculum.

A bladder speculum, No. 8, 9, or 10, is introduced as described in Chapter XII. The light is then reflected into the bladder, and illuminates the posterior wall. The speculum is next withdrawn until the internal urethral orifice begins to close over the end, when it is pushed farther in, about a centimeter, and turned from 25 to 30 degrees, either to the right or left, while the handle is dropped to bring the base of the bladder into view. The ureter itself, or the area immediately adjacent to it, now lies within the field of vision, about 1·5 centimeter (½ inch) distant from the end of the speculum. In thin patients the dorsal posture works very well, but in a patient of medium size the bladder may not distend well until she assumes the knee-breast position. Stout women must always be examined in the knee-breast posture.

In virgins and nulliparæ the bladder walls balloon out so much upon atmos-

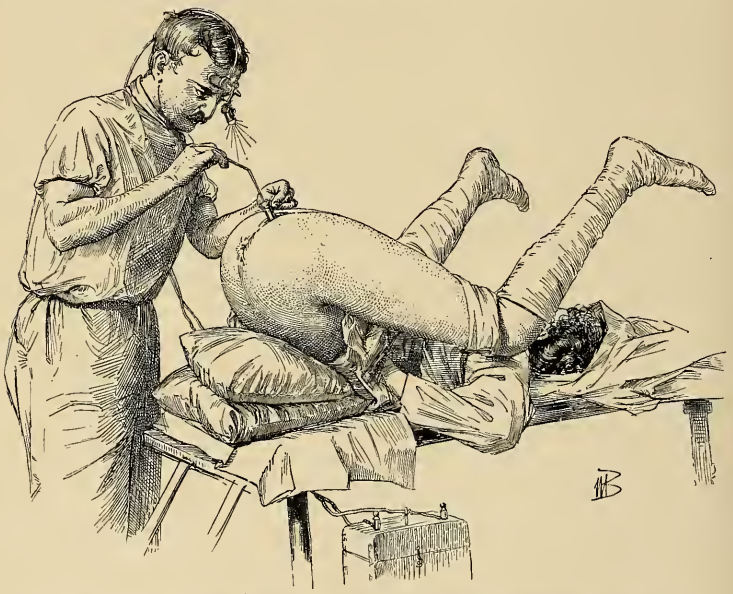


Fig. 236.—Sounding the Left Ureter with the Searcher before introducing the Catheter. The patient is in the elevated dorsal position, and the electric headlight is used to illuminate the bladder.

pheric distention that the base is carried up toward the sacrum, and becomes so markedly concave that the ureteral openings can scarcely be seen; if the patient is in the knee-breast position, the observer has to drop the handle of the speculum to such an extent that he is obliged almost to bring his head under the pelvis to find them. This difficulty will be obviated by first introducing into the vagina a little speculum, not more than 1 to 1½ centimeter, which lets

in the air and causes the anterior vaginal wall to drop down, bringing the base of the bladder into the plane of vision. If the distention is still too great after this manœuvre, the difficulty may then be overcome by introducing within the vagina a cotton pack large enough to hold the anterior wall down, or a small inflatable rubber bag, or an instrument shaped like a spatula with a strongly curved handle to make pressure on the vaginal wall and bring the ureteral orifice into view.

While the ureter is generally found at an angle of from twenty-five to thirty degrees with the urethra, it may be either more or less. I have often seen it upon simply carrying the speculum straight into the bladder without deviating more than from three to five degrees to the right or left. I use a simple device, figured in the text as a goniometer, to measure the angle between a line connecting the ureteral orifice with the internal orifice of the urethra and the axis of the urethra. The zero line of the goniometer is held in the line of the urethra while the long arm points to the ureteral orifice, when the angle can be read off on the graduated arc. In inflammatory cases the ureter is often drawn markedly to one side.

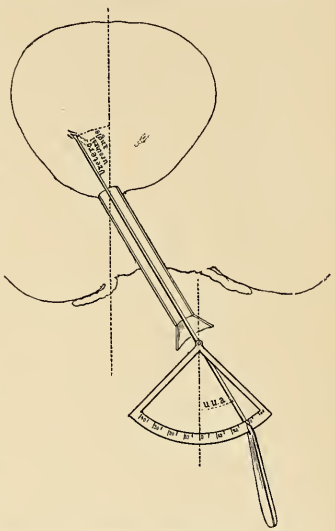


FIG. 237.—USING THE GONIOMETER TO DETERMINE THE ANGLE MADE BY THE AXIS OF THE URETHRA, WITH A LINE DRAWN FROM THE INTERNAL URETHRAL ORIFICE TO THE URETER.

If the abdomen is filled with ascitic fluid, or if there is a tumor wedged in the pelvis, or if inflammatory disease is present, the bladder may not distend enough to allow the ureteral orifices to be seen. In such cases the orifice may be sought in the dorsal position without elevation.

The ureteral orifice is recognized as soon as it comes into the field of the speculum as a fine transverse slit, 2 to 3 millimeters long, like a little dark line on the bladder wall, not unlike a water mark in paper. At times it appears more distinct, owing to a slight injection of its borders. Rarely it looks like a fine dark point or a distinct hole. In the knee-breast position a decided eminence, having the form of a truncated cone, marks its site, and the opening is situated on top or on the anterior urethral side of this. I have called this elevation the mons ureteris. In one of my cases there appeared to be two left ureteral orifices, parallel and exactly alike, about 2 millimeters apart, but on passing the catheter into the lower one on the edge of the mons instead of going up a ureter, it reappeared in the bladder and the false orifice was found to be a little bridle of mucous tissue, 2 or 3 millimeters long and about as wide.

When the ureteral orifice is not seen at all after a careful search it may be

found by directing the speculum to the area where it should be, taking care that it is not pushed too far in so as to cover it, and then with the searcher systematically and gently running over the whole surface feeling for it. Sooner or later the point catches and enters and the orifice is evident. The searcher upon enter-

Fig. 238.—Passing a Metal Ureteral Catheter into the Left Ureteral Orifice, which is exposed in the Lumen of the Speculum. The Patient is in the Knee-chest Posture.

ing separates the lips of the orifice a little, making them pale and opening up a dark hole about 2 millimeters in diameter, especially striking to an on-looker waiting for a demonstration of the possibility of catheterizing the ureter in this way.

Introduction of the Flexible Silk Catheter.—The location of the orifice is carefully noted, and while the speculum is grasped firmly so as to keep it in full view, the sterilized flexible silk ureteral catheter, projecting a

little from its glass tube, is held over the shoulder—in the left hand for the right ureter and in the right hand for the left ureter—and slowly guided up the tube, where its point is engaged in the orifice and pushed on from 10 to 15 centimeters (4 to 6 inches).

The end of the catheter must be lubricated by dipping it in a boro-glyceride solution before introduction, and before taking

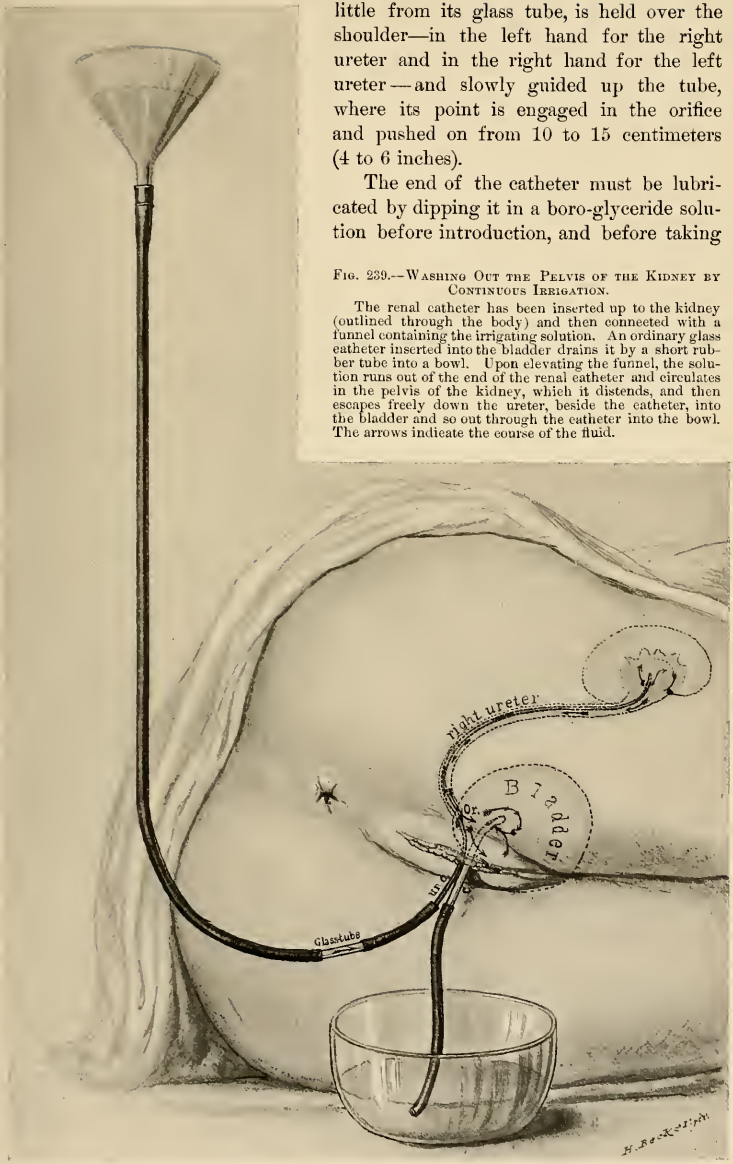


Fig. 239.—Washing Out the Pelvis of the Kidney by Continuous Irrigation.

The renal catheter has been inserted up to the kidney (outlined through the body) and then connected with a funnel containing the irrigating solution. An ordinary glass catheter inserted into the bladder drains it by a short rubber tube into a bowl. Upon elevating the funnel, the solution runs out of the end of the renal catheter and circulates in the pelvis of the kidney, which it distends, and then escapes freely down the ureter, beside the catheter, into the bladder and so out through the catheter into the bowl. The arrows indicate the course of the fluid.

hold of the end of the catheter sterilized rubber finger stalls must be drawn over the thumb and forefinger, to avoid direct contact with the fingers, and so a possible infection of the ureter. If there is any inflammatory process in the bladder, the ureteral orifice must be cleansed with a pledget of cotton held by the mouse-toothed forceps, and the lumen of the speculum must be cleansed in the same way.

In introducing the long renal catheter when the glass tube is not used, the handling of its upper part, which is to lie inside the body, may be avoided by first locating the ureteral orifice and then asking for the catheter. The assistant takes it up from the sterilized towel in which it rests by the outer end and hands it to the operator, who likewise receives it by this end, and slowly guides the swinging tip into the speculum and so on up into the ureteral orifice, when it is then easily run off from its stylet and on up the ureter.

When the catheter is in place the speculum is withdrawn, while the operator holds on to the catheter to keep it from being pulled out too. If the catheter is to remain in but a short time the patient may stay in the same position; otherwise she should be carefully turned over on her back or side, avoiding any pull on the catheter.

In many cases when a catheter not larger than 2 or 2·25 millimeters is used to wash out the pelvis of the kidney the fluid only distends the pelvis a little and then begins to run down the ureter and back into the bladder outside the catheter. Owing to this circumstance, in cases of catarrhal pyelitis and of pyelonephrosis it is often possible to wash the kidney out thoroughly by keeping up a continuous irrigation for from ten to thirty minutes or longer.

After the renal catheter is inserted the patient lies on the opposite side and a glass catheter is inserted into the bladder. It is well to color the irrigating solution with aniline dye to demonstrate its return to the eye. On raising the funnel and letting the fluid run into the kidney the return flow into and out of the bladder is noticed at an interval of from fifteen to seventy-five seconds. The end of the catheter is placed in a sterilized test tube to collect the escaping urine. If the tube is left in after the patient is put to bed it is best held in a block of wood in an auger hole bored at an angle as shown in the figure.

When the short metal catheter with a piece of rubber tubing on the end is inserted into the ureter for the purpose of collecting the urine of one side, it is best to drop a small quantity of a concentrated aniline solution into the bladder so as to have positive evidence that the clear fluid escaping by the catheter is not contaminated by the fluid in the bladder and that the catheter remains in place in the ureter.

In making a thorough examination of urine collected directly from the ureter five things must be inquired into:

1. The amount of fluid escaping at once upon the introduction of the catheter.
2. The rate of flow during catheterization.
3. Physical properties, specific gravity.
4. Chemical properties.

5. Bacteriological condition.

The watch is taken out and the time of introduction noted, so that the rate of secretion may be determined by measuring the amount collected within a definite time.

When both ureters are to be catheterized the speculum is withdrawn and re-inserted beside the first catheter, and the other orifice found and catheterized in like manner.

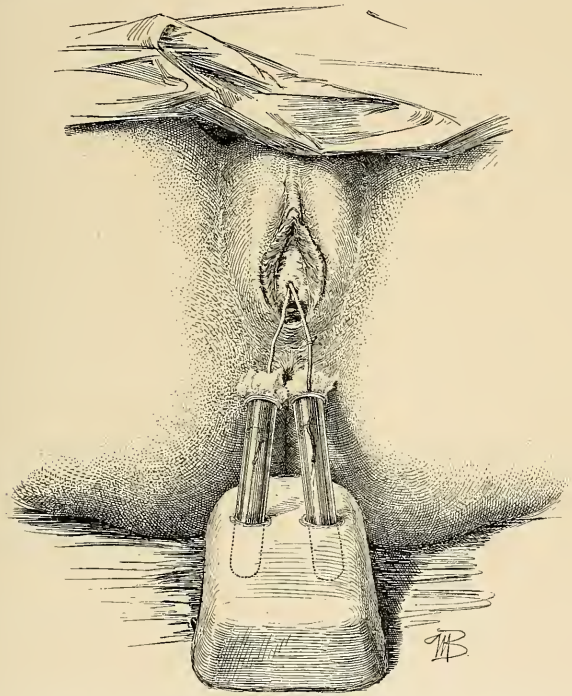


Fig. 240.—Catheterizing both Ureters; the Separated Urines are being collected in Test Tubes Plugged with Cotton and held in a Block.

Another way of securing separated urines from both ureters at the same time is to place one of the larger ureteral catheters in one ureter and then carefully remove all fluid from the bladder with the suction apparatus and pledgets of cotton. The patient lies on her back and the urine drains, say for an hour, through the ureteral catheter into a vessel in the bed. The urine which collects in the bladder during this hour may be assumed to come from the other kidney if it presents different chemical and microscopic char-

acteristics; it is removed either by an ordinary vesical catheter, before taking out the ureteral catheter, or by introducing a speculum and using the suction apparatus. This plan needs further trial and is not available when there is inflammation of the bladder which contaminates the urine accumulating in it.

A method of separating the urines from the right and left ureters without catheterizing the ureters has been devised by Dr. Neumann (*Deutsche med. Woch.*, No. 43, 1897). The patient is seated on the very edge of a table, with her feet on the floor or a stool. An instrument is then inserted which is intended to divide the bladder for a time into right and left halves, and at the same time to provide a free exit for each half, in this way separating the urines. The instrument is constructed like a catheter, 4 centimeters long and 1 centimeter in diameter, with a vertical partition down the middle; this partition is continued 4 centimeters beyond the body of the instrument, and ends in a blunt rounded point, connected with the end by two fine wires on each side. The distal end of the catheter ends in two little tubes, one for each side; on these little graduates are hung to collect the urine. The whole instrument has a gentle curve, like Hegar's cervical dilators.

The urines are separated by first washing the bladder out from one tube through the other, and then introducing the index finger into the vagina and pressing the base of the bladder firmly up against the instrument, which now fits snugly behind the symphysis pubis. The urine escaping from the ureters now flows down the tubes on the right and left sides completely separated.

How to obtain Uncontaminated Urine. — Sterilized urine, or urine free from any contamination from external sources, may be obtained by covering 3 or 4 centimeters ($1\frac{1}{4}$ to $1\frac{1}{2}$ inch) of the outer end of the sterilized ureteral catheter with a protecting rubber sleeve, and then introducing the catheter as described; the sleeve is then removed and another piece of longer sterilized tubing slipped over the end and used to convey the urine into a suitable sterilized glass tube plugged with cotton, resting in a block. To avoid contaminating the end of the catheter by contact with the sides of the speculum, it may be introduced into the bladder loosely covered with a sterilized rubber sleeve, which is pulled off as soon as it is well in; but I prefer simply cleansing the inside of the speculum with a boric acid solution.

It is also possible to obtain uncontaminated urine after introducing the catheter in the ordinary way by boiling the first drop of urine appearing at the end with an alcohol flame held under it; the urine which follows this is then in no danger of contamination by picking up germs at this point.

For a bacteriological examination and cultures it is sufficient in this way to let a few drops fall directly from the end of the catheter on to the slide or into the culture tube. It is always well to test alkalinity or acidity as the urine escapes.

How to secure Urine from the Ureter without using a Ureteral Catheter.—Sometimes there are serious objections to passing a catheter into a sound ureter; when, for example, the bladder is extensively inflamed the examiner will hesitate, on account of the risk of opening up the

ureter and of the dangers attendant upon the slight trauma under such circumstances. But it is almost always possible to get enough urine for a microscopic and chemical examination without even touching the ureteral orifice. This is done by putting the patient in the knee-breast position, exposing a ureteral orifice, wiping it off, and then holding the end of the speculum close up under it until a jet of urine escapes; the drop is caught in the lumen of the speculum and runs down its side on to the outer lip, where it may be taken at once on to a slide and examined or collected in a minim graduate. The microscopic examination in this way of a drop or two may be just as satisfactory as a large quantity secured by the ureteral catheter. (See *Twentieth Cent. Prac. Med.*, vol. i, 1895, p. 690.)

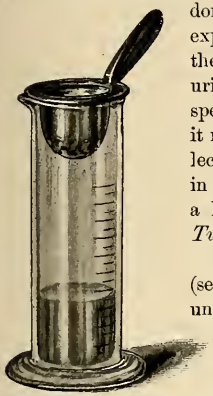


FIG. 241.—SIEVE AND GRADUATE FOR FILTERING AND COLLECTING A FEW DROPS OF URINE CAUGHT UP ON COTTON FROM THE URETERAL ORIFICE, THROUGH THE SPECULUM, WITHOUT CATHETERIZING THE URETER.

I have had a speculum made for this special purpose (see Fig. 193) with the end cut off obliquely to fit in better under the orifice in the knee-breast position.

Catheterization of the Ureters without Elevation of the Pelvis and without Atmospheric Distention of the Bladder.—Under certain circumstances, when it is awkward or when it consumes too much time to place the patient in the knee-breast position and to elevate the hips on cushions, I am in the habit of introducing the catheter in the following simple manner without elevation or atmospheric distention of the bladder:

The patient lies on her back on a flat table, with thighs well drawn up on the body, and the bladder is emptied. The No. 9 or 10 cystoscope is now introduced, its outer end strongly elevated, and the inner end turned toward the right or left side of the base of the bladder. The head mirror is now turned so as to

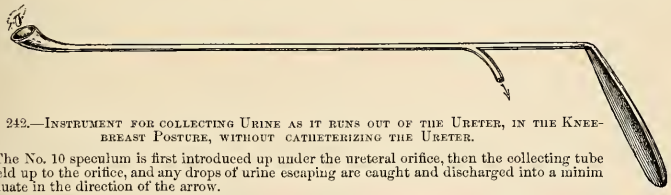


FIG. 242.—INSTRUMENT FOR COLLECTING URINE AS IT RUNS OUT OF THE URETER, IN THE KNEE-BREAST POSTURE, WITHOUT CATHETERIZING THE URETER.

The No. 10 speculum is first introduced up under the ureteral orifice, then the collecting tube is held up to the orifice, and any drops of urine escaping are caught and discharged into a minim graduate in the direction of the arrow.

illuminate the portion of the wall of the bladder at the end of the speculum. The speculum is now withdrawn as far as the urethral orifice, to locate its position, and then pushed in again and turned to one side with the idea of bringing the ureteral orifice at once within the lumen of the speculum. Sometimes it can be seen immediately, even through a little layer of clear urine; at other times it is necessary to keep the speculum against the bladder wall, and then, after drying out the few drops of urine in it, to find the ureteral orifice by gliding the instru-

ment over the vesical mucosa. Any depression resembling the mouth of the ureter is first tested with the searcher, and then if it is found the catheter is pushed in. By introducing the flexible catheters in this way just before a vaginal or abdominal hysterectomy the ureter is converted into a cord easily felt throughout the operation.

It not infrequently happens that the patient, with carcinoma of the cervix, is either so heavy that she can not be put into the knee-chest posture with the limited assistance at the command of the operator, or that she is so feeble that the operator feels unwilling to lose the amount of time necessary to change her position in order to find the ureteral orifices for catheterization. Under these circumstances I have often resorted to the method just described with perfect satisfaction. It will, however, hardly be possible for one not thoroughly used to the simpler way of catheterizing the ureters in the knee-breast posture, and so familiar with the exact location of their vesical orifices, to find them in the dorsal position with a collapsed bladder.

Points to be observed in securing Separated Urines.—I use the plural urines advisedly to make a distinction, hitherto impossible, between the mixed urine in the bladder from both sides and that from each kidney separately before mixing.

The purpose of the examination is to estimate correctly the status of each kidney by determining (1) its working coefficient as estimated by the amount of urea being secreted; (2) the existence of various morbid products, such as casts, albumin, pus, and bacteria.

To reach accurate conclusions, the following points should be observed in catheterizing both ureters:

1. The exact time of introduction of each catheter is noted. It is well to attach the note to the catheter on a card.

2. The time of withdrawal is noted and also written on the card, giving the exact duration of the flow.

3. The exact amount of secretion collected in the test tube is noted.

4. It is well to compare the rate of secretion, determined by noting the amount of flow in a given unit of time, say from five to fifteen minutes or longer, with the entire amount passed in the twelve hours during which the examination is made. If the amount secured is too small or too large the error may be rectified in this way. A nervous patient, for example, will sometimes pass an excessive amount through the catheter.

5. An analysis of each urine is made investigating its physical, chemical, microscopical, and bacteriological characters. Especial attention must be paid to the urea as the most important representative of the physiological activity of the kidney. It is better to keep a book of charts for recording each analysis under some such plan as the following:

ANALYSIS OF SEPARATED URINES.

Name, *Date,*

Diagnosis,

Time of insertion of catheter,

Right or left ureter catheterized,

Size of catheter used,

Time of withdrawal of catheter,

Amount of urine secured,

Average amount in twenty-four hours,

Appearance of urine on withdrawal,

Sediment,

Specific gravity,

Reaction,

Albumin,

Urea,

Microscopic examination,

Bacteria, cover-slip, and cultures,

Sounding the Ureters.—Sounds are introduced into the ureters to find a stricture or an obstruction, to dilate a stricture, and to convert the soft ureter into a firm resisting cord easily found and kept under the fingers during a pelvic operation.

In most instances the catheters serve the purpose of bougies as well or better than a solid instrument. The catheter, for example, gives evidence of the passage of a stricture by the difficulty of entrance, by the bite of the stricture, as well as by an immediate gush of urine, and the long, flexible silk catheters serve just as well to splint the ureter and mark out is course to prevent injury during an operation. The catheter, however, can not so well detect and estimate the character of resistance, and the force used in overcoming it can not be so well gauged. For these purposes I use hard-rubber bougies 30 centi-

meters (12 inches) long and 2 millimeters in diameter for the pelvic portion, and 50 centimeters (20 inches) long for the entire ureter and pelvis of the kidney.

These bougies are smooth and flexible, and easily follow the course of the ureter. The ureteral orifice is exposed as for catheterization, and the point of the bougie engaged. By pressing on one side or the other of the speculum the end may be brought to bear directly upon the ureteral orifice and slipped in.

By a gentle forward movement it is carried on and upward toward the kidney, easily guided by the ureter and taking all its curves.

Catheterizing the Pelvis of the Kidney.—The pelvis of the kidney can be catheterized by means of long, flexible silk catheters.

To introduce the renal catheter, the hands are carefully washed and sterilized, the ureteral orifice exposed, and the catheter, taken from the refrigerator or stiffened with a stylet, is coated with boro-glyceride at the end and slipped through the speculum and pushed on until its point is engaged in the ureter. The long outer end of the catheter, wrapped in a piece of sterilized gauze, or still lying in the sterilized towel, out of which it is drawn as it is introduced, must hang over the shoulder. The rate of introduction should be slow, 2 or 3 centimeters at a time, and the examiner should take care to keep the end of the speculum close to the ureteral orifice, and watch to see that the catheter does not kink in the bladder or speculum. The patient may have no sensation at all as the catheter goes in, or may be only conscious as the end touches the upper margin of the pelvis of the kidney.

When from 32 to 37 centimeters (13 to 15 inches) have been pushed in beyond the external urethral orifice the end will lie in the upper part of the renal pelvis.

If the catheter is soft and has to be braced by a stylet, this must not reach quite to the end, and as soon as a few centimeters of the catheter are engaged in the ureter the stylet is pulled out for the same distance, after which the catheter is stripped off from the stylet and pushed on up the ureter into the kidney.

Normally there is but little urine collected in the pelvis of the kidney, and it is necessary to wait a while for the catheter to fill and begin to discharge the droplets. The respiratory movements may be seen in the play of the drop to and fro as it hangs from the end of the catheter. When there is a stricture in the ureter or at the pelvis of the kidney there is an accumulation of urine or pus within the pelvis. The renal catheter relieves this retention by drawing off the fluid and discovers lesser grades of hydronephrosis and pyonephrosis which have hitherto escaped attention. I estimate the degree of hydronephrosis by measuring the exact amount of fluid discharged in a steady stream or by continuous dropping with the catheter held down so as to act as a siphon. If the catheter is a small one and it takes a long time to empty the sac, I then allow half a cubic centimeter per minute for the activity of the kidney during the time of evacuation. As soon as the flow begins to come at intervals it is evident that this is dependent on the present secretory activity of the kidney, and the accumulated urine has been exhausted.

Asepsis.—The whole technique of the examination and exploration of the ureters must be aseptically conducted. The danger from introducing septic material directly into a ureter is sufficiently obvious, and is illustrated by numerous examples of a fatal infection ascending from the urethra up to the kidney. If an infection of the urethra or bladder can spread in this way, it goes without saying that an infection introduced in the ureter will also spread.

The various manipulations ought to be conducted with a care in the aseptic technique equal to that of any surgical procedure, so that there is therefore no excuse for any ill sequel from a simple examination in a healthy case.

The aseptic technique is divided into two stages: (1) The care of the instruments; (2) care during their introduction.

The silk catheters must be sterilized before using by boiling two minutes in plain water, and washed immediately after every use with hot water, boiled for two minutes in pure water, and laid away on a sterilized towel until perfectly dry inside and out. They may also be washed out with a saturated solution of oxalic acid. They are then put singly or several together in a long sterile glass tube plugged at each end with cotton. The metal catheters are sterilized in the same way as other metal instruments, by boiling five minutes in the soda solution (see Chapter I).

In introducing the catheters the greatest care is necessary at every step to avoid contamination by the assistant, the speculum, the bladder wall, or the fingers of the examiner.

The lumen of the speculum and the ureteral orifice are cleansed with a pledget of cotton saturated with a boric acid solution held by the mouse-toothed forceps.

The metal catheter is held by its outer end, avoiding at all times touching the end that is to go into the ureter; it is then guided up the speculum and introduced. To introduce the flexible ureteral and renal catheters, the end is pushed a little way beyond the glass tube and dipped in boro-glyceride, and then the glass tube is rested on the examiner's shoulder. He now takes hold of it with thumb and forefinger covered with sterilized rubber finger stalls, draws it out of the tube, and guides it on into the ureter. By using these simple precautions all risk is avoided.

Ureteral Fever.—I have seen ureteral fever following the introduction of the ureteral catheter in four cases. In each of these cases the upper urinary tract was already infected, and the urine contained pus coming from the pelvis of the kidney.

One patient had a stricture at the vesical end of the ureter and a dilated pyoureter and pyelitis. On two occasions, while washing out the ureter and kidney, in a case under treatment for some time without any change in the technique, the introduction of the catheter was followed by a chill and fever, with an elevation of the temperature as high as 104° F. The pulse increased in rapidity in proportion to the fever, the face became flushed, and the patient was restless and had severe headache. From the second day on to the fourth or fifth day the temperature declined to normal. During the attack chilly sensations were repeated daily, and there was a decided tenderness over the course of the catheterized ureter.

In another case the attack began with a decided chill on the evening of the day of irrigation, which was practiced through a metal catheter injecting a bichloride of mercury solution (1 to 50,000). The patient complained of pain along the course of the ureter and in the back, and had a hot flushed face with headache and malaise. The temperature was highest on the second day, reaching 103°, and declined to normal on the fourth day. In a second attack, follow-

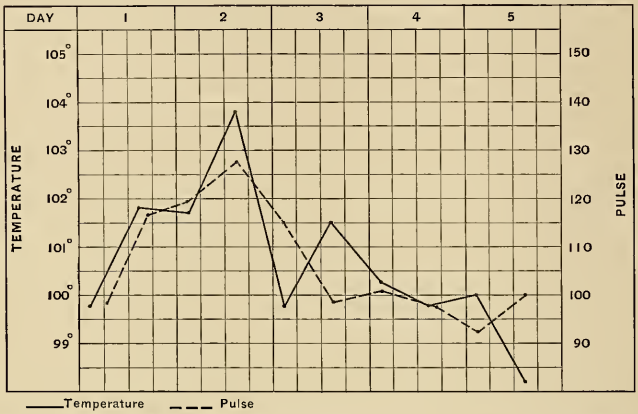


Fig. 243.—Composite Temperature and Pulse Chart of Two Cases of Ureteral Fever produced by Instrumentation.

ing treatment four days later, there was malaise and a temperature of 101·8° F. on the second day, but no chill. The temperature became normal on the third day. The other two cases were similar. In no case did any harm result. I give in the text a composite chart constructed by combining the two cases mentioned.

CONGENITAL AFFECTIONS OF THE URETER.

Anomalies of the ureter are rare, and especially rare are those which produce disturbance of function. In their extreme forms ureteral malformations are found oftenest in non-viable fetal monstrosities; for example, one ureter has been found entirely wanting, while the other was converted into a fibrous cord. (Förster, *Misbildungen*, Plate XXIII, Fig. 19.)

Double Ureter.—A double ureter is the commonest of all anomalies, and occurs in several forms; it may either start at the kidney from two distinct pelves, and then unite at some point below to form a single canal, or it may continue double all the way down, and end by two orifices in the bladder, one behind the other. This condition has been found on both sides in the same patient. The ureter starting from the upper pelvis of the kidney is the longest and crosses its fellow to end nearest the urethra. The duplication may, on the

other hand, be due to a split which begins at any point below the normal renal pelvis, and the ureter continues double all the way to the bladder; or again the two canals may fuse at any point on the way down.

An interesting case of complete duplication of the left ureter occurred in one of my patients and is reported by Dr. Otto Ramsay (*Johns Hopkins Hospital Bulletin*, November–December, 1896). The patient (A. W., 4154), forty-five years of age, was admitted to the ward with an inoperable cancer of the cervix and died soon after admission. Autopsy (No. 813, June 22, 1896).

Anatomical diagnosis: Sloughing carcinoma of the uterus, perforation into the rectum. Involvement of the ureters, with hydroureter and slight hydronephrosis.

The two left ureters begin at the hilum of the kidney in two separate pelves and run down into the pelvis side by side, closely bound together, but separate, to the bladder, which they enter by distinct orifices 1·5 centimeter apart. They are dilated from the point where they are involved in the cancerous growth near the cervix, all the way up to the kidney. Each one is about the size of the little finger and has clear contents. They show a marked contraction where they pass through the growth. The drawing on page 446 well illustrates the condition.

Such forms of duplicature have no pathological significance. Two other forms of malformation, however, are of the highest importance; these are the ectopic ureteral orifice and the dilatation of an occluded ureter.

Ectopic Ureteral Orifice.—An ectopic ureteral orifice is one located either in the vagina, or in the urethra at the external urethral meatus, or under the hood of the clitoris.

The one common symptom observed in such cases is a persistent leakage of urine, noted from childhood up, but varying in amount at different times as measured by the napkins worn. In spite of this constant discharge, the patient empties her bladder at regular intervals, and the abnormal flow continues as active after micturition as before it. The abnormally displaced orifice may be either the only one connected with the kidney, or a supernumerary orifice, the other opening normally into the bladder. The practical importance of distinguishing between these two allied and, to a superficial examination, similar conditions is evident.

Diagnosis.—In incontinence of urine not due to gross and easily demonstrable lesion, such as a vesico-vaginal or uretero-vaginal fistula, the inquiry into the cause must be made in a careful and orderly manner in order to discover cases of this kind.

The first question to be answered is whether the involuntary discharge of urine comes through the urethra, and if it does whether it is simply due to a breaking down of the sphincter fibers at the neck of the bladder, or whether there is some extraordinary channel of communication between the ureters or bladder and the genital tract.

If the patient is a virgin or has never borne children, and her bladder has not been subjected to any manipulative interference, and if the disease has

existed from earliest childhood, the presumption is at once in favor of a congenital malformation.

If, on the other hand, after lying down for a while a certain quantity of urine is found accumulated within the vagina, a vaginal orifice of discharge may be looked for. By drying out the vagina and placing in it dry pledgets of absorbent cotton, and at the same time filling the vulvar cleft with cotton, and waiting a few minutes, it will be easy to determine the fact of a leakage, by noticing the spots on the cotton, where a little urine has accumulated, and this will also approximately fix the position of the opening. By injecting the bladder with an aniline or sterilized milk solution, its independence of this viscus will be demonstrated. A prolonged careful inspection of the area indicated by the spot of urine on the cotton will reveal the minute orifice through which intermittent discharges of urine escape. If the discharge comes from the urethra, a careful urethroscopic examination must be made of the entire tract from the internal sphincter down to its external orifice by withdrawing the urethroscope millimeter by millimeter, constantly watching the funnel-shaped figure of the urethra at the end of the speculum for any small opening or jet of urine.

On finding the orifice the questions now to be answered are these:

1. Is the abnormal opening a ureteral orifice?

2. On which side is it located—that is to say, to which kidney does it belong?

3. Is it a single or a double ureter? If double, has it also a normal opening into the bladder?

4. If double, does it continue so all the way up to the kidney, or does it unite with its fellow at some point above the bladder?

5. If double all the way up, do both ureters enter a common pelvis, or have they separate pelves?

First, it is a ureteral orifice if, by injecting the bladder with a colored solution, none of the fluid escapes by the opening, demonstrating its independence, and if, in spite of the passage of urine at regular intervals from the bladder, little jets of urine are seen coming from the orifice, with intermissions not longer than a few seconds.

Second, the assurance that the opening is ureteral, and the answer to the question on which side it is located, to which kidney it belongs, is given by passing a long renal bougie through the opening up into the pelvis of the kidney, from 25 to 30 centimeters or more, and then by observing to which side of the cervix uteri the bougie turns, and by palpating the bougie through the vagina and rectum.

The third question, whether it is a single or double ureter, is answered by placing the patient in the knee-breast position and introducing a No. 10 vesical speculum and looking for the ureteral orifices within the bladder. If the orifices are found on both sides in normal position, it is evident that the ureter is supernumerary or split.

The fourth question, whether a double ureter continues so all the way up to the kidney, may, I think, be answered in the following way: I would pass a

catheter, 2·5 millimeters in diameter, large enough to fill the lumen of the abnormal ureter, all the way up to the pelvis of the kidney. I would then introduce a renal catheter into the normal vesical orifice of the same side and push it up. If the two ureters unite into one a short distance above the bladder, or at some point in the abdomen below the kidney, I should expect the second catheter to be stopped short in its course upon striking the first. The catheters could now be withdrawn after carefully noting the exact distance to which each had been introduced, and by laying them together on a sheet of white paper in a similar position a tracing of the form of the ureter could be made. To make sure of the diagnosis it would then be well to reverse the procedure by introducing a long catheter up into the kidney through the vesical orifice of the ureter, and then pushing up another catheter through the abnormal orifice, until it is stopped by the first catheter. Again noting the exact distances to which the catheters have been introduced, and withdrawing them, and reconstructing the ureteral situation on paper, the diagnosis will be confirmed if the two drawings correspond.

To determine whether the ureter is double throughout, and if double, whether the kidney has one or two pelves, the following plan will be sufficient: A renal catheter is passed through each ureter up to the renal pelvis and a sterilized aniline solution is injected into one, when, if there is a communication between the pelves, the colored fluid will immediately flow from the other; if there is no communication, it will simply be returned, while the other side discharges clear urine.

These various points in diagnosis are of practical importance in determining the nature of the operation to be performed.

When the opening is at the urethral orifice, the anterior wall of the vagina may present a characteristic prominent curved ridge, which covers the ureter, as in the case of Dr. F. H. Davenport, of Boston (*Trans. Amer. Gyn. Soc.*, 1890, p. 343), in which the orifice was in the posterior wall of the external urethral orifice. W. H. Baker's case opened similarly about two lines to the left of and below the urethra (*Boston Med. and Surg. Jour.*, Dec., 1878). It was not determined in either of these cases whether or not the ureter was double, which could now be done either by examining the orifices in the bladder cystoscopically or by passing a renal catheter up to the kidney pelvis and injecting an aniline solution, and noting whether the urine in the bladder is colored.

Erlach reported a case before the Vienna gynecological society, December 4, 1888, in which he found post mortem a right ureter double throughout, each ureter starting in a separate pelvis above. One of the ureters opened naturally into the bladder and the other into the urethra just below the internal orifice. In spite of this, there was no history of incontinence.

A case of congenital anomaly of the ureter has been observed by Baum in which the supernumerary opening was close to the external urethral orifice. The normal orifice was seen upon opening the bladder from above.

In a case of Massari (*Wiener med. Wochen.*, 1879, No. 33) a child four years old, with a preternatural vaginal anus, suffered from constant leakage of

urine, the cause of which was only explained post mortem, when the kidneys were found to be fused across the vertebral column. The right ureter was normal throughout, but the left one had no vesical orifice; instead, it passed the bladder in its course and discharged by a minute orifice just under the prepuce of the clitoris. The vagina was double and the uterus normal.

Treatment.—The object of the treatment is to get rid of the constant leakage by turning the urine into the bladder.

Two plans in general have been tried to effect this. First, by dissecting out the extremity of the ureter from its bed and turning it into the bladder, and, second, by a suprapubic incision into the bladder and then opening the ureter beneath the base of the bladder and establishing a communication between the two, after which the distal end of the ureter beyond the opening may be ligated. The suprapubic incision is closed at the end of the operation.

In case the ureter is double with a single renal pelvis above, it would be proper to try the plan of ligating the abnormal ureter at any point in its course where it could most conveniently be laid bare; the operator might introduce a flexible renal catheter, and, using this as a guide, incise the vaginal wall somewhere from 2 to 3 centimeters beyond the abnormal orifice, laying bare the ureter in its course. It should be then carefully dissected out from the surrounding tissues and freed on all sides sufficiently to allow a ligature to be placed about it. It may then be ligated with silkworm gut or fine silk, dropped, and the vaginal incision closed over it.

By the plans pursued by Baker and Davenport, the ureter is dissected out from its external orifice back to the base of the bladder by splitting the vaginal wall, exposing the abnormal canal, and carefully freeing it on all sides from the cellular attachments. When it has been freed up to a point under the base of the bladder corresponding in position to that of the normal ureteral orifice, an incision is made through the vesico-vaginal septum into the bladder a little less than a centimeter in length. The end of the ureter which has been dissected out is now cut off and the new orifice slit up for about 6 millimeters to make a larger opening. The end is then turned into the bladder through the opening, which is closed by two or three silkworm-gut sutures extending through from the vaginal surface to the vesical mucosa. The uppermost suture is made to include the muscular coats of the ureter at a point about on a level with its opening into the bladder. Another fine suture below this penetrates the vesico-vaginal septum for a short distance and catches the ureteral coats again. The ureter being fixed by the two sutures, the remainder of the vaginal incision from which the ureter has been dissected is closed by interrupted sutures.

This was done by Dr. W. H. Maxson, of St. Helena, Cal. (*Med. News*, March 21, 1896, p. 323), who operated upon a young woman twenty-two years old for an incontinence of urine dating from her earliest recollection. He found the orifice of the left ureter about a quarter of an inch within the external urethral orifice. At the operation the ureter was dissected out through the vagina for three inches and a half and drawn through a small opening made in the base of the bladder close by, after cutting off an inch and a half of the lower end. The

ureter was then stitched to the bladder wall with catgut and the vaginal incision closed. A complete recovery of function ensued.

It is important, as a preliminary precaution, to determine by a cystoscopic examination whether the ureter is single or double. If it is double, a bougie must be placed in the normal ureter opening into the bladder, so that in transplanting the abnormal orifice the normal one will not be cut or included in the sutures.

The plan of establishing a communication between the abnormal ureter and the bladder by a suprapubic incision in the bladder was adopted in Baum's case to avoid dilating the vaginal orifice in a girl eighteen years of age. The right ureter, discharging close to the urethral orifice by a fine opening, was greatly dilated in the neighborhood of the bladder. The base of the bladder was incised through a suprapubic incision and the dilated ureteral sac opened from above. A piece of the sac about a centimeter in diameter was now excised and the edges of the incision stitched together. The part of the ureter beyond this new opening was now ligated. A portion of the abdominal incision was closed with suture, and the prevesical space drained with iodoform gauze. After this operation urine passed naturally. The patient passed a urinary concretion five months later and suffered from a hernia.

Cystic Dilatation of an Occluded Ureter.—A rare but practically important anomaly of the ureter is that in which the lower end has failed to communicate either with the bladder or with any part of the genital tract, and remains occluded. If this forms the only avenue of discharge for the corresponding kidney or part of the kidney, complete atrophy of the organ depending upon it is a necessary consequence.

Where the terminus of the ureter is under the base of the bladder, and the lower end is dilated into a spherical or ovoid cyst, this has been seen projecting into the bladder, forming a prominent rounded tumor, occupying one side of the base, as in F. Tangl's case, where the patient was a woman sixty-seven years of age and the left ureter was affected, ending in a saclike projection into the bladder. The kidney of the same side was extremely atrophic and displaced downward. The right kidney was in a state of chronic interstitial nephritis. The tendency of such anomalies to be associated with other malformations was shown by the fact that the patient had a uterus bilocularis unicollis.

A similar case to this was that of Kolisko, where the right ureter was double throughout. The abnormal ureter began in a separate pelvis in the upper part of the kidney which was atrophied, and in its passage downward crossed its fellow and ended below the orifice of the normal ureter in a sac-like dilatation, which projected into the lumen of the bladder and extended down into the urethra. This tract had thick muscular walls. It was quite evident in this case that the kidney was a fused one, and that the maldeveloped ureter belonged to the upper kidney.

One of the most remarkable cases of cystic dilatation of the lower end of the ureter is that of Dr. E. G. Orthmann, of Düsseldorf, in which the cyst presented the characteristics of a vaginal cyst. The patient was twenty-seven years old,

and presented a circumscribed cystic tumor of the anterior vaginal wall which she thought was a prolapse of the uterus. This gradually kept increasing in size and was associated with drawing pains in the left side, extending around into the small of the back. The tumor was elastic and circumscribed and occupied the lower third of the vagina down to within a finger's breadth of the external urethral orifice. It could be pushed back, but returned on the least straining. Careful examination showed that it had no connection with the urethra or bladder. At the operation the thick walls of the tumor were dissected out up to a long pedicle on the left side which was bared from 8 to 10 centimeters (3 to 4 inches), when it became evident, from the way in which the tumor emptied itself upward, that there was a communication with the ureter above. The pedicle was tied and cut and retracted into the cellular tissue out of sight. The wound was closed with catgut and the convalescence was undisturbed.

In another group of cases of ureteral anomalies the lower end of the ureter may end in a blind pit without any dilatation. In these cases the kidney of that side is entirely absent or atrophic. When the ureter comes from a separate portion of the kidney by a pelvis of its own the atrophy may be limited to this part. Such is the case reported by F. Tangl (*Virchow's Archiv*, Bd. cviii, p. 414), in a patient sixty-five years old, with extreme atrophy of the left kidney and a double right ureter which united below and ended in a blind canal, recognized as Gartner's duct, in the anterior vaginal wall. The right kidney was affected with chronic interstitial nephritis. There was a bilocular uterus with one cervix.

Haller (*Deut. Arch. für klin. Med.*, Bd. v, Heft 2) and Weigert (*Virchow's Archiv*, No. 70, p. 490) report cases where, with complete duplication of the ureter and pelvis, one of the ureters ended blindly in the bladder wall, causing in this way a partial hydronephrosis.

Congenital Flexure of the Ureter.—A case of congenital flexure of the right ureter with extreme hydronephrosis is described by Weigert. The large kidney extended 3 centimeters (1¼ inch) beyond the middle line. The right ureter pursued a normal course from the bladder to a point 21 centimeters (8½ inches) above it, where it reached the lower border of the tumor. At this point it bent suddenly to the left, forming a sharp kink, beyond which there was considerable enlargement of the lumen. It extended from this point to the left border of the tumor into which it merged. The lower margin of the dilated ureter curved around on to its left side, while at the upper margin there was a second sharp flexure. There was no thickening or evidence of inflammation, and after releasing the flexure the fluid escaped easily.

Ureteritis and Periureteritis.—Ureteritis and periureteritis are found associated with a variety of urinary diseases. In ureteritis there is an inflammation and thickening of the coats of the ureter, the disease beginning with the mucous coat which is most exposed.

Periureteritis, on the other hand, is an inflammatory affection involving the cellular tissue in which the ureter lies throughout its whole course, from renal pelvis to bladder. The peritoneum overlying the ureter may also be involved

by contiguity. Periureteritis often arises in an affection of the cellular tissue, extending upward from the vaginal vault. I have seen two such cases following the division of the ureter in a vaginal hysterectomy, leaving a fistulous opening at the vault of the vagina. In one case I opened the abdomen some weeks after the operation to transplant the fistulous orifice into the bladder, and found the cellular tissue surrounding the ureter on that side dense and rigid from the vaginal vault up to the brim of the pelvis. The structures were so hard and immobile that any attempt to dissect the ureter out of its bed and lift it up could not even be considered. A periureteritis due to an inflammation extending from the interior of the ureter outward is rare; I have not yet encountered it in any case.

The causes of ureteritis are threefold: (1) by extension of the disease upward from the bladder; (2) by extension of renal disease downward into the ureter; or (3) the inflammation may originate from some cause located in the ureter itself, such as a calculus. The first and second causes are the most frequent.

In ureteritis due to calculus the evidences of the disease are found in a thickening and contraction of all its coats, forming a stricture below the stone lodged in it. When several stones are lodged in one ureter, a series of strictures are found with dilatation above each.

The most rational classification of the various forms of ureteritis induced by vesical or renal disease is that which depends upon the special exciting cause. We may thus distinguish a ureteritis due to streptococcus or staphylococcus infection, ureteritis due to gonorrheal infection, and finally a tubercular ureteritis. Of these forms, the first three commonly originate in the lower urinary tract, infecting first the urethra and bladder, and then the ureter through the continuity of mucous surfaces, while the tubercular disease more commonly starts in the kidney and affects the ureter from above downward.

It is remarkable how frequently extensive inflammatory lesions are found, either in the bladder or in the kidney, without any marked participation of the ureter directly continuous as it is with the bladder below, and constantly bathed with the infectious renal discharges from above.

Another and rare form of inflammation affecting the ureter and pelvis of the kidney is cystic ureteritis and pyelitis, characterized by the formation of little cysts projecting from the mucous surface the size of a hemp seed, or smaller, containing a thin watery or tenacious fluid. These cysts are more abundant in the upper part of the ureter, and probably originate in the sparse glands or crypts in the mucosa.

The symptoms common to the various forms of ureteritis arise either from the inflamed ureter itself, or from the interference with function resulting from the inflammation. Owing to the fact that the ureteritis is always secondary and is usually simply an extension of grave renal or cystic disease, its own peculiar symptoms are often masked. This is particularly the case in acute forms resulting from a severe infectious process extending rapidly from the bladder up to the kidney.

In chronic ureteritis the most marked symptoms are the pain localized on one side extending up into the flank, with frequent and painful micturition. Pus is always found in the urine, and sometimes blood.

The prognosis in the acute forms, while depending somewhat upon the involvement of the ureter, will be better guided by the condition of the bladder or kidney which can be investigated and estimated, while that of the ureter can only be surmised. In the chronic forms the prognosis depends entirely upon the cause; the gonorrheal ureteritis tends to form stricture just as in the urethra. When not actively treated, the tendency is to run a long course, often extending through a series of years. It is important to note that, in spite of extensive involvement of the ureter, the function of the kidney is rarely entirely lost.

The diagnosis of ureteritis is not difficult to make with the direct means of investigation at our command. The subjective symptoms often so closely simulate cystitis that a differentiation can not be made by symptoms alone, the most characteristic of which is pain along the ureter.

Infallible diagnostic points are found by making a digital examination. After emptying the bladder and rectum, upon introducing the finger into the vagina, and palpating the antero-lateral vaginal wall in its upper part, a large, thick, exquisitely tender cord is found sweeping upward to the vaginal vault and disappearing at the side of the cervix under the base of the broad ligament. It is often nodular, and when felt for the first time in the vaginal vault it invariably creates the impression that it is an adherent ovary or tube. I have known inflamed ureters to be mistaken for ovaries in this way. The pain provoked by the examination is usually so great that an anesthetic is necessary to outline thoroughly the structures. The thickened ureter is often movable in the cellular tissue; by introducing the finger into the rectum it may be traced over the sciatic notch and on up toward the brim of the pelvis, where it is found lying close to the internal iliac artery. Upon palpating through the abdominal wall, down upon the pelvic brim, at a point 3 centimeters ($1\frac{1}{4}$ inch) to the right or left of the promontory of the sacrum and a little below it, the patient will complain of pain, and, if the abdominal walls are unusually thin, the thickened ureter may be felt rolling under the fingers. If the umbilical ring is relaxed the ureter can be felt through it with the utmost distinctness. Upon continuing the palpation upward in the course of the ureter, it can be traced by the pain elicited when the pressure is made directly over it. Through an open abdominal incision, by preference in the semilunar line, the thickened left ureter may readily be found at its point of transit from the abdomen into the pelvis, by lifting up the sigmoid flexure to the right and exposing the ureter just beneath the peritoneum, crossing the common iliac artery beside the ovarian vessels. On the right side the ureter will be exposed by lifting up and drawing the head of the colon to the right.

By making a cystoscopic examination with the bladder distended with air, the ureteral orifice of the affected side will often be found the center of an area of intense injection, situated on a truncate cone, sometimes surrounded by papil-

lary eminences, and not infrequently markedly everted. If the orifice is watched for a time, turbulent or purulent urine may be seen escaping.

By means of a catheter, urine may be collected from an infected ureter, and if the catheter is not contaminated in the introduction, a bacteriological examination of the urine obtained will often reveal the cause of the inflammatory trouble, whether due to tubercle bacillus, gonococcus, or streptococcus.

As we can do nothing directly to the ureter in an acute inflammatory condition which will be beneficial, the treatment of this form of ureteritis is purely expectant, and devoted to the associated disease in the bladder or kidney.

In its chronic form the treatment must vary according to the extent of the disease, and to the changes it has produced in the kidney. If the result of the ureteritis has been simply to thicken the coats of the ureter, forming an obstacle to the downward passage of urine, the urinary channel above such an obstacle will be dilated with urine or pus, and in all cases, before any more radical measures to relieve the obstruction are adopted, a renal catheter must be passed in order to determine the degree of stricture estimated from the bite on the catheter and from the amount of urine behind it, and the character of the infection by the pus secured. If pus is present, an effort should be made to sterilize the upper urinary tract by emptying it and washing it out with weak bichloride solution (from 1–100,000 to 1–10,000) every two or three days. For treatment see under Stricture of the Ureter.

Tubercular Ureteritis.—One of the most frequent forms of ureteritis producing profound alterations in the coats of the ureter is due to tubercular infection. This commonly involves its entire length, and arises secondary to a tubercular kidney. The thickening of the ureteral coats converts the organ into a rigid tube, irregular on its outer surface, and presenting marked irregularities in its lumen.

The rare cases which present themselves for treatment, if of long standing, are one-sided.

The lining membrane of the ureter is ulcerated and the pelvis of the kidney filled with pus. When more advanced still, the bladder mucosa is affected, varying from some disseminated tubercles sowed about the ureteral orifice, all the way to an extensive diffuse infection with areas of ulceration.

The chief clinical symptom is the frequent painful urination, the patient being obliged to sit on the vessel every few minutes, and rarely being able to wait half an hour or longer.

Blood is only found in the urine in advanced cases, when it generally comes from the bladder. Pus secreted by the ureter is always present in varying quantities. Large amounts may be passed at intervals, being held back by the constriction of the lumen of the ureter, until sufficient pressure is developed in the upper ureter and renal pelvis to break through the obstruction. In this way we have intermittent pyuria, accompanied by a constant pyuria of lesser degree.

Fever is a symptom of cases in which the pus is held back in the kidney in quantity.

The diagnosis is, as a rule, not difficult to make when the various means of investigation at our command are employed. These consist in palpation by the vagina, rectum, and abdomen, a cystoscopic examination of the ureteral orifice of the bladder, rarely in a direct inspection through an abdominal incision, and in catheterization with the isolation of urine from the infected area, and above all in the demonstration of the tubercle bacillus in the urine.

It is often necessary to make repeated examinations before the tubercle bacillus can be found. A source of error here is the smegma bacillus which is found around the genitals of both sexes and which has the same staining qualities and the same size and form as the tubercle bacillus.

Grünbaum (*Lancet*, January 9, 1897), who has studied the question experimentally, comes to the conclusion that, "as a rule, careful catheterization eliminates all sources of diagnostic error." These conclusions he drew from the examination of the urine from 47 persons—10 male and 37 female. The urine in all cases was centrifugalized and stained in the ordinary manner for the tubercle bacillus. He could not find the smegma bacillus in any of the ten specimens voided by the men, though its presence in the male urethra has several times been demonstrated.

Of the thirty-seven specimens from the women, eleven were obtained by the catheter, and in none of them was the smegma bacillus found, while, on the other hand, in twenty-nine voided specimens the smegma bacillus was found seventeen times.

Another method of deciding definitely whether the tubercle bacilli are present is by the inoculation of the suspected urine into animals. I have operated on a case where the presence of a tuberculous kidney was first diagnosed in this way by Dr. T. K. Holmes and Dr. A. McPhedran, of Canada. They made inoculations both into the eye of a rabbit and into the peritoneal cavity of a guinea pig, and in both places the tubercular lesions were readily demonstrated.

The method of inoculating the peritoneal cavity is easy, a few centimeters (2 or 3) of the suspected urine being injected into the unopened peritoneal cavity of the guinea pig with a clean hypodermic syringe. The animal dies, as a rule, in three or four weeks.

Strong presumption of a tubercular ureteritis exists if the vaginal examination reveals a ureter greatly enlarged, thick, hard, exquisitely sensitive, and more or less nodular, lumpy, or uneven, and traceable under anesthesia by the rectum up to the pelvic brim. The characteristic tender spot will always be found at the brim upon palpating through the abdominal wall.

By cystoscopic inspection of the bladder we may infer the specific nature of the ureteral inflammation, either by the areas of extensive ulceration in the advanced cases, or by the scattered tubercles in the milder ones, located mostly at the base of the bladder and about the orifice of the affected ureter. An intense injection about the ureteral orifice may be the only vesical sign pointing to the affected side.

By catheterization of the ureter unmixed urine is obtained, which, in the earliest stages of the disease, may exhibit no changes at all; later, sparse tu-

bercle bacilli may be found after repeated use of the centrifuge. When the tubercular disease is in an advanced stage, urine is obtained which is milky or thick with pus, peculiarly pale in color, and sometimes alkaline, and containing a markedly diminished amount of urea. The tubercle bacilli are found in the flocculent sediment, which begins to fall as soon as the urine stands for a short time. It may take five or six examinations to find the bacilli, when they will often appear in great abundance.

The prognosis of the affection is years of invalidism, and life is finally destroyed when the kidney is full of pus, the ureter choked, and the bladder infiltrated and converted into a mass of ulcerations. Oftentimes, also, there is extensive tubercular disease of other organs.

The treatment is either palliative or radical, and the palliative course is only resorted to in order to improve the patient's condition for an operation if possible. Where the ureter is obstructed, and pus is dammed up above the stricture and in the kidney, a catheter may be passed, the pus drawn off, and the dilated portion washed out with a bichloride solution, beginning with 1 to 20,000. This may be repeated every few days until the general condition is so improved that the disease may be safely extirpated with the knife. Nephro-ureterectomy, or extirpation of the infected kidney and ureter, is the only possible means of cure. I have done this in three instances, and will describe the proper method of operating by giving the details of one case, which I owe to the courtesy of Dr. M. D. Mann, of Buffalo.

C. R. (No. 1836), aged thirty-one, began to suffer at the age of fifteen with an "irritable bladder" at the menstrual periods, the difficulty extending into the intermenstrual period as well after six months. Pain in the bladder soon became constant, and to this was added in another year pain in the left loin and down the thigh. In about five years she was pretty constantly confined to her room. No treatment produced more than temporary relief from the agonizing pain and spasms accompanying the act of micturition every few minutes by day and night, when her screaming could be heard at a long distance.

Upon examination, the left ureter was found thick, hard, and nodular, as if slightly constricted at irregular intervals, and in the left fornix it felt like a distinct mass in the broad ligament. The slightest pressure on it produced exquisite pain and a desire to urinate. On catheterizing both ureters at the same time, several cubic centimeters of amber-colored urine collected from the right side, while none at all escaped on the left, but on pushing the catheter farther in, behind the broad ligament, there was then a sudden escape of pale lemon-colored urine flowing in a steady stream until the beaker was filled (see Fig. 244). The urine on the right side was acid, while that on the left was alkaline, and also contained abundant pus and tubercle bacilli.

On trying to withdraw the left catheter, it was found firmly held in the bite of the strictured ureter. The presence of the stricture was further demonstrated by passing into the ureter a small bulbous bougie, which entered the enlarged portion and came out over the stricture with a decided jump. The rate of discharge from the left side further demonstrated the existence of a large pyo-

ureter for 150 cubic centimeters (5 ounces) escaped in three minutes; at this rate of secretion the amount passed per diem would have been 72 liters, or about 18 gallons—a *reductio ad absurdum.*

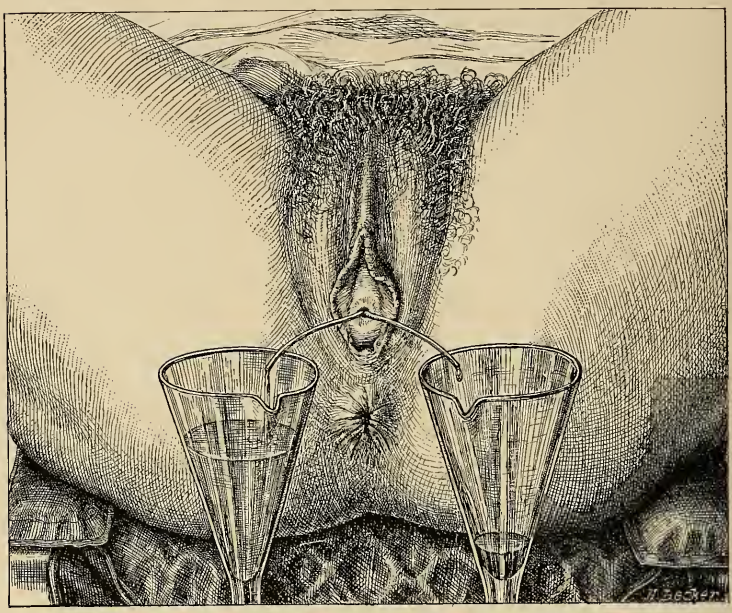


FIG. 244.—DEMONSTRATION OF STRICTURE OF THE URETER AND OF HYDROURETER.

Both ureters are catheterized; the catheters are crossed in the urethra so that the beaker on the patient's right side collects the urine from the left side. In the same time that the small quantity of dark acid urine collected in one glass, the pale lemon-colored alkaline urine poured out and almost filled the other glass. The catheters in this case entered as far as the brim of the pelvis only.

Nephro-ureterectomy, or extirpation of tuberculous left kidney together with its ureter, was performed March 30, 1893. After due cleansing, an incision 16 centimeters (6½ inches) long was made just outside of and parallel to the linea semilunaris, terminating below over the brim of the pelvis. The peritoneum was then opened, the small intestines displaced to the right, and the sigmoid flexure lifted up at the pelvic brim and carried to the right side, making tense its peritoneal fold, the outer layer of the meso-sigmoid. This was incised and the greatly thickened ureter exposed, crossing the common iliac artery. The incision through the posterior peritoneum was now carried on upward, freeing the descending colon up to the middle of the abdomen and laying bare the entire ureter, easily traced from its pelvic end up the kidney. The kidney was found in its normal position, covered with peritoneum and fat cellular tissue.

The peritoneum was next incised over the kidney and the process of enucleation begun. The separation was effected with difficulty, owing to the dense adherent fibrous tissue interpenetrating the fat and sticking tight to the kidney, especially about the hilum. Slowly, and with much care, the large vessels were freed and tied with four fine silk ligatures, and the kidney severed from all its attachments, except the ureter. Now, taking the kidney in hand, it was pulled downward and the ureter gradually dissected out of its bed of cellular tissue all the way to the pelvic floor. The ovarian vessels were tied in the abdomen at about the middle of the ureter.

The ureter was then ligated at the pelvic floor, and cut off wedge shaped 1 centimeter above the ligature, forming flaps for easy closure. Care was taken throughout not to contaminate the peritoneum with the infected end, which was finally burned out with a Paquelin cautery down to the ligature, and the flaps united with fine silk sutures. The left flank was then pushed out by two fingers and pierced with a knife, making a hole 3 centimeters ($1\frac{1}{4}$ inch) long in the line of the iliac crest, just in advance of the spinous muscles. A gauze drain reaching the ureteral stump below was put in here, 14 centimeters ($5\frac{1}{2}$ inches) long by 3 centimeters ($1\frac{1}{4}$ inch) wide, and the anterior incision was closed. The colon fell into its natural position without suture.

On the first day there was a free bloody serous discharge, which gradually decreased, and the drain was taken out on the fifth day. The patient made a quick, undisturbed recovery, and is still living, three years later, remarkably improved. For the removal of the entire ureter with the kidney by an extraperitoneal operation, see Nephro-uretectomy.

The following is the pathological report:

Kidney Macroscopically.—The mass representing the kidney is made up of four large lobules, separated from one another by shallow sulci. The upper third of the organ is least affected, though this is deeply pitted in every direction, and contains a number of small cysts, which become distended on injecting the pelvis of the kidney, proving direct connection. This portion measures 6 by 4·5 centimeters ($2\frac{1}{2}$ by $1\frac{3}{4}$ inches), while the whole kidney mass measures 11 by 6 by 3·5 centimeters ($4\frac{1}{2}$ by $2\frac{1}{2}$ by $1\frac{1}{2}$ inches). Below the mass just described on the anterior face is a cyst measuring 5·5 by 5 centimeters ($2\frac{1}{5}$ by 2 inches), and below this two yellowish masses, 7 by 4·5 centimeters (3 by $1\frac{3}{4}$ inches), independent of one another but connected by a shallow sulcus. All the cysts are covered by the capsule. The weight of the whole organ with the attached ureter is 100 grams.

The capsule of the kidney is thickened and intimately adherent in places. On section, about 65 cubic centimeters (2 ounces) of fluid escapes from the cysts; in one it is white and flaky, consisting almost entirely of fatty *débris*; in another, the fluid resembles blood-stained urine. These cysts are all found to communicate with the pelvis of the kidney and represent dilated calices. The parenchyma of the kidney is largely destroyed. In one place an area of cortex is found 7 millimeters in depth, but elsewhere the kidney substance is represented by layers averaging 1·3 millimeter in thickness spread out over the dilated calices.

Frozen sections of the kidney show a diffuse infiltration with fatty granulation tissue, with here and there areas of complete necrosis, with fragmentation of nuclei. Numerous definite tubercle nodules, containing giant and epithelioid cells, can be made out. The tuberculous process goes gradually over into the more healthy kidney substance, and here and there a single tubule or glomerulus can be seen in the diffuse tuberculous tissue.

Ureter.—The ureter presents two points of constriction, repectively, 3 and 8 centimeters ($1\frac{1}{4}$ and $3\frac{1}{4}$ inches) from the kidney. The hilum of the kidney is filled with dense adherent fat, preventing dissection of the stricture without tearing it.

The ureter is much dilated, more at some points than at others, the caliber of its lumen varying from 1·7 to 3 centimeters ($\frac{1}{2}$ to $1\frac{1}{4}$ inch). Its wall is much thickened, measuring in places from 5 to 6 millimeters. The mucous membrane is of an opaque buff color, and at one spot, near the pelvis, there is a superficial area of calcification 5 millimeters in diameter.

Frozen section of the ureter shows that the epithelium is entirely absent from the surface, and that the mucous membrane is converted into a mass of diffuse tuberculous tissue, in which here and there definite tubercular nodules can be made out. The surface is not infrequently quite necrotic, and the cells near it have undergone fatty degeneration. The muscular layer has been involved, and there are many aggregations of small round and epithelioid cells there. In some places there is cell proliferation in the fibrous layer of the ureter. The connective tissue is from three to four times thicker than normal.

This ureter had been catheterized previous to the operation, and numbers of tubercle bacilli demonstrated in the pus which was present in the urine thus obtained. Cultures made from the pelvis of the kidney and from the kidney substance on ordinary agar-agar remained sterile.

Diagnosis.—Tuberculosis of kidney, pelvis of kidney, and ureter.

Although in the case just cited a transperitoneal route was followed, the best routine way to reach the ureter is entirely extraperitoneal (see *Johns Hopkins Hosp. Bul.*, Feb. and March, 1896), by means of a long incision beginning back in the loin in front of the quadratus muscle, halfway between ribs and ilium, and continued in an oblique direction downward and forward, skirting the anterior superior spine within 4 centimeters ($1\frac{1}{2}$ inch) of it, and ending in the semilunar line over the top of the broad ligament. The skin, fat, muscles, and fascia are divided down to the peritoneum, which is then dissected up by the fingers, being lifted toward the opposite side; the ureter is found, after raising the colon, crossing the belly of the psoas muscle with the ovarian vessels, and if not seen at once, it may be traced from the pelvis of the kidney down. It may further be recognized by tapping it sharply, or by watching a peristaltic wave pass downward. The peritoneum need not be opened at any point. After freeing the kidney by ligating its vessels and detaching the abdominal portion of the ureter as described, the pelvic portion is then freed by following the upper portion as a guide, while the fingers readily lift the pelvic peritoneum from the vessels which drop with the ureter over the brim. By pulling it out the ureter

may be freed not only down to the floor of the pelvis, but well forward. To complete the enucleation as far as the vesical attachment, the uterine artery and veins must be tied and divided.

Obstruction of the Ureter.—Obstruction of the ureter, diminishing or obliterating its lumen, will be more frequently diagnosed when the opportunities of examining the ureters afforded by abdominal surgery and catheterization are more generally embraced. The importance of recognizing the existence of a ureteral obstruction can not be overestimated, on account of its damaging effect upon the kidney, diminishing or even suppressing its excretory power; the danger of an obstruction is vastly greater when both ureters are involved.

The immediate effect of obstruction is to back up the urine above it in the pelvis and calices of the kidney, producing hydroureter and hydronephrosis, varying in their clinical appearance according as the obstruction is produced gradually or suddenly, is partial or complete. If the hydroureter and hydronephrosis become infected, we have then to deal with a pyoureter and pyelonephrosis above the obstruction.

Causes.—Ureteral obstruction may be produced in a variety of ways, and is far more common in women than in men, being frequently associated with diseases of the uterus and ovaries. They may be classified in general as—

First, causes acting from without and occluding the ureter by pressing upon it or overstretching it; such are—

1. Ovarian tumors.
2. Uterine tumors.
3. Cancerous infiltration of the broad ligaments.
4. Cancer of the cecum.
5. Retroperitoneal pelvic sarcoma.
6. Aneurism of the iliac artery.
7. Scar tissue in the broad ligament.
8. Periureteritis.
9. An omental adhesion to the pelvic brim.
10. Thickened bladder walls.
11. Sarcoma of the bladder.
12. Pediculated tumor of the bladder.

Second, foreign bodies lodged in the ureteral canal:

1. Calculus.
2. Blood clot.
3. Echinococcus cyst.

Third, affections of the ureteral walls themselves:

1. Ureteritis bacilli coli communis.
2. Ureteritis gonorrhoica.
3. Ureteritis tuberculosa.
4. Valve formation in the ureteral wall.
5. Gumma in the wall.
6. Cancer of the ureter.
7. Psorospermial cysts.

Some of the twenty-two causes of obstruction just cited act unilaterally, while others are more apt to act on both ureters at once; it therefore becomes important from a practical standpoint to divide them further into groups according to this tendency.

Both ureters are apt to be obstructed by cancer of the cervix uteri extending out into the broad ligaments, by thickened bladder walls, by some large subperitoneal fibroid tumors, and in rare instances by calculi.

But one ureter is apt to be involved in parametritis, small pelvic tumors and inflammatory masses posterior to the broad ligament, gonorrheal stricture, and tuberculosis.

The location of the obstruction in almost all cases is in the pelvic portion of the ureter, at some point between the brim of the pelvis and the vesical end. The reasons for this predilection lie, on the one hand, in the proximity to the ureters of the uterus, tubes, and ovaries, and their liability to inflammatory affections or new growths, and, on the other hand, to the fact that the ureters are enclosed with these organs in the unyielding bony pelvic canal, which affords a point of resistance against which pressure can be made. Next in frequency to the pelvic extremity is the involvement of the upper end near the pelvis of the kidney.

The clinical symptoms of obstruction are variable, depending on the cause and the completeness of the occlusion, as well as the rapidity with which it is produced. In the milder grades, where the distention is not great, there may be no symptoms at all. I have a patient whose right ureter and renal pelvis are dilated by a stricture at the vesical end of the ureter until they hold 100 cubic centimeters of urine without producing any subjective sensations whatever. Extreme dilatation may be produced without pain if the cause acts slowly. I had one case, a little girl about three years old, in whom the right ureter was lifted out of the pelvis and dilated to a diameter of $1\frac{1}{2}$ centimeter by a retroperitoneal sarcoma.

Where the obstruction depends upon inflammatory disease the chief symptom is frequent painful urination; in cases of tumors and pelvic inflammatory masses the ureteral symptoms are often masked by the associated complaint. The sudden closure of one ureter, as by a ligature, produces violent pain in its course, extending into the kidney, associated with restlessness, a hot, dry skin, and fever and diminished urine. If both ureters are obstructed, uremia develops soon after the pressure in the sac of urine formed is equal to that in the blood vessels, checking further secretion.

To make a diagnosis three questions must be answered:

First, Is the ureter obstructed at all?

Second, What is the nature of the obstruction?

Third, What is its degree?

A diagnosis from symptoms alone can only be made in that small percentage of cases in which the occlusion has taken place suddenly, as in the case of a calculus or clot descending from the kidney and lodging in the ureter and blocking its flow, or when in an operation the ureter is tied and the persistent agoniz-

ing ureteral and renal colic definitely located in its course leave no doubt as to the nature of the difficulty.

There are no reliable symptoms of a dilatation of an aseptic ureter that has developed slowly. A diagnosis of obstruction with dilatation may be made with assurance whenever uremic symptoms are noted in the course of a cancer of the cervix.

While diagnostic means heretofore have been indirect and unsatisfactory, enabling us only to infer the existence of obstruction, and that in a small percentage of cases, the means of direct exploration of the whole ureteral tract now at our command leave but little to be desired in the way of accuracy. These are the inspection of the ureteral orifices and the catheterization and sounding of the ureters.

Before describing the actual use of these methods it will be important to consider first in what class of cases it is desirable to try to ascertain whether there is or is not an obstruction. I should always make an examination for obstruction where there is persistent pain in the course of a ureter; where the patient is distressed by frequent urination, for which a sufficient cause does not exist in the bladder or urethra; where there is pus in the urine in cases of pelvic inflammatory diseases; and where pelvic tumors might be supposed to make pressure on a ureter.

In investigating an obstructed ureter we wish to determine—

1. Whether there are any abdominal or pelvic tumors or masses which could press upon a ureter.
2. Whether any form of ureteritis exists.
3. Whether the ureter is blocked by a stone or clot.
4. Whether two of these conditions do not act in combination.

The presence of an abdominal or pelvic tumor pressing on a ureter can be determined by a bimanual and rectal examination and deep abdominal palpation under anesthesia. Sufficient cause for an obstruction exists when a band of scar tissue, following injury in childbirth, is felt in the parametrium, dragging the uterus to one side, or when an inflammatory mass is felt fixed to the pelvic wall and floor, or when there is a uterine or ovarian tumor choking the pelvis, or some other tumor filling the lower abdomen.

Palpation of the ureter through the vaginal walls shows whether it is thickened or not, and so demonstrates the presence or absence of a ureteritis.

The blocking of the ureter by a stone or clot can only be demonstrated by the passage of a sound or catheter, and this brings us to the method of demonstrating with absolute certainty the existence of an obstruction. In examining any given case the investigation must not cease when one cause sufficient to explain an obstruction is found; other associated causes must always be sought for, and their absence definitely proved, before the one cause found is finally accepted. For example, an inflammatory obstructive ureteritis may be found associated with a pelvic abscess of the same side.

By the direct examination the existence of an obstruction is proved either when (1) a ureteral catheter or sound passes freely up the ureter until it is sud-

denly checked, or (2) when each time after passing a certain point in the ureter there is an immediate continuous flow of urine of from several up to a hundred or more cubic centimeters in quantity. Sufficient time must be allowed to elapse for more urine to accumulate before repeating the examination. The demonstration is still more complete in a case of this kind if the instrument is distinctly grasped in the bite of the stricture and resists withdrawal.

In sounding and catheterizing a ureter for obstruction, the metal catheter is only of use for the lower part of its course, from the vesical orifice to the posterior pelvic wall. With gentle tact the metal catheter may sometimes be coaxed through a tight stricture impassable to the yielding silk catheters. As a rule, it can not be pushed in more than from 4 to 6 centimeters ($1\frac{1}{2}$ to $2\frac{1}{2}$ inches) under inspection with the patient in the knee-breast position, and it is better after introducing it to turn her over to the dorsal position, or to put it in, in the first place, in the dorsal position, and to let the air out of the bladder with a catheter, and then to guide the further progress of the ureteral catheter with a finger at first in the vagina and then in the rectum. It is needful to empty out the air, as the distended bladder splints the catheter and impedes its onward movement.

An ordinary solid sound has no advantage over a catheter, which does equally well as sound and catheter. The only sound I have ever used with advantage is one made like a catheter, but solid, and with a slight bulbous enlargement, 1 centimeter back of the point, which trips in passing any narrow place in the lumen.

The short flexible ureteral catheter is only valuable in locating strictures in the lower ureter, but is easy to introduce and is safer in experienced hands. The long flexible catheters, 50 centimeters (20 inches) in length, are used to locate strictures in the upper ureter all the way up to the pelvis of the kidney. It is always important in searching for a stricture to pass the catheter up slowly, so that the flow of urine will make it evident as soon as the stricture is passed. If the catheter is pushed up rapidly, the end may be several centimeters or more beyond the stricture before the flow begins, and the stricture in this way estimated to be higher up than it really is. A good telltale is made by dipping the finger in water and touching it to the end of the catheter, which is then closed by a thin film of water until the urine begins to flow, forcing the air out and pushing the water off from the end of the catheter in the form of a little bubble, in this way announcing the coming of the urine some seconds in advance of its actual appearance. The escape of urine backed up behind an obstruction is different from the intermittent normal flow drop by drop. The urine which has been held back often pours out of the catheter in a steady stream until it has almost all escaped, when it continues to drop steadily for a while longer, and so the sac is emptied. The fact that the urine has been backed up, and that it is not simply an abnormally rapid secretion, can be proved by a simple calculation. For example, if the normal secretion is about 1·5 liter per diem (3 pints), this makes about 1 cubic centimeter per minute from both sides combined, or half a cubic centimeter from one side. If now I collect 90 cubic

centimeters in three minutes after putting one catheter in, that equals 30 cubic centimeters in one minute, or sixty times the normal amount, 90 liters (180 pints) a day, manifestly impossible.

An important part of the investigation is to decide exactly where the stricture ends and the dilated portion of the ureter begins. This is done by withdrawing the catheter slowly during the escape of the urine, and noting the moment the flow is checked; the length of the catheter inside, of course, then measures the distance of the upper end of the stricture from the meatus. To determine the distance from the vesical end of the ureter, the distance of the external meatus to the ureteral orifice is measured with the searcher and deducted.

The treatment of ureteral obstruction depends upon the cause; in some cases it can be easily removed, in others it is irremediable. An obstruction should never be allowed to persist if it can be removed without undue risk to life. The danger of surgical interference is greater where both ureters are involved, and is greatest of all if infection of one or both sides is superadded. Where both sides are occluded by a cancer in the broad ligaments, the plan proposed of prolonging life by severing the ureters just under the kidneys, and turning the ends out to discharge the urine in the flanks is rarely applicable on account of the condition of the patient by the time the disease has advanced so far. In case uremia is threatened from occlusion of both ureteral orifices by thickened, inflamed bladder walls, it will be proper to save the kidneys and preserve life by opening each antero-lateral vaginal wall, isolating the ureters, and making a longitudinal incision in them 1 centimeter long, so as to suture them to the vaginal wall (kolpo-ureterostomy). In case of recovery of the bladder, the ureteral fistulæ could afterward be closed.

Where the ureteral dilatation comes from the pressure of a pelvic tumor, it is treated by taking away the tumor and removing the pressure. Indeed, this is often done in removing pelvic tumors without the operator knowing all that he has accomplished. In all cases of pelvic tumors both ureters should be inspected before removing the growth, for dilatation in varying degrees (hydroureter) will be discovered with surprising frequency. If to the dilatation an infection has been added, this will need treatment later, either by washing out the pelvis of the kidney and the ureteral tract, or by opening the pelvis in the loin. I have twice seen pelvic abscess in the left side associated with pyoureter and pyelonephritis. In another case a densely adherent ovarian cyst on the left side blocked the ureter. The upper ureter and pelvis of the kidney were filled with pus, and the enlarged kidney contained multiple abscesses. I removed the tumor and the kidney, and the woman regained complete health and is still living three years later.

Ureteritis as a cause of obstruction is quite common. The ureteritis itself can not be directly treated unless it has formed a stricture and the ureter is dilated above it; the treatment is then directed to the dilatation of the stricture and the removal of the infection. Where it is due to stone, relief will be obtained only by uretero-lithotomy. I have seen two cases of colon bacillus infec-

tion producing ureteritis. In one of them I opened the pelvis of the kidney and took out a small stone fitting like a valve into the mouth of the ureter, when the pus disappeared from the urine.

Tubercular ureteritis can only be treated successfully when it is unilateral, and then by the extirpation of the ureter and its kidney. The kidney is generally so extensively diseased in these cases that the question of sacrifice does not arise.

Stricture of the Ureter.—Under stricture of the ureter I desire to discuss the treatment of localized contractions or occlusion of the lumen, due to inflammatory thickening or valve formations. According as these strictures differ in their causes, character, and location, so do the plans of treatment vary.

Where the closure is effected by a thickening of the walls of the pelvic portion, much will be gained by passing through it successively catheters increasing in size, 2, 2½, 3, 3½, 4, 4½, 5 millimeters in diameter and 28 centimeters (13 inches) long. The stricture is not entirely relieved by this plan, but the quantity of urine held above it is markedly lessened and relief from pain is afforded. This is the best, the safest, and the easiest mode of direct treatment in all strictures located low down in the ureter and due to chronic inflammation, excepting in tubercular ureteritis; here, too, temporary relief will sometimes follow a moderate dilatation and evacuation of the accumulation, with a regular washing out of the tract above.

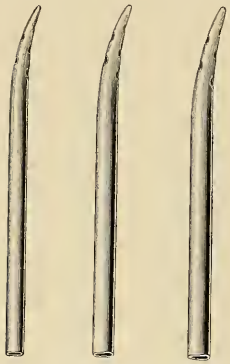


Fig. 245.—The Ends of the Dilating Metal Catheters, Three Sizes (3, 3.5, and 4), used in dilating Stricture of the Lower Extremity of the Ureter.

A case of tubercular ureteritis, in which I found a tight stricture well back in the pelvis, and drew off from time to time 100 cubic centimeters (over 3 ounces) of pale lemon-colored alkaline urine, the patient felt better after each evacuation, but made no permanent improvement, as it was impossible to keep the channel open even for a short time.

My method of treating a gonorrheal stricture of the vesical end of the ureter with pyoureter and pyelitis is demonstrated by the following case:

The patient came to me with an extensive accumulation of pus in the left ureter, extending up into and filling the pelvis of the kidney, caused by a corkscrew stricture of the vesical end of the ureter. This was due to a gonorrheal infection.

I treated the stricture by dilatation with a series of ureteral catheters, increasing in diameter from 2 to 5 millimeters. After drawing off the purulent fluid, the ureter and pelvis of the kidney were washed out with medicated solutions. The caliber of the stricture was enlarged by the dilatations so as to reduce the quantity of the accumulation above it from 150 to 100 cubic centimeters.

The purulent character of the secretion was removed and all trace of gonococci, at first abundant, disappeared.

My patient (E. S., San. 96) was a married woman, thirty-one years of age, of slight build and haggard-looking. She had had one child four years before without special difficulty, the only pregnancy in six years of married life. The menses were regular and without pain. Headaches were rare; the appetite was good and the bowels regular. She had no chills.

She had been feeling depressed for some months and had lost weight, and complained of severe pain on urinating, which persisted for a half hour or longer. There was a sense of pressure in the bladder, and she was obliged to urinate every two or three hours by day and oftener by night. There was no acute pain, but aching in the limbs and discomfort of the lower abdomen. She noticed that the appearance of the urine varied greatly, being clear at times, and at other times containing much yellow sediment.

My examination showed that the vaginal outlet was torn superficially back almost to the anus; the cervix was in the axis of the vagina, somewhat low down, showing a slight tear, and the uterus was in retroflexion; the left ovary was displaced downward, not adherent, and tender on pressure. On examining the anterior wall of the vagina, no special tenderness was developed on palpating the bladder.

The ureters were then palpated by the vagina. The left felt distinctly harder than normal and somewhat thickened, but was without marked tenderness; it was also displaced toward the pelvic floor.

The bladder was then examined under atmospheric dilatation, with the patient in the knee-chest position, through the No. 10 speculum. There was evidence of a patchy, mild cystitis. The field opposite the ureter, the posterior pole, and its surrounding area were mottled, red, and injected, the vessels being obscured; the injection increased toward the vault, which was covered over an area 4 by 5 centimeters by fine granules, averaging one or two to the square millimeter, most marked on the right side. The tips of each of these granules reflected the light and gave the surface a bright studded appearance. On the left side in places the surface presented a superficial worm-eaten appearance. On the right lateral wall, $2\frac{1}{2}$ centimeters behind the ureteral orifice, was a ridge 2 millimeters in height, extending downward to the base of the bladder. Near the right ureteral orifice was an area of intense congestion, presenting an edematous appearance, surrounding the ureter, whose orifice could only be located by a little pallor in the form of a crescent. Posterior to the right ureter was a superficial ulcer 2 by 3 millimeters, with a narrow red border and a yellow center.

The left ureteral orifice was situated on a truncate cone, about 6 millimeters in diameter at its base and 2 millimeters at the top. It was slightly edematous, and on the urethral side broken up by a number of irregular papillary eminences. The sight of the ureteral orifice at the first examination was marked by a yellow spot of pus. On introducing a searcher into the opening of the orifice, a thin stream of pus escaped and ran down on the bladder wall.

Upon leaving the ureteral catheter in the left ureter for three minutes, 11 cubic centimeters of dark fluid escaped, followed by 6 cubic centimeters of fluid containing much pus. In the twenty-four hours following the examination the patient passed 700 cubic centimeters of urine.

During the whole time the patient was under treatment, from the 2d of March to the 2d of June, 1894, I catheterized her left ureter about one hundred and twenty times in all. The first three weeks of her stay were passed in repeated vain endeavors to get the ureteral catheter through the stricture into the ureter. Three difficulties prevented this at first. In the first place, the irregular papillary prominences on the left side, in the neighborhood of the ureteral orifice, obscured it, and made it impossible to locate it with precision subsequent to the first examination, in which pus was seen oozing out; in the second place, the location of the ureteral mons and its orifice were in extreme displacement to the left; in the

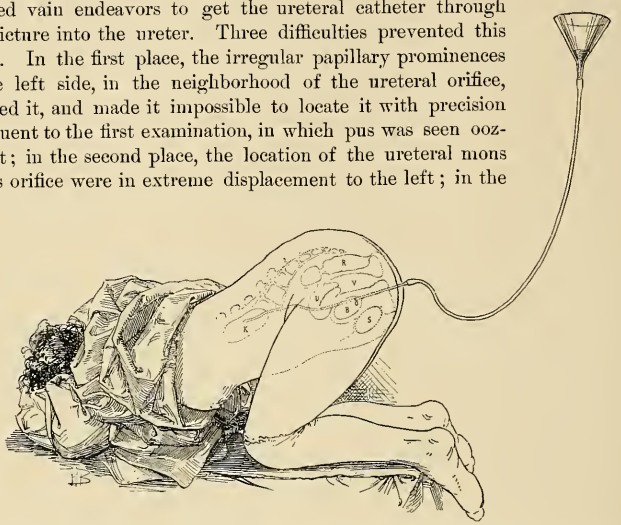


Fig. 246.—Washing Out the Right Kidney for Gonorrheal Ureteritis and Pyelitis.

A flexible catheter is usually used. In this case a metal catheter was passed through a stricture at the lower end of the ureter and the solution carried up to the kidney by gravity by means of a funnel and long rubber tube. The patient is in the knee-chest position to aid gravity.

third place, there was a spiral stricture of the intravesical portion of the ureter, and it was necessary for me to learn the twist of the stricture before I could pass the catheter at once at every sitting.

After almost daily efforts for three weeks the stricture was finally cleared by an accidental turn of the hand; this was more readily repeated on two or three occasions subsequently, but not without many discouraging failures, after which the ureteral orifice was definitely located on the side of the pyramid in relation to certain papillæ, and the direction of the stricture was ascertained, so that the catheter could be passed with ease. After pushing the catheter through the stricture with a half turn it entered about 8 centimeters; a distinct sense of resistance was felt in attempting to withdraw it, due to the bite of the stricture, about 1½ centimeter long. So long as the point of the catheter went no farther than the stricture, no urine escaped; but as soon as the catheter cleared the stric-

ture, pale urine began to pour out in a steady stream, continuing until 150 cubic centimeters were collected in three minutes. Sometimes the first urine drawn off would be of a reddish-brown color, followed by a whitish sediment, and at the last a thick, creamy fluid like pure pus.

The fact that so much urine escaped in so short a time proved conclusively that there was an extreme dilatation of the left urinary channels above the stricture, for the normal rate of secretion being at the most 1 cubic centimeter a minute for both ureters together, or 1½ in three minutes for one ureter. The discharge of 150 cubic centimeters would be twenty-nine times the normal amount, or at the rate of about twenty-two gallons a day for both sides together, proving that there was a dilated pyoureter and pyelitis.

After drawing off all the fluid, a piece of fine rubber tubing with a funnel at the end was connected with the catheter, and a saturated boric-acid solution, equal to two thirds of the quantity of fluid taken out, was run into the ureter by gravity by simply elevating the funnel filled with the fluid from 40 to 60 centimeters above the level of the bladder. Care was taken to have the tubes full of fluid, so as not to inject air. The patient, during all these manipulations, was in the knee-breast position. She took no anesthetic, as the treatment was not painful. After the catheter was in the ureter she raised herself on her hands and knees to dispose the fluid to run out faster. When the injection was given she again let her chest down to the table, and rose again when it was to flow out. I found that I could wash the urinary tract repeatedly with the same fluid, if I desired it, by holding the funnel high for the fluid to run in, and by holding it an

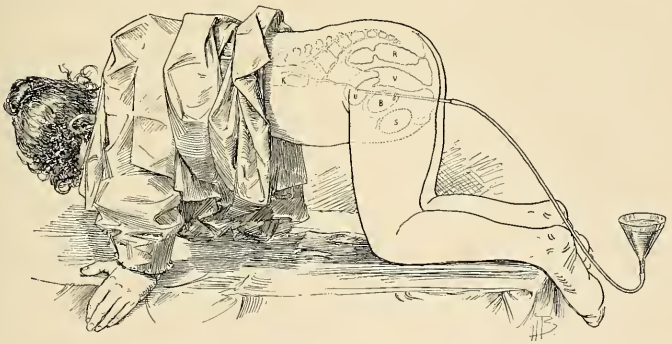


FIG. 247.—WASHING OUT THE KIDNEY AND URETER.

Letting the fluid run back again into the funnel from the kidney and ureter. The funnel is held low and the patient rises on the hands and knees to facilitate the outward flow. San., Mrs. S.

equal distance below the level of the table for it to run out again, often bringing with it a considerable amount of shreddy white *débris* from the ureter.

A small Y-shaped switch with a stopcock in the angle was used at times to facilitate the inflow and outflow of the solutions.

After the first few treatments she began to experience relief from pain and was less frequently disturbed at night.

Examination of the urine by Dr. Barker in the pathological laboratory of the Johns Hopkins Hospital showed that it was straw-colored, neutral in reaction, and contained abundant muco-purulent, stringy, tenacious sediment. There was a small amount of albumin, but no sugar and no casts. The specific gravity was 1·032. There were many polynuclear leucocytes, crowds of pus cells, and many diplococci, nearly all of which were within the protoplasm of the leucocytes. Octahedra of calcium oxalate were found, and a few cylindroids. There were no tubercle bacilli, and no other bacteria than diplococci, which were of the typical appearance of gonococci, and much smaller than staphylococci or streptococci.

The bladder walls were treated by occasional applications of a 5 per cent solution of nitrate of silver, applied directly to the affected areas on absorbent cotton with an applicator, and by daily irrigations of a bichloride solution (1–150,000).

My first effort in the treatment of the case was to secure a continuous drainage of the ureter, avoiding all accumulation above the stricture, hoping by this plan to induce a contraction of the ureteral walls. To do this I made a short ureteral catheter 2 millimeters in diameter and 5 centimeters long, with a little shoulder about 2 centimeters back of the inner end to keep it from slipping out of the ureter after introduction, and with a flange 6 millimeters in diameter at the lower end to keep it from slipping altogether into the ureter. I placed this in the ureter by means of a searcher used as a mandarin to conduct it through the stricture. I found, however, that its presence gave so much pain and increased the irritation of the bladder, after being in place for twelve hours, that I was obliged to abandon its further use, although it acted well mechanically.

My next plan, which was successful in curing the case, was to have ureteral catheters made in four sizes, increasing from the smallest, 2 millimeters, to the largest, which was 6 millimeters in diameter. The points of the catheters were blunt and straighter than the ureteral catheters ordinarily used, on one side almost on a line with the shaft.

In the course of two months of such treatment the ureter was dilated sufficiently to permit the introduction of the largest catheter, from the end of which the accumulated uriue would drop in a large free stream. With the catheters I began systematically to wash out the ureter and kidney with a bichloride of mercury solution (1–150,000), constantly increasing the strength until 1–16,000 was used. The treatment with the bichloride was interrupted several times for the injection of a 1 per cent nitrate of silver solution, and once for a weak iodine solution. Toward the end, while using the larger catheters, I was obliged some six times to suspend the treatment for from two to three days, on account of a chill followed by elevation of temperature from 102° to 104° F., with a quickened pulse (120), headache, nausea, and pain in the left inguinal region and legs. The patient was flushed and restless, and suffered from sleeplessness at these times.

The result of the bichloride washings was a complete disappearance of pus cells, leucocytes, and gonococci from the urine, and the reduction of the size of the distended ureteral tract from one holding regularly from 140 to 150 cubic centimeters down to 90 or 100 cubic centimeters. The bladder assumed a normal appearance and she became able to sleep through the night without rising once. She gained 20 pounds in weight and resumed the rosy appearance of perfect health, with a corresponding remarkable improvement in spirits.

The treatments were discontinued August 8, 1894, and I saw her again in January, 1895, and then on two occasions catheterized the ureter, drawing off only 90 and 100 cubic centimeters of clear urine from the left ureter without a trace of pus or cocci. She has therefore recovered from the infection, but still has a stricture of the ureter of larger caliber with a lax distended ureter above it.

I made several attempts to empty the ureter by massage, with considerable success at first, but the procedure became so painful that it had to be stopped. Just before the massage the bladder was emptied by catheter, and immediately after treatment as much as 90 cubic centimeters of urine were secured.

I demonstrated the success of the massage and mapped out the exact positions in which to make pressure by placing the patient in the dorsal position and then introducing a catheter with a rubber tube attached to its outer end, when a straight glass tube, 50 centimeters long, attached at the other end of the rubber tubing, filled at once with urine to the level of the ureter and acted as a manometer. Respiratory movements were traced by its rhythmical ascent and fall. On making pressure over the ureter through the abdominal wall the column ascended in the vertical glass, and, by increasing the pressure, could be forced out over the top. If the pressure was made to one side of the ureter there was only a slight effect or none at all. By marking all the points of effective pressure on the skin, and afterward connecting the markings, the course of the ureter was accurately mapped out.

The following important points are demonstrated by this case:

1. Stricture of the lower extremity of the ureter can be diagnosed without any operation by using the cystoscope with the bladder dilated with air by posture.

2. Stricture of the ureter can be improved by gradual dilatation by a series of hollow bougies (catheters) and without a kolpo-ureterotomy. (See *Johns Hop. Gyn. Rep.*, No. 1.)

3. A stricture through which a No. 5 (5 millimeters in diameter) bougie is passed every day for several weeks will still hold back the urine if the walls of the ureter above have lost their contractility.

4. Pyoureter and hydroureter can be diagnosed by drawing off in a few minutes such a quantity of fluid as it is manifestly impossible for the kidney to secrete in that amount of time.

5. Pyoureter and pyelitis can be cured by washing out the ureter and pelvis of the kidney without any preliminary cutting operation to disclose the ureteral orifice (as in kolpo-uretero-cystotomy, Bozeman).

6. Variations in pressure in the column of fluid in a distended ureter can be demonstrated by a manometer attached to the ureteral catheter.

7. In this way the course of the ureter can be mapped out.

There are several sorts of stricture in the upper part of the ureter at or near the junction with the pelvis of the kidney.

In one important group of cases the closure is intermittent, or depends on a ureteritis without a definitely localized stricture.

Complete closure may be congenital or it may follow an injury or inflammatory disease. The treatment will depend upon the length of time which has elapsed since the occlusion was effected as well as upon the result of the occlusion. Where the kidney has undergone atrophy nothing need be done. If it has become greatly distended, temporary relief may be afforded by tapping. If the occlusion is but recently acquired, the effort should be made by operation to make the passage pervious.

I have examined the first patient on whom I performed a nephro-ureterectomy, leaving 6 or 8 centimeters of the lower end of the tuberculous ureter, and found the position of the ureteral orifice in the bladder marked by a shallow pit impervious to the sound.

In another case of an intermittent hydronephrosis of long standing, due to a stricture of the ureter just below the pelvis of the kidney, in attempting to locate the stricture by means of a catheter the vesical opening was lacerated; a few days later the kidney was exposed and the ureteral stricture divided and sutured so as to make a free opening from the kidney into the ureter. The pelvis of the kidney was drained through an incision in the dorsum so as to allow the repaired stricture to heal at rest. During this time the bruised lower end of the ureter, no longer kept open by the passage of the urine, closed completely, as I found by a cystoscopic examination several weeks later, when no efforts made to pass the sounds succeeded.

The following case of complete occlusion of the renal end of the ureter came under my care in May, 1894.

C. F. (San. 109, May, 12, 1894), twenty-three years old, was suffering from an old fistula discharging pus beneath the left anterior superior spine. Her trouble began ten years before with "awful spells of pain" in the left side, extending around into the small of the back. These came about twice yearly and lasted two weeks at a time, when she had to stay abed on account of the pain and fever attending them. In the intervals she suffered from constant soreness in the left side. In 1890 she had a spell lasting a year, treated as "typhoid fever," and terminating in April, 1891, in an abscess in the left inguinal region, which was opened and 2 liters of pus and blood evacuated. The abscess continued discharging until October, 1892, when it closed. In June, 1893, she got worse again and the abscess reformed; it was opened in August, and since then the discharge had been constant. Several gritty particles escaped recently from the wound. Seven months before coming to me she had been in a sanitarium, where she was treated for spinal caries. Each time the sinus closed and pus accumulated she had a chill with pain and fever until it was reopened.

She was a little woman, under five feet in height, and well nourished. I found in the crease of the left groin, just under Poupart's ligament, the funnel-shaped orifice of a fistula, 2·5 by 1 centimeter (1 by $\frac{2}{5}$ inch), discharging a little thin, watery pus. The sound entered readily for 16 centimeters ($6\frac{1}{2}$ inches) back toward the lumbar vertebræ. Her hip movements were normal. The back was tender but showed no abnormality. There was an ill-defined but positive sense of resistance in the flank under the left ribs. The examination of a bit of gritty substance discharged from the fistula showed that it was made of amorphous urates.

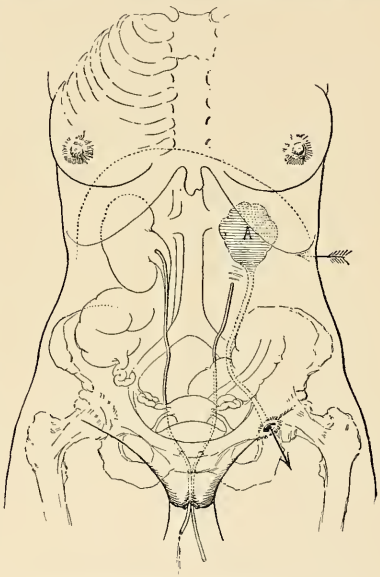


FIG. 248.—DIAGNOSIS OF OLD ABSCESS OF THE LEFT KIDNEY BY MEANS OF RENAL CATHETERS.

A, sinus discharging under the left anterior superior spine had been treated as a psoas abscess, but on inserting a renal catheter up to the right kidney and another up to the left, the catheter on the left side entered four centimeters short of that on the right side, and upon leaving both catheters in the ureter for an hour, that on the right side discharged urine freely, while none at all came through the left ureter. Upon cutting down on the left side in the direction of the arrow, an old cheesy focus was found occupying the situation of the kidney.

A positive diagnosis was arrived at in the following way, by an examination under anesthesia. She was put in the knee-breast position and the No. 10 bladder speculum introduced. I was then able to pass a flexible renal catheter 26 centimeters ($10\frac{1}{2}$ inches) on the right side. On the left side the catheter stopped suddenly, as if meeting an obstruction 23 centimeters (9 inches) in, nor could it be induced to go farther. I then left the catheter in the left ureter over an hour, with its outer end lying in a receptacle. No urine at all escaped during this time. The diagnosis therefore was complete occlusion of the left ureter at the kidney, with abscess of the kidney discharging by a long fistulous tract at the anterior superior spine. The kidney was so completely disorganized that there was no chance of restoring its function, and the effort of the treatment was directed simply to doing away with the fistulous tract.

A cure was effected by making an incision 8 centimeters ($3\frac{1}{4}$ inches) long, between the crest of the ilium and the ribs, down through the muscles and a mass of inflammatory tissue, opening and evacuating several sacs of clear fluid, and scraping out one sac of cheesy material. Nothing was done to the ureter. A drain was left in and gradually withdrawn; she made a complete recovery and is well and married now, three and a half years later.

Traumatic stricture is a rare occurrence on account of the protected condition of the ureters. External injuries, involving a ureter, are almost invariably associated with such extensive damage to other important viscera that the patient does not often survive. In spite, however, of this comparative immunity, cases do now and then occur.

The accidents most liable to reach the ureter are stab and gunshot wounds, a kick of a horse, a severe blow, or the crushing wound of a cart wheel. Manifestly men are far more exposed to such injuries than women. As Christian Fenger has said, "Early diagnosis in these cases is often difficult, if not impossible, because of the uncertainty of the symptoms. A slight transient hematuria, which might easily be overlooked, was noted in three cases. Hematuria may be entirely absent. If no injuries to other organs complicate ureteral rupture, there are no grave symptoms in the beginning."

Swelling from the accumulation of urine around the place of rupture is often from one to seven weeks in developing.

In Fenger's analysis he shows that the treatment has never yet been directed at an early stage to the ureter itself, but consisted in puncture of the sac when forming, or in incision and drainage. Most of these cases became septic, and made a secondary nephrectomy necessary to save life. In some cases where the collection was not opened the patients survived, either with an obliteration of the ureter or a stricture.

The treatment of strictures will vary according to their location. Those most amenable to treatment will be found located at the vesical and renal ends. I should propose to treat a stricture of the vesical end surgically by opening the vault of the bladder above the symphysis (*sectio alta*), and exposing the orifice, so as to slit it back into the dilated portion, and then to unite the edges of the V-shaped cut with a fine continuous catgut suture which will stop the bleeding and keep the urine out of the cellular tissue.

Fenger's plan (*Surgery of the Ureter*, *Trans. Amer. Surg. Assoc.*, 1894) for treating a traumatic stricture of the ureter in its upper part is by a linear longitudinal incision dividing the stricture. The ends and the sides of the incision are then sutured together so as to make a ureter of enlarged caliber. This was successfully carried out in the case of a man of forty-seven years, in whom the stricture was close to the junction with the renal pelvis, and the patient had suffered for four years with intermittent pyelonephrosis. As the attacks increased in frequency a nephrotomy was performed, but no stone was found in the sacculated kidney. The ureteral entrance could not be discovered either through the renal incision or after incising the pelvis. After making a longitudinal incision in the ureter below, the stricture was located in its upper part, and treated by making a longitudinal division and approximating the sides of the incision by sutures. Recovery took place in six weeks without a fistula.

Prof. E. Küster, of Marburg (*Arch. f. klin. Chir.*, Bd. xliv, chap. xxxvii, p. 850), had a case in a boy eleven years old in whom he divided the ureter below a stricture at the renal junction, and transplanted the divided ureteral end into the pelvis of the kidney.

Two years before, the boy had had a left hydronephrosis for which a lumbar incision was made, resulting in a fistula; from this time on little or no urine came from the bladder, showing that the right kidney was either absent or inactive. In order to make the ureter patent, Küster made a lumbar incision and opened the pelvis of the kidney, exposing the ureteral orifice. On cutting this down to make it patulous, he discovered a stricture 2 centimeters (3 inches) below the kidney, necessitating cutting off the ureter transversely below the stricture. The lower end of the ureter was now enlarged by splitting it longitudinally, and then suturing it into the incision in the renal pelvis. The rest of the wound in the renal pelvis was closed with catgut.

The result was that four months later the patient was able to pass 100 centimeters (3½ ounces) of urine by the bladder in twenty-four hours, while the rest escaped by a fistula in the loin. This was closed by curetting and dilating the sinus and using buried sutures, when the recovery was complete, with a lumbar hernia.

Stricture is also formed by an abnormal entrance of the ureter at an acute angle into the renal pelvis, replacing the normal funnel-shaped opening. The orifice is situated high up in the side of the renal pelvis, and is valve-shaped or minute and punctate. The nature of the obstruction is easily demonstrated by injecting fluid in both directions. It will be found to pass readily upward into the pelvis, but to escape from the pelvis into the ureter with difficulty. This condition of the ureter has especially been studied in its relation to hydronephrosis, which in some cases is caused by it, while in others it would seem that the twisting of the distended kidney produced the occlusion of the lower border of the ureter.

In the treatment of these cases two things must be done: First, the accumulation must be relieved if it is distressing; and, second, the passage must be made patulous. The proposition to extirpate such a kidney should no longer be seriously considered, for even after a blockade of weeks or months the kidney retains to a remarkable degree its excretory power. In a case under my care I evacuated a hydronephrosis of six years' standing, withdrawing 155 cubic centimeters of urine, in which I found 0·039 gram of urea to the cubic centimeter. This was done by placing the patient in the knee-breast position, and with the speculum and head mirror exposing the right ureteral orifice, when a delicate renal catheter was passed up into the ureter and the sac evacuated. If the stricture proves impassable, then the second procedure alone remains to be carried out—that is, the exposure and plastic repair of the contracted portion.

Fenger's plan of treatment of the valvular orifice is the best. He has carried it out successfully in the following way:

The patient was a woman, twenty-eight years old, having intermittent hydronephrosis with severe pain. The lower third of the kidney was drawn forward into the wound in the left loin, and the posterior surface of its pelvis exposed and freed of the enveloping fat. An incision was then made, about 2 centimeters (¾ inch) long, through the thickened pelvis. On holding this open with forceps, a small semicircular opening was seen at the lower portion of the

inner wall, with its posterior border convex and the anterior straight, forming a valvelike fold over the entrance likely to close the ureter when the pelvis became moderately distended.

This stricture was overcome by making an incision through the mucosa and

FIG. 249.—HYDROURETER OF BOTH SIDES DUE TO STRICTURES PRODUCED BY A CANCER OF THE UTERUS; DOUBLE URETER ON THE LEFT SIDE FROM KIDNEY TO BLADDER.

Note the separate vesical orifices on the left, and the position of the right orifice on top of a cushioned eminence. $^{5}/_{6}$ nat. size. June 22, 1896.

the muscular wall of the renal pelvis and ureter without cutting through into the surrounding cellular tissue. The lower ends of the cut in the ureter and in the renal pelvis were now simply united by a single very fine silk suture, changing the vertical incision into a horizontal line, giving a wide exit into the ureter. In place of the No. 5 French bougie introduced at the outset, a No. 11 could

now be passed. This was left in the ureter and brought out of a wound in the dorsum of the kidney to keep the ureter open while healing. The opening into the renal pelvis was closed by ten fine interrupted silk sutures, not piercing the mucosa. The wound was partially closed with extensive drainage. The bougie in the ureter was taken out on the second day. The woman recovered without a fistula, and had no return of the hydronephrosis.

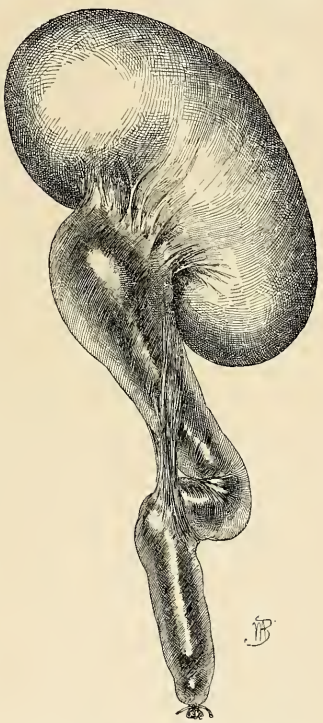


Fig. 250.—Hydroureter and Hydronephrosis, showing Kink in Ureter due to Band of Adhesion stretching from the Lower Part of the Pelvis of the Kidney almost down to the Pelvic Brim. 3/5 Nat. Size.

Sarcoma of peritoneum. H. B. Autopsy, April 4, 1895.

Hydroureter, or an abnormal distention of the ureter with urine, is but the complement of stricture which we have just considered. The cause of the hydroureter and hydronephrosis, which is genetically the same and always associated with it, is invariably due to an obstruction to the outflow of the secretion without infection. The various causes, therefore, are those just enumerated, which need not be cited again.

Bilateral hydroureter and hydronephrosis may arise from an obstruction as low down as the urethra, or from a hypertrophy of the bladder walls. It has been noticed arising from the compression of the orifices in exstrophy of the bladder.

Pelvic tumors, neoplasms, and inflammatory diseases act on one or both ureters according to their disposition. The hydroureter always extends from the point of constriction up into the pelvis of the kidney, which it involves (hydronephrosis). The tract included is therefore greater or less, according to the location of the obstruction. It is greatest when the stoppage is at the extreme lower end of the ureter, as in the case of a calculus plugging its orifice. One of the commonest forms, generally of lesser degree, is that produced by the pressure of large uterine or ovarian tumors, which is almost always greatest just at the pelvic brim, so that the hydroureter affects the abdominal portion only.

A marked case is shown in the figure taken from one of my patients (S. A. H., 4039, Dec. 30, 1895), who died with an enormous carcinoma of the cecum filling the whole abdomen and pelvis. Following the distention the ureter be-

came kinked, and adhesions formed which bound the kinks together and would tend to keep up the distention even if the cause were removed.

In one instance figured in the text (Fig. 250) the ureter was obstructed by the pressure of a sarcomatous growth of the peritoneum; as the ureter distended it kinked and became further obstructed by a band of adhesion uniting it to the pelvis of the kidney.

A sharp line of distinction between hydroureter and pyoureter can not be drawn; in many cases of hydroureter pus is found in small quantities. In some instances this increases while under observation until it is so abundant that there can be no hesitation in calling it pyoureter; in other cases a pyoureter will rapidly improve and the pus diminish from day to day, ultimately leaving behind a simple hydroureter without the observer being able to decide just when the transformation took place.

Pyoureter.—Pyoureter is an accumulation of pus in the ureter. In order to bring this about, two things are necessary: first, an obstruction, and, second, an infection, or the infection may take place first and the obstruction develop afterward. A common example of the first class is a hydroureter which becomes infected, while the second class is typified by the case cited under gonorrheal stricture of the ureter. Properly speaking, many of these cases should be classified under ureteritis and its sequelæ. The quantity of pus found varies from a large deposit falling as a sediment in the urine as soon as it is withdrawn, or a thick and creamy pus only brought out of the catheter by suction, all the way down to a small quantity of pus just sufficient to give the urine a turbid or milky appearance, or the pus may even not appear at all until the urine is centrifugalized and put under the microscope. The same causes may act to produce pyoureter as hydroureter, of which the former may sometimes be considered an advanced stage.

Fever is, as a rule, only an occasional symptom. I have seen several cases where an intense intermittent colic was the most pronounced symptom, and where no calculus was present.

The diagnosis is made by the ureteral and renal catheters. Upon introducing the catheter and clearing the obstruction the pus or purulent urine will begin to flow. It must be borne in mind that urine thickened by pus will escape much more slowly than normal urine; if necessary, the discharge at the end of the catheter may be hastened by applying suction with an air-tight syringe.

Whenever the pus is inspissated or too thick to flow readily through the small catheter, it is best to dilute it by injecting some warm boric acid solution and allowing it to mix well with the pus before escaping again; by repeating this maneuver an accumulation may be evacuated in a few minutes which could not otherwise escape in the course of several hours. When the thick pus is in the pelvis of a large kidney the dilution may be aided after injecting the solution by manipulating the kidney freely between two hands.

I have met a number of cases due to tubercular ureteritis with stricture, and the one case cited of gonorrheal infection.

The prognosis depends upon the cause. In tubercular cases the disease is

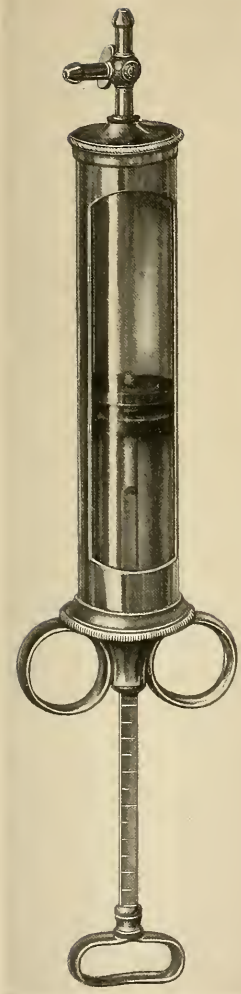


Fig. 251. — Syringe and Aspirator with Cock for injecting and washing out the Pelvis of the Kidney through the Renal Catheter; or to inject Fluid so as to dilute a Collection of Pus too thick to run out through the Catheter.

progressive until removed. In other cases the infection involves not only the ureter but the pelvis of the kidney, and the kidney substance too, impairing the secreting function.

The treatment will also depend on the cause, and the possibility of completely removing any obstruction to a free outflow. Disinfection of the whole urinary tract up into the kidney may be carried out as already detailed.

Ureteral Calculus.—A calculus lodged somewhere in the course of the ureter is far more rarely found than in either the renal pelvis or in the bladder.

The chemical characters of such calculi are the same as those found in the kidney; the form, however, of a calculus which has lodged in the ureter for some time is peculiar, being elongate, from four to six or more times its diameter, which averages about 5 millimeters, and pointed at both ends. The forms of these calculi and the appearance of the layers show that they gain by accretion at the ends and lose by attrition at the side. A ureteral calculus has been observed 12·5 centimeters (5 inches) long. Small calculi may be round or even horseshoe shaped, as in Dr. R. B. Hall's case (*New York Medical Record*, Oct. 18, 1890). The pelvis of the kidney is the source of these calculi, which drop down into the ureter or are slowly forced down until they lodge somewhere in its course.

Fig. 252. — A Ureteral Calculus which was passed spontaneously, showing the Characteristic Ovoid Form. Actual Size.

I had one case of a ureteral calculus forming upon a silk thread used to suture the opened ureter to the vaginal vault (kolpo-ureterostomy) for the purpose of treating a stricture of the ureter. The patient suffered intense pain from vesical spasms until I discovered the stone and took it away. It was about 6 millimeters in diameter.

Ureteral calculi lodge by preference within certain well-defined limits—for example, just below the renal pelvis, about the flexure at the pelvic brim, and the pelvic floor, are decidedly points of predilection.

The symptoms produced by a stone lodged in the ureter are attacks of severe pain extending from the kidney down the course of the ureter, and sometimes accompanied by rigors. The pulse is elevated and there is fever. The point of location of the stone is tender on deep pressure. These attacks are intermittent, and recur at variable intervals as long as the stone remains. With the attacks may often be noticed the formation of a tumor in the loin of that side. Where the stone is not lodged, but is gradually descending toward the bladder, its advance can be traced by the patient, and is often marked by bloody urine. Mechanically the obstruction produces a hydroureter and hydronephrosis, varying in grade according to the completeness of the obstruction; if there is infection, pyoureter and pyonephrosis may arise. In time the function of the kidney becomes greatly impaired, but it is remarkable how persistently it continues to excrete a diminished percentage of urea after months and years of such interference.

Fig. 253.—End of a Wax-tipped Catheter.

Diagnosis of renal calculus by means of a wax coat on the catheter. The scratch marks were made by the calculus shown in Fig. 254. Four times enlarged.

The valve action of a stone in plugging the ureter and then permitting the dammed-up contents to escape suddenly is well shown by the history of Dr. Hall's case cited above, in which he found a renal tumor the size of a pint cup, which was not present the day before.

A presumptive diagnosis will be made when all the symptoms above described are found. It must be remembered, however, that the passage of a blood clot, or the temporary closure of the ureter by an inflamed thick mucosa, may give rise to similar symptoms. The most certain of all means of diagnosis is the direct examination by vagina, by rectum, or by cystoscope and catheterization of the ureter, or by an abdominal incision. A stone of good size lodged in the ureter in advance of the broad ligament can be felt through the antero-lateral wall of the vagina and rolled under the finger. Back of this point the normal ureter is easily accessible *per rectum*, all the way up to the pelvic brim, by following the landmarks described, and the palpation is all the easier if the ureter contains a foreign body.

A cystoscopic examination may be so fortunate as to disclose a stone projecting partly into the bladder. By using the metal catheter with a diaphragm on

the end a stone can be recognized all the way back to the posterior pelvic wall, or even up above the brim, by the click when struck. Above this point the diagnosis must be based upon the fact that an obstruction exists in the form of a foreign body, which is demonstrable upon passing the flexible renal catheter, tipped with wax, which takes an impression from the stone.

It has not yet been my good fortune to sound for a stone in a ureter with a wax-tipped catheter, but I offer as bearing upon the method of diagnosis some of the evidence gathered in searching for renal stones, with the remark that it would be better in the case of a ureteral calculus to put the wax on the very tip of the catheter.

Fig. 254.—Calculus of the Pelvis of the Kidney found by the Wax-tipped Catheter introduced by the Ureter. Natural Size. Jan. 29, 1896.

Mrs. P. had a calculus in the pelvis of her right kidney, and a catheter coated with dental wax softened with olive oil was passed up into the kidney, the vesical speculum was removed, and the catheter then withdrawn. Upon placing the glistening wax surface under a lens the scratch marks seen in Fig. 253 were plainly visible, and at the operation the calculus shown in Fig. 254 was removed.

Another patient, sent to me by Dr. F. Henrotin, of Chicago, had a calculus in the kidney which gave the following evidences of its presence: The renal catheter was passed into the pelvis of the kidney, and upon withdrawing it its end was found hammered down and scratched, as seen in *b*, Fig. 255; in the eye of the catheter was lodged a bit of a stone (see *a*, Fig. 255), and upon magnifying this (*c*, Fig. 255), it was found smooth, black, and mammillated on one surface, and on the other jagged, crystalline, and buff-colored, showing that it had been broken off from a larger stone.

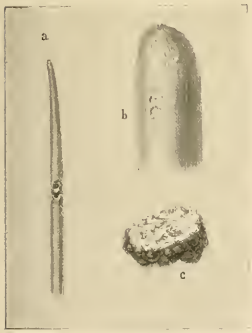


Fig. 255.—*a*, Stone caught in the eye of a Renal Catheter. Actual Size. *b*, End of Catheter Hammered down and Scratched. Magnified. *c*, Free and Broken-off Surface of the Same Stone. Magnified.

The treatment is both palliative and radical. It is proper to use palliative treatment during the attacks, relieving the pain with hypodermics of morphia, and producing relaxation by hot baths and packs. Where a number of stones have passed previously, it is best to wait and see if the attack in question will not also pass off in the same way. When, however, the stone is caught and refuses to advance, if the symptoms are urgent and the formation of a renal tumor shows that the stoppage is complete, no time should be lost in delaying a resort to surgical measures.

In the surgical treatment of ureteral calculus its removal is effected by an extraperitoneal or by a transperitoneal route. In the extraperitoneal method the peritoneum is not opened at all, but even when the stone is caught in a por-

tion of the ureter lying beneath the peritoneum, the latter is loosened and turned to one side and the ureter arrived at in this way from behind. In the transperitoneal method the anterior abdominal wall is opened, preferably in the semilunar line, and the ureter exposed and incised, making in this way two incisions through the peritoneum on opposite sides of the abdomen.

The extraperitoneal route is always to be preferred, on account of the danger of peritonitis, and on account of the risk of a urinary fistula, which will be safer behind than across the peritoneum.

In two positions the stone must always be taken out by the extraperitoneal route: first, when lodged anywhere between the kidney and the superior strait; second, when lodged in the anterior part of the pelvis, under or in front of the broad ligament. The ureter is more easily accessible from the brim of the pelvis down to the broad ligament after opening the abdomen, but even here it is better to make a long lateral incision and peel up the peritoneum so as to get at the stone in this way.

The presence or absence of infection also influences the choice of route. When the urine is discharging pus from the affected side, the extraperitoneal route must always be followed, on account of the enormously increased risks of infection if the peritoneum is opened. As stated in discussing the diagnosis of stone in the ureter, it may be proper in doubtful cases to make a preliminary abdominal incision in the semilunar line in order to locate the stone, and then to remove it by a lateral incision.

The various operations for ureteral calculus are performed as follows: When the stone is found lodged in the lower vaginal part of the ureter, if its end can be seen through the cystoscope projecting into the bladder, the effort should be made to grasp it with a pair of ordinary forceps, or alligator forceps, with a hook, or in a noose, and by traction, aided by pushing from behind with one finger in the vagina, to draw it out of its bed and through the urethra.

If this fails, and whenever the stone is behind the vesical orifice of the ureter, it must be reached by a vaginal incision.

After definitely locating by touch the part of the vagina nearest the stone, the patient is put on her back, or in the lateral posture, and the posterior vaginal wall retracted, exposing the anterior and the lateral walls.

The bladder is emptied and a longitudinal incision is made through the vaginal wall about 3 centimeters ($1\frac{1}{4}$ inch) long; pulling apart the borders of the incision and dissecting down into the cellular tissue, the enlarged ureter is exposed and caught by passing blunt hooks under it, above and below the stone. A longitudinal incision is then made in the ureter over the end toward the bladder, just large enough to push the stone through endwise without any tearing. After this is accomplished a bougie is run up the ureter to make sure there are no more stones above, and the ureteral incision is sewed up with five or six fine interrupted catgut sutures, introduced with a delicate curved intestinal needle, each one embracing the outer coats and avoiding the mucosa. If a good closure is secured and there is no infection, the vaginal wound may be closed too, but if there is much pus in the urine it is safer to drain the vaginal incision.

The remainder of the ureter can be exposed by the incision in a line beginning in front of the quadratus muscle, halfway between the crest of the ilium and the ribs, and extending obliquely downward and forward above the anterior superior spine to the semilunar line, where it ends over the pelvis. The incision, which must be a generous one, is carried boldly through the skin, and three layers of muscles down to the fat overlying the peritoneum. Most of the bleeding vessels are best clamped, but the arteries should be tied with fine catgut. As soon as the fat layer is reached the knife is laid aside and the incision drawn widely open with retractors, while with the fingers alone the perito-

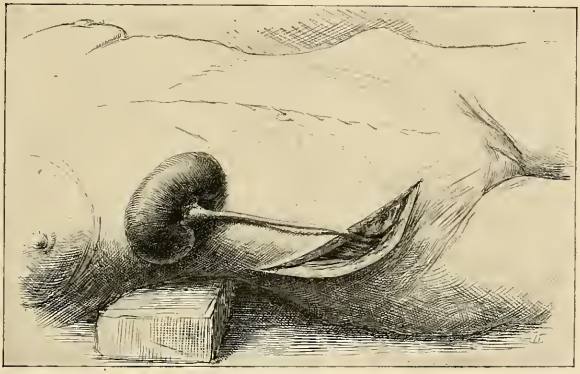


Fig. 256.—Removal of the Kidney and Ureter without opening the Peritoneum.

The operation is here done on a cadaver and photographed. The figure is used in this place to demonstrate the course of the incision from the lumbar region around the anterior superior spine to the semilunar line above the pubis; through this incision the whole ureter can be reached extraperitoneally.

neum and cellular tissue are easily lifted up and dissected back toward the spine. In this way the ascending or descending colon is drawn to one side, and the ureter is exposed in its course across the psoas muscle. If not readily found it may be detected by finding the kidney first and then tracing it down from the pelvis.

The stone will be found easiest, if it is a small one, by grasping the ureter between the thumb and forefinger and passing it between them from above downward until the foreign body is felt. A longitudinal incision is then made over the end of the stone, it is taken out, and the opening is closed at once with fine catgut sutures, embracing all but the mucous coat. Where the pelvis of the kidney has been opened to extract renal calculi, and a doubt is felt as to whether or not there is a calculus in the ureter, this may be determined by passing a sound down the ureter toward the pelvis. If a stone of any size is found the instrument will be checked, and a little wax on the tip will demonstrate the nature of the obstruction. The diagnosis of stone in the upper ureter may also be made by passing the finger through the lumbar incision made for nephrotomy down along the course of the ureter. I have been able to palpate

the ureter in this way all the way to the pelvic brim over the common iliac artery without making a longer incision than necessary to deal with the renal stone.

The transperitoneal plan of removing calculi is safe and proper when there is no infection, and the stone is fixed in the ureter at a point near the pelvic brim. In this position the ureter is easily found and exposed, and may be treated through an incision in the semilunar line with the pelvis well elevated. The stone is then removed by a longitudinal incision closed by catgut mattress sutures embracing peritoneum and muscular coats. If the suturing is accurate, and there is no stricture below to dam back the urine, there is no need of a drain, and the abdominal wound should be completely closed.

W. A. Lane, of Guy's Hospital, operated on a calculus impacted in the ureter for twenty years (see the *Lancet*, Nov. 8, 1890, p. 967).

The patient was twenty-three years old and began having violent abdominal pains when she was three years old; she had hematuria when eight years old. Attacks of violent pain were referred to the left side low down and were accompanied by great irritation in the urethra. After each attack abundant pus appeared in the urine.

At a first operation a lumbar incision was made and the kidney explored; a "kink" in the ureter was found and corrected, but the pain soon recurred.

On July 5, 1890, an abdominal incision was made in the left linea semilunaris and the ureter palpated about the pelvic brim, where a stone was felt and pushed up; a longitudinal incision was made in the side of the ureter and a small oval stone three quarters of an inch long was removed, and the opening closed with a fine continuous silk suture. The wound healed without leakage and the patient recovered. The calculus was made up of alternating layers of uric acid and urates.

Prolapse.—An eversion or prolapse of the ureteral mucosa is one of the rarest of the ureteral affections. It is commonest in female children and oftenest congenital. The prolapse usually depends for its origin upon a narrowing or stricture at the ureteral orifice, the pressure of the urine filling the pelvis of the kidney and the ureter behind this is then sufficient to cause the ureteral mucosa to pout out into the bladder in the form of a cystic tumor with the obstructed ureteral orifice at some point of its periphery. In the child the prolapsed ureter may even escape through the urethra and appear at the vulva, where it may be mistaken for an everted urethra. An example of an acquired prolapse in a man following an acute cystitis five years before death is shown in Fig. 257, examined and reported by Dr. George Blumer (*Johns Hopkins Hospital Bulletin*, Sept.–Oct., 1896, p. 174). The patient died of an extensive urinary infection, to which this class of cases is peculiarly liable. The enormously hypertrophied bladder, in one place 3 centimeters thick, was corrugated and covered with diphtheritic patches. On the right side there was a hydroureter and a cushiony protrusion into the bladder as big as the end of the thumb. On the left side a pyramidal sac occupied the position of the ureteral orifice.

The sac was fluctuating, 8 centimeters long, 3 centimeters in diameter at the base, and 9 centimeters in diameter near its extremity. High up on one side the minute ureteral orifice was found (see Fig. 257 *a*) as big as a pin point and

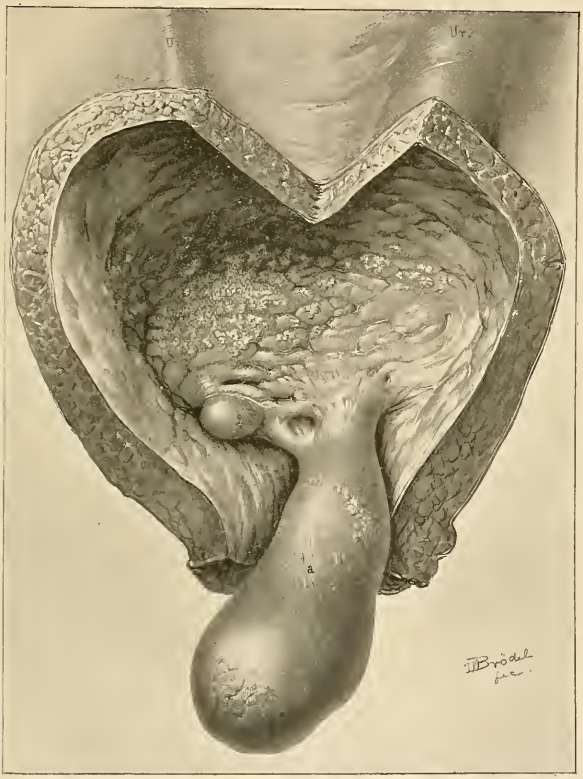


Fig. 257.—Prolapse of the Ureteral and Vesical Mucous Membrane, most Marked on the Left Side, Slight on the Right. Diphtheritic Inflammation of the Bladder and Left Ureter.

Note the position and narrowness of the ureteral orifices at *a* and *b*, and the large pyoureter above the bladder on the left and the smaller hydroureter on the right side. ⅔ natural size.

situated in the center of a small area of dense fibrous tissue. On opening the thin-walled sac, the finger could be carried directly up into the ureter.

Ureteral Fistula.—A ureteral fistula is an abnormal opening through which the urine is discharged directly from a ureter on to the surface of the body or into some part of the genital or alimentary tract, and in so far as the affected ureter is concerned the bladder is thrown out of use.

Ureteral fistulæ are the result of a trauma, or of ulceration, or they are congenital, and by far the commonest are those involving the anterior part of the pelvic portion of the ureter.

A uretero-vesical fistula is produced by a ureteral stone ulcerating through the ureteral walls into the bladder, or by the artificial making of a communication between the bladder and the ureter behind a strictured orifice. Such a fistula requires no treatment, and only needs mention.

The commonest causes of ureteral fistulæ were formerly the traumatisms of labor, tearing open the uterus, vagina, bladder, and ureters, and leaving a permanent communication between the ureter and uterus or ureter and vagina, forming a uretero-uterine or a uretero-vaginal fistula. Other causes acting but rarely were the ulceration through the vagina into the ureter, produced by a large pessary, or the cutting of a ureter on opening a pelvic abscess *per vaginam*. To-day the commonest cause of ureteral fistulæ is to be found in the frequently performed vaginal and abdominal hysterectomies in which the ureter is accidentally injured. In vaginal hysterectomy for cancer the wonder is that the ureter is not more frequently tied or cut, as it lies so close to the field of operation and is often so intimately involved in the disease. Indeed, it seems quite certain that this accident must occur with far greater frequency than is apparent from the reported cases. In rare cases both ureters are injured, forming a double ureteral fistula.

The diagnosis of ureteral fistula is not difficult. The traumatic forms must first be distinguished from the congenital. Congenital ureteral fistulæ almost always open at a point below the neck of the bladder, even as low down as the external genitals, while the traumatic forms open either at the base of the bladder, or, more commonly still, at the vault of the vagina, or into the uterus. An additional distinguishing feature is the fact that the congenital fistulæ are known to have existed from childhood, while the traumatic take their origin from some definite period in adult life.

The next step of importance is to distinguish ureteral from vesico-uterine and vesico-vaginal fistulæ. A fistula involving one ureter discharges constantly, while the patient is also emptying the bladder at regular intervals to discharge the urine received from the sound ureter. Care must also be taken to distinguish cases of small vesico-vaginal fistulæ situated high up in which the bladder still retains some of its functional activity, discharging urine *per urethram*, in spite of more or less leakage.

By injecting the bladder by an aniline solution, or with sterilized milk, if the case is one of vesico-vaginal fistula, the colored fluid will escape by the vagina; if, on the other hand, the fistula is ureteral, the flow from the vagina will continue clear.

Berard's method of diagnosing between a ureteral and a vesical fistula is to empty the bladder and then cause the patient to sit on a vessel for two hours, when, if the fistula is a ureteral one, the amount of urine collected ought to approximate that drawn by a catheter at the end of this time.

Upon exposing the anterior vaginal wall and the vaginal vault the ureteral

fistula is found usually near the cervix, imbedded in scar tissue. Upon introducing a flexible catheter or bougie into a ureteral fistula the instrument can be pushed up beyond the pelvis into the abdomen as far as the kidney, and if left in place the urine is seen dropping at intervals from the end of the catheter.

In every case of vesico-vaginal fistula a careful search must be made to be sure that the ureteral orifice does not open on the margin of the fistula. Winckel has reported a case in which a minute fistula communicated with the bladder and the ureter at the same time.

A sure sign of a ureteral fistula is obtained by exposing the ureteral orifice and passing into it a sound or a catheter. It will be found that the sound will only enter a short distance, not more than 3 or 4 centimeters, on the injured side, where it is stopped, and if the orfice is watched no urine will be seen to escape. On the sound side the metal catheter or sound can be carried back to the posterior pelvis and a flexible catheter can be pushed up to the kidney, and, if left in, the urine is discharged through it.

Treatment.—Various plans have been devised for the purpose of diverting back into the bladder the urine which discharges through the fistula. The following is an outline of some of these methods:

1. By buttonholing the bladder and making an artificial vesico-vaginal fistula close to the ureteral fistula, and, after this has healed, bridging over a channel between the two fistulous orifices by drawing together the sound vaginal tissues at the sides.

2. By making an artificial vesico-vaginal fistula close to the ureteral fistula and then encircling both orifices in a ring of vaginal denudation, which is folded on itself so that the urine flows first from the ureter into a little vaginal pocket and then into the bladder by way of the vesico-vaginal fistula.

3. By dissecting out the end of the urethra and, after splitting it to prevent contraction of the orifice, to turn the end into an opening made into the base of the bladder.

4. By making a big vesico-vaginal fistula in the vaginal vault near the ureteral fistula and closing the upper part of the vagina (partial colpocleisis).

5. When the ureter is not completely severed and the fistula simply involves its lateral wall, by closure of the fistula, by means of denudation and suture of its margins.

6. By opening the abdomen to release the end of the ureter and turning it into the bladder (abdominal uretero-cystostomy).

7. By total occlusion of the vagina after making a large vesico-vaginal fistula (total colpocleisis).

8. Removal of the kidney corresponding to the fistulous ureter (nephrectomy).

Of these various plans of treatment, no one is adapted to all cases, but that plan is to be selected which best meets the individual requirements of the particular case. In general the simplest plan must be followed, involving least risk to life and avoiding if possible any extensive mutilation or the sacrifice of such an important organ as the kidney; the last thing to be thought

of is colpocleisis or nephrectomy, and the abdomen must not be opened if a simple anastomosis can be effected *per vaginam*.

The condition of the patient must be carefully considered. I have had patients referred to me for the treatment of a ureteral fistula following vaginal hysterectomy, who were suffering from pelvic cellulitis and periureteritis, and so prostrated that I was unable to perform an operation. In one case the patient was emaciated, had a rapid pulse, and a constantly elevated temperature.

When the fistula is traumatic the best time to operate is some months after the receipt of the injury, because for several weeks after its formation the mass of fresh young scar tissue forming in the vaginal vault is unfavorable for any kind of plastic operation.

Fistula in the Lateral Wall of the Ureter.—A fistula in the lateral wall of the ureter is easily closed by making a circular denudation in the vaginal wall around the opening about 4 millimeters in breadth, similar to the denudation for a vesico-vaginal fistula. The sides of the denudation are then brought together by means of a series of interrupted silk or fine catgut sutures approximating the tissue in the direction of least resistance. I have had one operation of this sort to perform upon a patient upon whom I had previously opened the lateral wall of the ureter near the vaginal vault and sutured it to the vagina in order to get at and dilate a ureteral stricture in the back part of the pelvis. The denudation was made and the sutures were applied as just described, and the wound healed *per primam*.

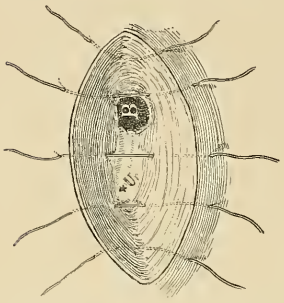


FIG. 258.—SWITCHING THE URETER (*Ur*) INTO THE BLADDER BY MEANS OF AN ARTIFICIAL VESICO-VAGINAL FISTULA (*B*).

The area of undenuded vaginal mucosa is seen between *Ur* and *B*. The five sutures bring the denuded vaginal mucosa together over this.

Ureteral Fistula at the Base of the Bladder.—A ureteral fistula situated at the base of the bladder is best treated by dissecting up the ureter to the extent of 1 or 2 centimeters, and then perforating the base of the bladder and turning the end of the ureter into the bladder. The vaginal part of the incision is closed by interrupted sutures, taking care to catch the outer coats of the ureter in one or two of the upper sutures so as to hold it fixed in the incision and so prevent retraction as described in the treatment of ectopic ureteral orifice.

Ureteral Fistula at the Vaginal Vault.—When the fistula lies in the vault of the vagina and there is enough loose vaginal tissue around it, the best plan of treatment is the formation of a vesico-vaginal fistula near by, not less than a centimeter in diameter, and then making a circular denudation, including both fistulæ, as shown in Figs. 258 and 259. The sides of the denudation on the vaginal surface are brought together by interrupted silk or catgut sutures. The difficulty in this operation is the tendency of the vesico-vaginal

fistula to contract and close, and for this reason the opening must be made sufficiently large and the mucous surfaces of the vagina and bladder accurately approximated.

Ureteo-cystostomy.—The abdomen should be opened and the end of the ureter freed and turned into the bladder in those cases where a sound kidney is discharging its urine into the vaginal vault, and where, at the same time, on account of the scar tissue or its retracted position, a vaginal operation establishing the connection between the ureter and the bladder is impossible.

Contraindications to abdominal uretero-cystostomy are an enfeebled condition of the patient, fresh scar tissue in the vaginal vault and pelvic floor, and an extensive periureteritis. I have twice been obliged to abandon the operation on account of periureteritis. This can be detected by first recognizing the mass of resistant tissue in the vaginal vault, and then passing a catheter up the ureter

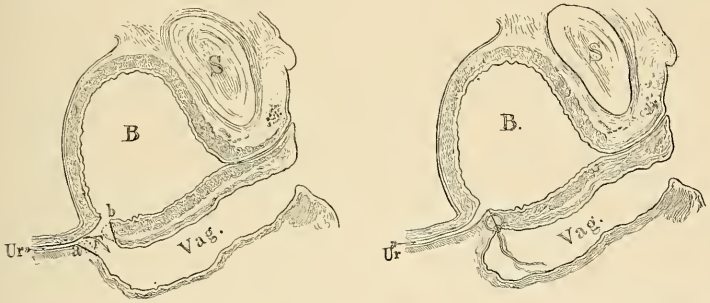


FIG. 259.—URETERO-VAGINAL FISTULA, SWITCHING THE URETER INTO THE BLADDER THROUGH A VESICO-VAGINAL FISTULA. *a b*, AREAS OF DENUDATION.

The union of the edges of the fistula is shown in the second picture. March 8, 1896.

and examining by the rectum, when the ureter will be found to be no longer free and movable, but is distinguished with difficulty imbedded in a mass of hard tissue, extending a variable distance up toward the superior strait.

Similar operations have been successfully performed by Drs. C. B. Penrose, of Philadelphia (*Univ. Mag.*, April, 1894), and Florian Krug, of New York. (See J. M. Baldy, *Amer. Gyn. and Obs. Jour.*, Nov., 1894, and H. J. Boldt, personal communication).

It is important to note that the operations of uretero-ureteral anastomosis and uretero-cystostomy must not be looked upon as rivals in the same field. Where the ureter is cut far enough back from the bladder to permit an anastomosis of the upper into the lower end, the distance between the upper end and the bladder is too great to allow a uretero-cystostomy to be considered. Where, on the other hand, the ureter is cut near enough to the bladder to allow the upper end to be turned into the bladder, it will be found that the lower end is so short and so awkwardly placed that a uretero-ureteral anastomosis is not to be thought of.

There is but one class of cases in which the procedure is elective; that is, when the ureter has become lengthened and dilated by displacement upward over a uterine myoma. I would in this case elect to do a uretero-ureteral anastomosis if the ureter were dilated, or a uretero-cystostomy if it were of normal caliber.

The method of performing uretero-cystostomy is described in the following case, operated on seven weeks after vaginal hysterectomy: The patient (B. Z., 2990) entered the hospital in August, 1894, with an extensive carcinoma of the cervix, for which Dr. W. R. Russell, then the resident gynecologist, performed vaginal hysterectomy. The disease had extended so far out into the broad ligaments that he was obliged to place the ligatures at a greater distance from the cervix than usual. She recovered rapidly from the hysterectomy, but retained as a sequel a ureteral fistula in the vault of the vagina near the middle of

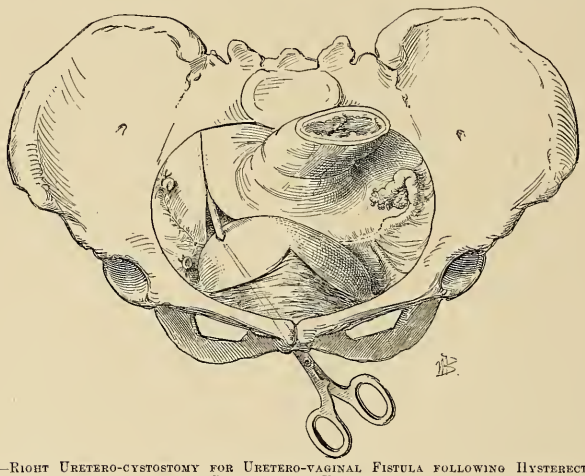


Fig. 260.—Right Uretero-cystostomy for Uretero-vaginal Fistula following Hysterectomy for Cancer of the Uterus.

The ureter has been dissected out of its bed and cut off close to the base of the right broad ligament; it was too short to reach to the bladder, so the bladder was loosened from its attachments to the anterior pelvic wall and thrown back 3 centimeters to meet the ureter.

the cicatrix. From this there was the usual constant leakage of urine, although she regularly passed the urine accumulating in the bladder from the other kidney. From a simple vaginal inspection it was impossible to say whether the flow from the cicatrix came from the right side or the left. It clearly did not come from the bladder, for it remained unchanged by the injection of a sterilized solution of milk into that viscus.

To decide which was the severed ureter I placed the patient in the knee-breast position and introduced my No. 10 cystoscope, when the bladder filled with air and I was able to inspect the ureteral orifices. By introducing a

searcher into the left ureteral orifice I found that this ureter was intact as far as the posterior wall of the pelvis. Upon introducing the searcher into the right ureteral orifice it could not be carried in more than 2 centimeters, on account of meeting an impassable obstruction. The urine was seen flowing from the left ureteral orifice while nothing escaped from the right side. The demonstration was thus complete that it was the right ureter which was injured and the left was intact.

Having cleared up the diagnosis in this way, I proceeded to operate to relieve the condition, in October, 1894, seven weeks after the original operation.

Operation. — The patient was placed in the Trendelenburg position and an incision 12 centimeters long made through abdominal walls loaded with fat. Every step throughout the operation was embarrassed by the obesity of the patient. After opening the abdomen, the large fat omentum and intestines were dislodged from the lower abdomen and pelvis with great difficulty, and held away by means of cotton gauze pads.

The end of the ureter could not be found on the pelvic floor on account of the rigidity and inflammation surrounding the line of scar tissue between the rectum and bladder. The right ovary and tube, which had been left, were also pinned down to this scar tissue by numerous vascular adhesions. The attempt to reach the ureter at this point was therefore abandoned and it was sought out at the pelvic brim, where it was readily found after lifting up the caput coli and incising the peritoneum and pushing aside the fat. It was then traced from the point where it crosses the common iliac artery down to the pelvic floor, exposing the whole length of the pelvic portion by splitting the peritoneum over its upper surface. The anterior portion was involved in the inflammatory material surrounding the scar, which bled so freely that no attempt was made to dissect it out. Four centimeters of the lower end of the ureter lying directly behind the scar tissue were dissected loose and the ureter lifted up from its bed and divided close to the scar, sacrificing as little as possible of its length.

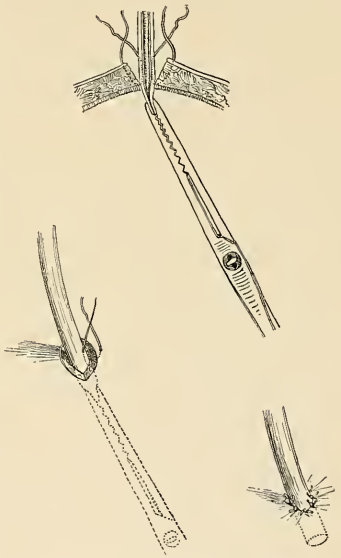


Fig. 261.—Uretero-cystostomy.

Showing in the upper figure the end of the ureter drawn through the opening made into the bladder by a pair of forceps passed through the urethra. The middle figure shows one of the sutures introduced, holding the ureter in place. The lower figure shows the ureter secured in the bladder by sutures, deep and superficial on all sides.

I now found that although I had cut the ureter to the best advantage possible

under the circumstances, I could not do more than merely bring it into contact with the bladder by pulling on it. It was evident that if I were to suture it to the bladder, exercising this degree of traction, it would pull loose soon after the operation, leaving a uretero-abdominal instead of a uretero-vaginal fistula to deal with.

I was able to cope successfully with this formidable difficulty in the following manner: The bladder was dissected free from its attachments to the horizontal rami of the pubis on both sides, with scissors and fingers, and dropped down into the pelvis so as to extend it and carry it more into the back part of the pelvis, gaining at least 3 centimeters in this way. By this means the ureter and the bladder were now easily approximated without strain. I then made a small incision through the bladder wall, which was covered with fat at least a centimeter thick, at the point on the right side nearest the ureteral end drawn straight across the pelvis. This incision passed through the peritoneum and was not more than 3 or 4 millimeters in length, and just large enough to receive the ureter snugly.

I then slit up the under surface of the ureter for about 4 millimeters, enlarging the caliber of its orifice to avoid a stricture, and with a pair of long delicate forceps introduced through the urethra, the bladder, and through the incision, I caught the ureteral end and drew it into the bladder and held it there while it was being attached to the bladder wall by about six fine interrupted silk sutures passed through the muscular tissue of the bladder and the peritoneal and muscular coats of the ureter on all sides, beginning with the under side.

The ureter thus dissected out of its bed, and attached to the bladder, was stretched like a lax cord from the posterior part of the pelvis to the bladder, which lay gibbous and flattened out on the pelvic floor.

The abdominal incision was closed down to its lower angle, where a narrow gauze drain was inserted for fear of leakage. Care was taken in closing the incision not to draw together the peritoneum underlying its lower end, to avoid raising the bladder and indirectly pulling upon the ureter. No leakage occurred and the drain was removed, and the wound healed without suppuration. Her urinary difficulties were immediately and completely relieved with the perfect restoration of continence.

At a subsequent cystoscopic examination I discovered the abnormally placed ureteral orifice opening into the posterior hemisphere of the bladder into which it freely discharged its urine.

This case is one of especial interest for the following reasons:

I was able to determine on which side the injury had been sustained by sounding the ureter in the knee-breast position with the bladder distended with air. I was enabled, by a simple but delicate plastic procedure, to secure at once a perfect restoration of function without sacrificing any such important structure as a kidney. (See *J. H. H. Bull.*, February, 1895.)

The only case I know of in which a double ureter has been accidentally divided in the course of an operation, and then anastomosed into the bladder, was reported to me by Dr. Anna M. Fullerton.

"On March 10, 1897, the patient, R. L., thirty-six years old, the mother of six children, entered the Woman's Hospital, of Philadelphia, for a double pyosalpinx with ovarian abscesses. She had been ill and confined to bed for three months before admission to the hospital.

"At the operation the uterine appendages alone were removed; the uterus, not being especially enlarged, was allowed to remain, because the patient was not in fit condition for a prolonged operation. Dense adhesions existed; on the right side the adhesions were so firm that some of them required to be cut. Enucleation of the appendages was very difficult; a band passing across the pelvis a little below the brim was firmly adherent to the broad ligament a little below the uterine tube and at the junction of its middle and outer third. Not thinking of its being the ureter in that location, I severed it with scissors close to its attachment to the broad ligament. Upon doing this I found I had severed two canals covered with peritoneum and lying side by side imbedded in a common sheath of connective tissue. Each was the size of a normal ureter. No blood or fluid appeared to escape from the canals at any time. A sound was passed down through each canal to the bladder, and struck upon a catheter placed in the bladder. Similarly a long sound was passed upward through the superior pair of orifices, and passed several inches toward the kidney, proving the condition to be one of double ureter traversing the pelvis at a much higher point than normal, and thence passing between the folds of the broad ligament to the point of attachment to the bladder. The vesical ends of the ureters being ligated, the portion communicating with the kidneys was drawn down, and the two orifices introduced into the bladder by a common opening made in the superior portion of the organ a little to the right. The patient made a perfect convalescence, and was discharged, April 18th, in good health."

Extraperitoneal Uretero-cystostomy.—O. Witzel, of Bonn (*Centralb. f. Gyn.*, 1896, No. 11), has devised a plan for the anastomosis of the ureter into the bladder by bringing the ureter under the peritoneum in a new direction, so as to shorten its course. In addition to this, the bladder was detached and drawn out in the manner just described. The patient had ureterovaginal fistula operated on in vain by the vagina. The abdomen was opened, and the thickened ureter found at the pelvic brim and traced downward, and divided at about the middle of the broad ligament. The lower end was closed by sutures and dropped, while the upper end was brought to the upper part of the incision at the brim of the pelvis, and drawn down beneath the peritoneum above the innominate line by a pair of long forceps started upward under the peritoneum to the right of the bladder.

The incisions in the pelvic peritoneum and the peritoneum in the median line of the abdomen were now closed, and the remainder of the operation conducted extraperitoneally.

The bladder was now pulled up on the right side until it reached more than 4 centimeters (1½ inch) beyond the end of the ureter, where it was attached by some stout catgut sutures.

The ureter was then transplanted into the bladder by forming an oblique

channel; the end of the ureter was cut off obliquely, and its mucous coat attached by fine catgut to the mucosa of the bladder, exposed through a small opening made over the end of a pair of forceps introduced through the urethra. Another row of catgut sutures outside of this attached the ureteral walls firmly to the vesical walls.

The oblique channel was then formed by uniting the bladder walls over the ureter on both sides. A drain was put in through a separate opening in the bladder, and the bladder was drained for four days.

The patient made a perfect recovery.

Nephrectomy, removing the kidney corresponding to the fistulous ureter, must be performed when the kidney is extensively diseased and the seat of suppurative septic affection. An attempt should be made, however, to save the kidney by washing the renal pelvis to cure any existing pyelitis, after the manner described in the treatment of pyelonephrosis.

G. Simon, of Heidelberg (*Chir. der Nieren*, 1871), first extirpated the kidney for uretero-abdominal and uretero-vaginal fistulæ.

Schede (*Münch. med. Wochenschr.*, 1888, p. 512) extirpated the kidney in a case of uretero-uterine fistula after several plastic operations had failed.

Ureterostomy.—When the ureter is cut off in the course of an abdominal operation, and the upper end can not be grafted into the lower (uretero-ureterostomy), the only alternatives left are either to bring the ureter out onto the skin surface and to let it discharge there, or to extirpate the kidney of that side.

The plan usually adopted has been to bring the ureter out onto the surface of the abdomen in the incision in the median line. I have the report of such a case furnished by Dr. C. P. Noble, of Philadelphia.

The patient, thirty years old, had an extra-uterine pregnancy, requiring the removal of both tubes and ovaries together with the uterus. She had a pulse rate of 160, and was so prostrated toward the end of the operation, when the right ureter was found cut off above the brim of the pelvis, that the only thing to be done was to get through as soon as possible by closing the incision and sewing the ureter into it. The patient has recovered with a urinary fistula. Although ureteral catheters were kept in this ureter for more than six days, there was no infection, or fever, or chill.

I am indebted to Dr. Noble also for a remarkable case in which he assisted at the operation.

The patient, a German woman fifty-eight years old, had a papillary tumor of the ovary, forming a large mass filling the pelvis and the lower abdomen. At the operation the abdomen was opened and 2,500 cubic centimeters of fluid withdrawn from a cyst, whose wall was found densely adherent and continuous, with an extensive cancerous involvement of all the pelvic organs. The cyst was peeled out of the left broad ligament and tied off and removed. The left ureter was then found divided, but the patient was in such a bad condition that it was deemed inadvisable to prolong the operation, and the end of the ureter was brought out in the abdominal incision, which was closed. A flexible catheter was put into the ureter to conduct the urine away from the wound, but no

urine ever flowed from that side, showing that the kidney was completely atrophied.

Ureterotomy.—Ureterotomy, or incision into the ureter (see *Johns Hopkins Hospital Bulletin*, Dec., 1894, p. 137), is practiced either for the removal of a foreign body from the ureter, or in order to pass a bougie into its lumen, with a view to ascertaining whether or not it is patulous.

The alternative of a ureterotomy is a cystotomy or incision opening the bladder and exposing the ureteral orifice, which can then be catheterized.

The method of performing ureterotomy is to expose the ureter by making an incision into the peritoneum 3 centimeters long, preferably near the pelvic brim, where it is easiest to pick up and to handle the ureter, and then lifting it up a little out of its bed, to incise it longitudinally, cutting through its muscular coat and exposing and cutting the mucosa also, taking care not to injure its opposite wall. The delicate tortuous ureteral artery must also be carefully avoided. The incision should not be longer than 5 to 6 millimeters.

It is closed with three or four interrupted sutures of fine silk passed with a delicate needle, including the muscular coats and leaving out the mucosa.

After neatly approximating the edges in this way, the ureter should be watched until two or three peristaltic waves of urine have passed down, to make sure that there is no leakage.

I have performed ureterotomy in one case to remove a foreign body (J. D. S., 4038, Dec. 27, 1895). It was an abdominal hysterectomy for cancer of the cervix, and hard-rubber bougies had been introduced into both ureters before the operation, in order to keep them perfectly distinct throughout. The result of the manipulation during the enucleation was that the right bougie broke off about 10 centimeters (4 inches) behind its vesical orifice. I could not work the upper part of the bougie down into the bladder without injuring the mucosa with its sharp edge, so I lifted the ureter up and made the upper end prominent, and cut a hole in it just large enough to draw the broken bougie through. The little opening, 3 millimeters long, was closed with two interrupted silk sutures penetrating the muscularis, and it healed without a fistula remaining.

I have also cut into the ureter four times, at a point varying from 3 to 4 centimeters below the brim of the pelvis, for diagnostic purposes. The incision was made in each case with a view of determining whether the ureter was included in a ligature in the broad ligament.

In none of these cases had a bougie been placed in the ureter before the operation, so that the exact relation of the ureter to the cervix was a matter of doubt. After placing numerous ligatures close to the cervix to control oozing veins, the ureter was traced into close proximity to the ligated masses, in a case of hystero-myomectomy, one of hystero-salpingo-oöphorectomy for pelvic inflammatory disease with dense adhesions, and in two cases of panhysterectomy for carcinoma uteri.

In two cases after opening the ureter the bougie stopped short at the ligatured area, and the ureter had to be freed by cutting the ligatures. Although

the ligatures were tightly tied, the ureter appeared to have suffered no harm from its brief constriction.

The little longitudinal incision in the ureter was closed with fine silk mattress sutures in two cases, and with interrupted sutures in the other two cases, each suture including the muscular coat. If mattress sutures are used, it is important to make the loop a narrow one, so as not to pucker the delicate ureter.

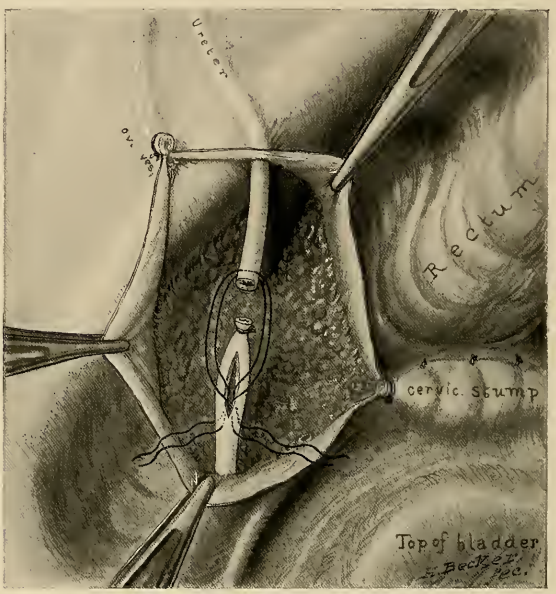


Fig. 262.—Uretero-ureteral Anastomosis,

Showing the ureter divided and the lower end tied and split on one side, ready to receive the upper end which is drawn down into it by two traction ligatures. The operation was done on the right side after division of the ureter in a hystero-myomectomy. Recovery.

Uretero-ureterostomy.—Uretero-ureterostomy is the anastomosis of the upper end into the lower end of a divided ureter as a means of re-establishing its lumen.

The plan of implanting the upper end of a cut ureter into the side of the lower end was devised and successfully practiced on the dog by Weller Van Hook, of Chicago (*Jour. of the Amer. Med. Assoc.*, vol. xxx, March 4, 1893), and utilized by me in the human being May 1, 1893 (*Annals of Surgery*, Jan., 1894, p. 70).

The patient was a negress (F. M., 1946) with a large myomatous uterus filling the lower two thirds of the abdomen, and lifting the right ureter high out of the pelvis.

The ureter, exposed for 7 centimeters of its length on the anterior surface of an intraligamentary myoma 18 centimeters (7 inches) in diameter, looked like a large whitish, flat vein; it disappeared from sight at the cornu uteri among a number of other vessels. I took it for a vein, and doubly ligated and cut it in two, but a sound passed down into the bladder and another up to the kidney, after cutting the ligatures, at once demonstrated the error. After removing the

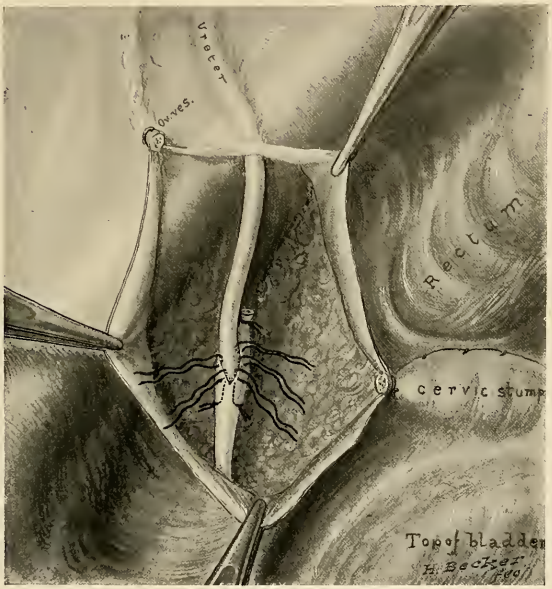


FIG. 263.—URETERO-URETERAL ANASTOMOSIS,

Showing the ureter held in place by the traction ligatures which have now been tied. The five untied sutures unite the entering ureter to the cut edges of the intussuscipient ureter.

uterus down to the vaginal cervix, and closing the cervical stump, I anastomosed the upper end of the ureter into the lower in the following manner:

The lower end was tied with a silk ligature close to its cut extremity, and then a slit about 1 centimeter long was made lengthwise in the ureter just below this. The upper end was cut obliquely to avoid too great a contraction of its orifice, and was drawn down by means of a fine silk traction suture snugly into the slit, so as to project into the lower end, where it was held by fine silk interrupted sutures, each one of which grasped the edge of the cut and the wall of the intussuscepted end as shown in the figures.

The peritoneum should be drawn over the whole area of bared pelvic connective tissue, and the abdomen closed without a drain, such as was used in this

first case. There was no leakage, and the patient recovered and is now in good health, over three years after the operation.

A sketch and a diagram are also shown of a similar operation performed upon the dog by Dr. Bloodgood at the Johns Hopkins Hospital. (See Fig. 264.) See also important papers by Bache Emmet, *Amer. Jour. of Obs.*, April, 1895, and J. W. Bovee, *Annals of Surgery*, January, 1897.

Nephro-ureterectomy.—Nephro-ureterectomy, the extirpation of a kidney with its ureter, is indicated when there is a tuberculosis localized in one kidney and ureter, or when there is other extensive inflammatory disease of the kidney associated with such alterations in the ureteral coats as renders the recovery of the ureter after extirpation of the kidney improbable.

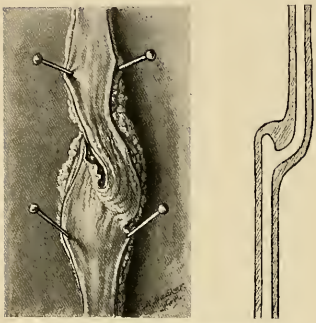


Fig. 264.—Experimental Uretero-ureteral Anastomosis in a Dog.

The ureter is laid open and its lumen exposed by four pins. The direction of the lumen and the little diverticulum above the anastomosis are shown in the right-hand figure. Actual size. Operation by Dr. J. Bloodgood.

The kidney and ureter may be removed by one or by two steps; by the first plan the kidney is separated from its connections, and the ureter is taken out immediately afterward; by the second plan the kidney is removed, and at some subsequent date its ureter, which has proved troublesome, is removed also (ureterectomy); such an operation as the last was performed on a man by Reynier, and reported at the Surgical Society of Paris (*Sem. méd.*, vol. i, No. 8, Feb. 24, 1893); his patient was twenty years old, and had a uretero-pyelonephritis, for which the right kidney was removed. He continued to suffer so much with the same side that five inches of the upper end of the ureter was removed by extending the lumbar incision, and, as he still did not improve, an unsuccessful effort was made to reach the pelvic end by a pararectal incision. At a later date the last five inches of the ureter were removed through a suprapubic incision parallel to the inguinal canal, and the patient then made a complete recovery.

The better plan is to remove both kidney and ureter together. This operation is more formidable and more time-consuming than a nephrectomy, and for this reason the indications for its performance must be well established. By this I mean:

(a) The disease must be sufficiently advanced on one side to demand nephrectomy.

(b) The opposite side must be either sound, or so near sound as to be capable of supporting life by itself.

(c) The ureter of the diseased side must also be affected in the same manner as the kidney, either by a tubercular ureteritis or a pyo-ureteritis, or by a calculous ureteritis.

Unless much caution is exercised, the operator will often be tempted to proceed to this more formidable operation upon a false indication. For example, out of three cases which I have treated in this way (nephro-ureterectomy), all tubercular, the first had an extensive ureteritis, and the kidney was removed with its ureter down to the floor of the pelvis, but in the other two cases, although the kidneys were extensively diseased, tubercle bacilli were demonstrated, and one ureter appeared thickened and tender to vaginal touch, with a marked mammillated, inflamed area about its vesical orifices; yet, in spite of all these indications, only a slight inflammatory thickening was found on removal, insufficient to justify this part of the operation.

It is clear from this that an irritation or a slight inflammatory thickening may be excited throughout the ureteral tract by a tuberculous kidney, and that this will disappear of itself when the kidney is removed.

I would therefore make these distinctions: The ureter must not be removed with the kidney simply because it feels thickened and tender and its vesical orifice is inflamed, but it must be removed when it forms a large, hard, somewhat gristly, irregularly nodular, exquisitely tender mass, which, as a rule, is strictured and dilated in different portions.

The first case, removed transperitoneally, has already been described in a section on tubercular ureteritis. I have operated on two other cases, in each

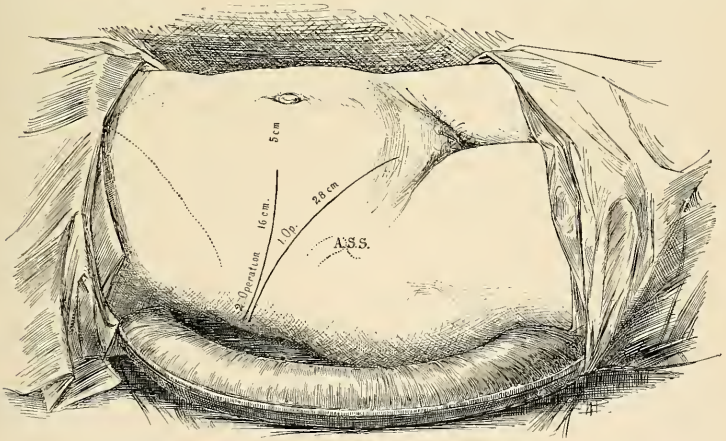


Fig. 265.—Showing the Lines of Incision made in the Two Cases of Nephro-ureterectomy, in the First Operation 28 Centimeters Long, and in the Second Operation 16 Centimeters Long.

one removing the kidney, once the right and once the left, with a ureter all the way down to the vesical end. In the second case I lengthened the lumbar incision down to a point just above the pubic spine, and by detaching the

peritoneum from the iliac fossa and the lateral pelvic wall, succeeded in taking the right ureter out after doubly ligating and cutting the uterine vessels, without tying any other vessels or without opening the peritoneum at any point.

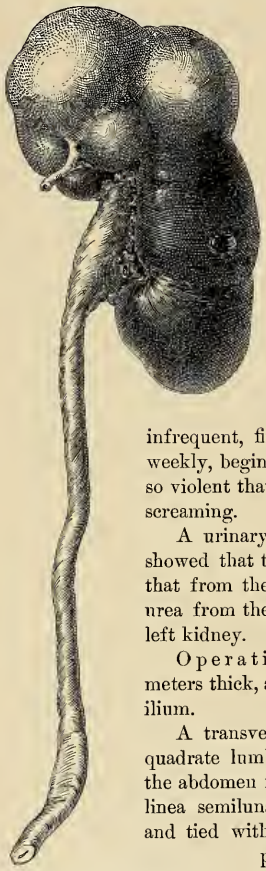


Fig. 266.—Total Extirpation of a Tuberculous Left Kidney with its Ureter by the Long Incision. ½ Natural Size. P. Dec. 13, 1895.

Removal of the Right Kidney and Ureter through a Short Lumbar and a Vaginal Incision (see *Johns Hopkins Hospital Bulletin*, Feb., 1896, p. 34).—The plan of operation adopted in this case worked so well that I shall describe it fully.

The patient (K. W., 4012, Dec. 21, 1895) was a large, stout woman, weighing 225 pounds, and thirty years old. She had suffered for two years with attacks of violent pain, beginning in the region of the right kidney and extending around to the front of the abdomen and down into the pelvis. She also suffered from frequent burning micturition. There was some pus in the urine, but she had never passed any blood or a stone. The attacks of pain, which at first were infrequent, finally came on as often as three or four times weekly, beginning under the right shoulder blade. They were so violent that she was wont to throw herself down on the floor screaming.

A urinary analysis, made after catheterizing both ureters, showed that the urine from the right side contained pus while that from the left was free from it, and that the percentage of urea from the right kidney was 2·1, while it was 2·6 from the left kidney. No tubercle bacilli could be found.

Operation.—The fat on the abdominal walls was 7 centimeters thick, and the margin of the ribs close to the crest of the ilium.

A transverse incision was made, beginning in front of the quadrate lumbar muscles and extending 16 centimeters across the abdomen in the umbilical line, reaching almost to the right linea semilunaris. Numerous bleeding vessels were clamped and tied with catgut. One large nerve, with vessels accompanying it, was divided between the transversalis and the peritoneum in the posterior part of the wound.

The perirenal fat was freed on all sides of the kidney, completely detached, and brought out of the incision. By drawing it down over the lower lip of the incision the renal vessels were exposed, with the pelvis of the kidney lying beneath them.

An examination was now made to determine, first, whether the kidney was

diseased at all; second, whether a conservative operation could be done; and, third, whether extirpation was necessary.

The capsule of the kidney became almost completely detached in the simple manipulation necessary to bring it out of the incision. The upper and lower portions of the organ looked like a normal kidney substance intensely congested. At the middle there was a zone 3 to 4 centimeters wide where the kidney was greatly thickened. This zone was of a pale color, slightly lobulated, and fluctuated on pressure, showing the presence of considerable fluid within. The peeling off of the capsule disclosed a markedly granular white surface over an area about $2\frac{1}{2}$ centimeters in diameter on the anterior surface near the pelvis. A similar irregular depressed area with numerous white granules was also seen near the lower pole of the kidney, surrounded by tissue apparently healthy. The case was one of tubercular nephritis, limited to the right side, as shown by the previous examination of the urine separated from that of the opposite side. The broad affected zone extending entirely through the central portion of the kidney rendered any conservative resection impossible. The renal vessels were therefore clamped in three artery forceps 1 centimeter from the kidney, after freeing them from the surrounding fat. Each of the vessels was tied with a silk ligature cut short. The vein, which was 8 millimeters in diameter when flattened out, slipped from the grasp of its ligature as it sank back into the abdomen, but forceps at once checked a hemorrhage which would otherwise have been excessive. As it was, there was a free oozing from both ends of the mouth of the large vein, but it was fortunately found and caught by the forceps again deep down in the abundant fat under the ribs, and another ligature placed about it, using a needle and carrier without drawing it up. Two other small actively bleeding vessels were also tied in the perirenal fat.

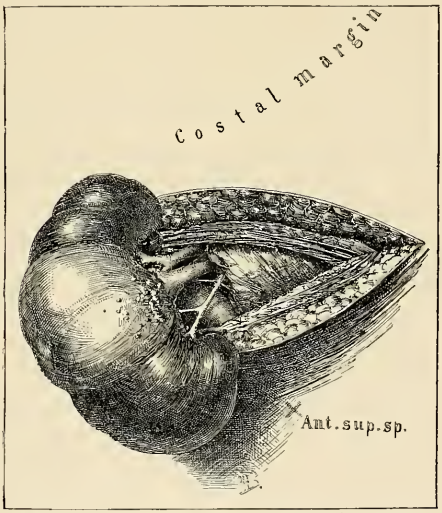


Fig. 267.—Removal of Tubercular Kidney and Ureter.

The kidney is brought out of the horizontal incision in the right loin; the vessels are exposed and ready to tie. The ureter is seen behind the vessels. $\frac{2}{3}$ natural size. First step.

The kidney and the entire ureter were now removed in the following manner: By pulling on the kidney and ureter, the latter was made tense and so

easily followed and dissected out of its cellular bed, with the index and middle fingers pushing the peritoneum, the ascending colon, and the caput coli to one side, and stripping off the loose cellular tissue surrounding the ureter. This dissection was carried down to the brim of the pelvis, and the common iliac artery could be felt with the tips of the fingers over its entire length, with the thumb resting on the surface of the abdomen, the end of the thumb reaching the anterior superior spine.

I now freed the ureter down to its vaginal portion by introducing the entire hand and part of the forearm into the cellular tissue, at first between the

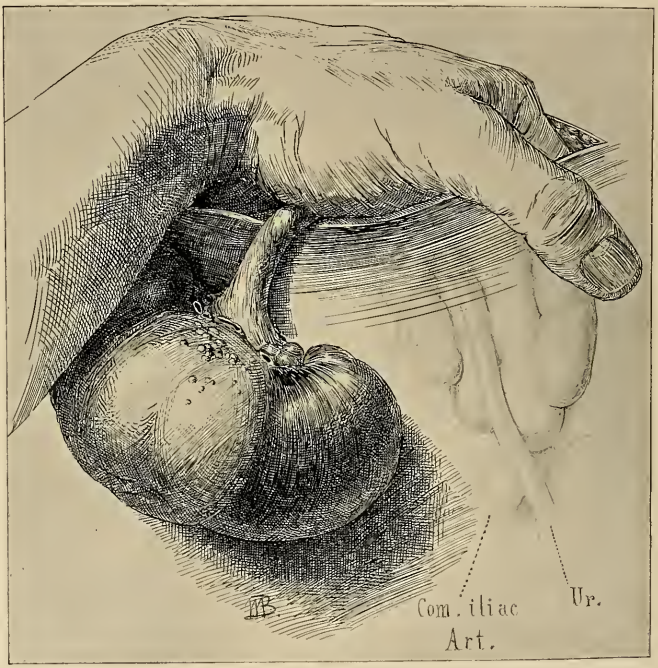


FIG. 268.—REMOVAL OF THE KIDNEY AND URETER, SHOWING THE FACILITY WITH WHICH THE URETER CAN BE PALPATED AND FREED ALL THE WAY DOWN TO THE COMMON ILIAC ARTERY WITHOUT INTRODUCING THE ENTIRE HAND INTO THE TRANSVERSE INCISION. SECOND STEP.

peritoneum and the abdominal wall, then under the peritoneum of the false pelvis, and finally between the peritoneum and the walls of the true pelvis. This blunt dissection with the fingers was facilitated by pulling on the kidney and making the ureter tense. In this way I freed it and followed it forward to the broad ligament. At this point considerable resistance was felt, and the ure-

ter appeared to the touch to pass through a hole with a sharp border in its upper part. Above this I distinctly felt the uterine artery pulsating.

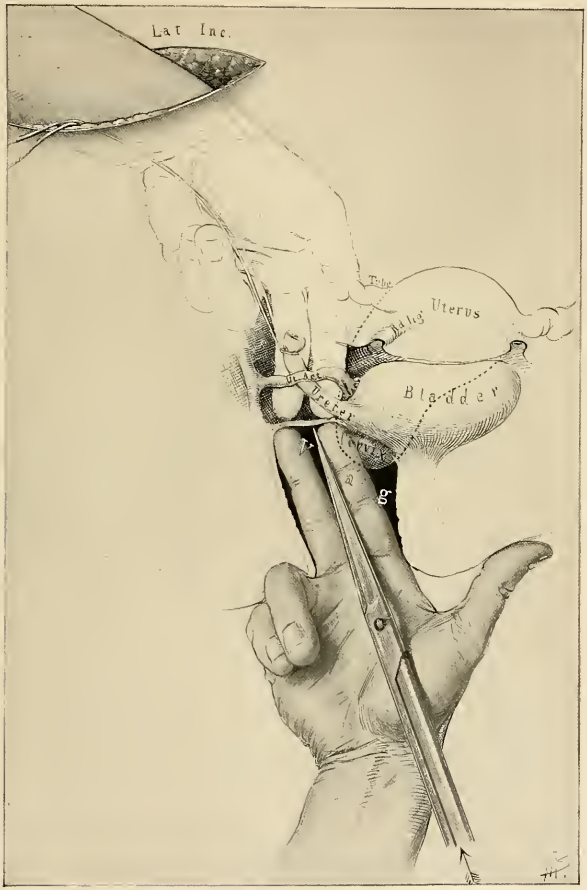


Fig. 269.—Showing the Method of removing the Lower End of the Ureter through the Vaginal Vault.

The upper hand introduced through the horizontal incision holds the ureter and lifts up the uterine artery, while the vaginal vault is opened by a pair of sharp-pointed scissors to allow the ureter to be drawn through. Third step.

At this juncture the ureter broke, about 6 centimeters from the kidney; the lower end was at once caught in forceps and held, while by dint of pushing and

working in my finger I succeeded in freeing about two centimeters more of the ureter. Before doing this, however, I put a stout silk ligature over the abdominal end of the ureter, and by means of one hand in the pelvis and the other holding the long outside end of the ureter I succeeded in tying a knot about it, just behind the broad ligament; then with a long pair of scissors introduced through the abdominal incision and controlled by the hand introduced into the pelvis in the same way, the ureter was cut off half a centimeter above the ligature, after taking care to milk back any of its contents and to keep the upper end tight squeezed until it was removed.

The vagina was now thoroughly disinfected, and, with the patient still lying on her left side, I passed two fingers of my right hand up to the vaginal vault, and with my left hand introduced into the pelvis through the abdominal incision, I brought both hands together with nothing but the vaginal tissue between them. I now made an opening in the vaginal vault and brought the end of the ureter through it and clamped it in a pair of forceps, until the abdominal wound was closed, when the vaginal end was removed also.

This opening was made in the following manner: I passed my entire left hand through the abdominal wound down into the pelvis and pressed the index and middle fingers against the right vaginal fornix, at the same time lifting up the uterine artery on the index finger so as to avoid any danger of cutting it; the end of the ureter lay between these fingers. The index and middle fingers of the right hand were now introduced into the vagina (the patient was lying in the left lateral posture) and pressed up against the fingers of the left hand in the abdomen, the palmar surfaces of both hands being turned upward. The opening in the vault necessary to draw the end of the ureter into the vagina was now made by the assistant, who introduced a pair of sharp-pointed scissors along my fingers up to the vaginal vault and pushed them through the thin septum, guided by my instructions; he then spread the blades of the scissors and withdrew them, in this way enlarging the hole in the vault to about 2 centimeters. The opening was situated about 2 centimeters to the right of the cervix. The bleeding from this torn wound was venous and slight. With a pair of forceps pushed through this vaginal opening, the ligature attached to the end of the ureter was now caught, and the ureter drawn through the vagina and held there by forceps while the abdominal wound was being closed.

Closure of the Abdominal Incision.—The whole wound tract was first irrigated with normal salt solution. Although the bleeding was slight, a drain was put in on account of extensive separation of the cellular tissues and the fear of the accumulation of the products of a serous weeping. The fascia and muscles were brought together by interrupted silver-wire sutures, with a gauze drain in the middle, and the fat and skin were closed by buried and subcuticular cat-gut sutures.

The condition of the patient was excellent, and the pulse as quiet as if no operation had been performed at all. I therefore did not hesitate to put her at once in the lithotomy position and proceed with the extirpation of the remainder of the ureter *per vaginam*. The end of the ureter and the hole in the vault

were exposed by using retractors and catching the right side of the cervix with a bullet forceps and drawing it strongly to the left. By pulling on the forceps holding the ureter it was made tense, while I cut down through the vaginal wall, at first at the side between the anterior and the lateral walls, and then curving the incision forward under the base of the bladder to a point within 1½ centimeter of the end of the ureter in the bladder. The ureter broke off 3 centi-

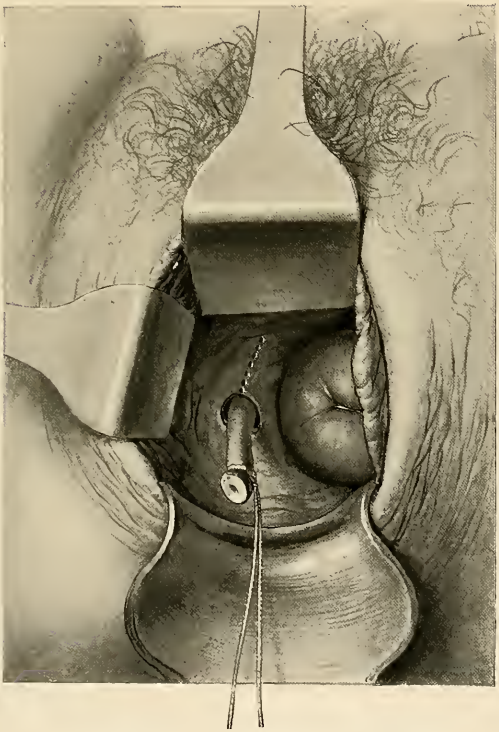


FIG. 270.—REMOVAL OF THE KIDNEY WITH THE URETER.

The last step, the removal of the lower end of the ureter through the vagina. The ureter has been drawn through the opening made in the vaginal vault. The dotted line indicates the direction of the incision to expose the ureter down to its vesical extremity. Fourth step.

meters below the vaginal vault, and I had some difficulty in finding the short end in the tissue by the sense of touch and in grasping it with the forceps. There was a free venous oozing from the cut vagina below the vault. The ureter broke once more, and this time at its vesical extremity, and as I could not find the end again I closed the wound and stopped the bleeding by introducing

about six catgut sutures, tied tightly. The hole in the vault communicating with extensive cellular area above was left open for an inferior drain, which was now inserted, pushing a piece of iodoform gauze well up into the cavity and leaving its end hanging down in the vagina.

The recovery of this patient proceeded without a single unfavorable symptom, and she is well two years later.

Pathological Report.—The specimen consists of the left kidney and ureter. The lower half of the kidney is 6·5 centimeters long, 4 broad, and 5 thick. It is for the most part of a dark-red color, but on its anterior surface presents three pale, slightly elevated areas composed of aggregations of minute yellow tubercles. The remaining portion of the kidney presents a lobulated appearance, and is 6 by 4·5 centimeters in its various diameters. This portion of the kidney is soft and yielding, and on section is found to consist of three or four large caseous abscesses containing thick, creamy, odorless fluid. The lower half of the organ is in most parts normal in appearance, but at one point contains a caseous nodule 1 centimeter in diameter. The pelvis of the kidney is smooth and glistening. The ureter is 19 centimeters in length; in the vicinity of the kidney it is 5 millimeters in diameter, at its vesical end 9 millimeters; it is firm and somewhat rigid.

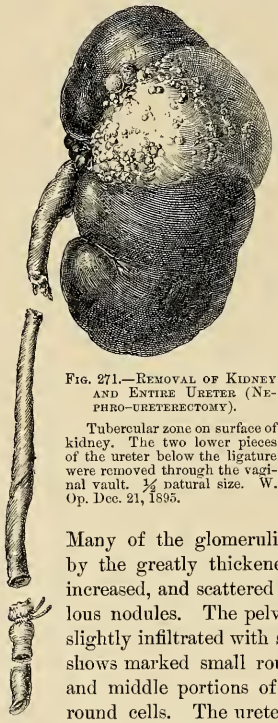


Fig. 271.—Removal of Kidney and Entire Ureter (Nephro-ureterectomy).

Tubercular zone on surface of kidney. The two lower pieces of the ureter below the ligature were removed through the vaginal vault. ½ natural size. W. Op. Dec. 21, 1895.

The walls of the abscesses are composed of typical tuberculous granulation tissue, lined by caseous detritus. The tissue in the vicinity of the tuberculous abscesses is greatly altered. Many of the glomeruli are completely hyaline, others are compressed by the greatly thickened capsule. The connective tissue is markedly increased, and scattered here and there throughout it are young tuberculous nodules. The pelvis of the kidney has an intact surface epithelium slightly infiltrated with small round cells. The stroma beneath, however, shows marked small round-celled infiltration. Sections from the upper and middle portions of the ureter are also slightly infiltrated by small round cells. The ureter in the vicinity of the bladder, although dilated, is little altered. The ureter throughout its course shows no trace of the tuberculous process. Tubercle bacilli were found in the wall of the caseous areas in the kidney.

Diagnosis.—Tuberculosis of the kidney.

The diagnoses were made in this and in the second case referred to by symptoms, by palpation, by inspection, and by the analyses of the separated urines.

The patients—all three—presented a history of pain in the side, extending down the course of the ureter and accompanied by frequent painful micturition.

In the first case the renal symptoms were masked by the strangury in the bladder, due to cystitis and some tubercle nodules.

In the second case the intense pain in the left side, and in the third case in the right side, accompanied in both cases by attacks of intense renal colic, pointed toward the chief focus of the disease.

By palpation in all cases the pelvic portion of the ureter was found to be enlarged and thickened, but only in the first case did it show any nodular enlargement. There was also in each case a point of tenderness at the place where the ureter crosses the pelvic brim. It was also shown by palpation that the ureter of the opposite side was normal.

By inspection the bladder was shown to be normal excepting around the orifice of the ureter on the diseased side, where there was a reddened granular, mammillated appearance.

The separated urines showed that the abnormal constituents of the urine came entirely from the side indicated by this appearance in the bladder, and that the opposite side was sound.

Tubercle bacilli were found in the first case after a patient search; in the second case bacilli, undoubtedly tubercle bacilli, were found which had some of the characteristics of the smegma bacillus. In the third case no bacilli were found, and the diagnosis depended upon the history and the physical examination. (See *J. H. H. Bull.*, Feb. and March, 1896.)

CHAPTER XIV.

OPERATIONS UPON THE CERVIX OF THE UTERUS, INCLUDING DILATATION AND CURETTAGE.

1. Dilatation.
2. Curettage: 1. Preparation and examination of uterine scrapings. 2. Normal uterine mucosa. 3. Acute endometritis. 4. Chronic endometritis. 5. Decidual endometritis. 6. Mucous polypus. 7. Remnants of abortion. 8. Tuberculosis of the endometrium. 9. Cancer of the body of the uterus. 10. Adeno-carcinoma of the body of the uterus. 11. Sarcoma of the uterus. 12. Curettage for cancer of the cervix: *a*. Epithelioma of the cervix. *b*. Adeno-carcinoma of the cervix.
3. Repair of the lacerated cervix.

DILATATION.

The cervical canal is dilated for the relief of dysmenorrhea, and for the purpose of removing portions of the endometrium, or the remains of an incomplete abortion, and to overcome sterility.

For dysmenorrhea, the operation of dilating the cervix does not yet stand upon a scientific basis, as its mode of action is not clear and the results are far from uniform. While a small percentage of cases are cured, and a larger percentage are relieved, still a considerable number are not in the slightest degree benefited. A common cause of failure is a want of care in selecting suitable cases. The general practitioner, and even many specialists, fall into a common error of beginning the treatment of all cases of dysmenorrhea by a dilatation, without a proper preliminary search for other causes of pain, such as tubal and ovarian disease, pelvic peritonitis, and the presence of small fibroids in the uterine walls. It must not be forgotten that dysmenorrhea is but a symptom common to a variety of diseases, and to make clear its relation to a variety of pelvic affections which are most apt to escape detection upon a superficial examination, I have analyzed 255 of my cases of pelvic peritonitis with adherent ovaries and tubes, tubercular peritonitis, hydrosalpinx, pyosalpinx, and catarrhal salpingitis, taken consecutively. Of these 255 cases, 185 suffered from dysmenorrhea, and it was absent in but 70 cases; therefore, from this analysis it would appear that 72 per cent of pelvic inflammatory cases present dysmenorrhea merely as a complication.

In spite of failure, even in many of the well-selected cases, the relief and the occasional cures effected make dilatation one of the most important, and often one of the most satisfactory, of all the minor gynecological procedures.

The most suitable cases for dilatation are those in which the pain is spasmodic, begins with the flow, and is most intense during the first day or two.

Operation.—Dilators of the Goodell-Ellinger pattern, of three sizes, are needed; the smallest, having smooth blades, is 4 millimeters in diameter, and the

two larger 5 and 6 millimeters in diameter, respectively, both corrugated, as recommended by the late Dr. William Goodell. My own dilators have a spring between the handles, but are not provided with ratchet or screw. The handles are bent at an angle and made large enough to be grasped in the full hand; the dilating end is blunt and but slightly curved (Fig. 273). Light instruments with a strong curve and a tapering point are dangerous and must be avoided.

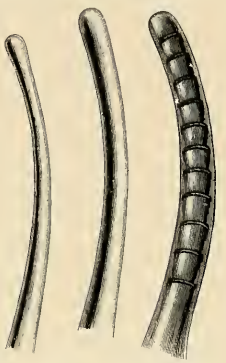


Fig. 272.—The Dilating Ends of the Three Sizes of the Ellinger and Goodell-Ellinger Dilators, showing the Slight Curve and Relative Sizes. Ordinary Size.

Slow dilatation by means of sponge or tupelo tents, formerly so much used, has, by common consent, been generally abandoned on account of the great danger of septic infection. The uteri, which need dilatation and curettage, are often already infected, and the use of a hard foreign body, which bruises and lacerates the tissue and makes a constantly increasing firm pressure, seems to offer just those conditions which are most favorable to the rapid introduction of pathogenic organisms into the system. In many instances the patient survives such a treatment with a chronic pelvic inflammation. Two such cases have come under my notice recently; one lady, a prominent member of society, died, and the other would have died if she had not been promptly relieved by skillful surgery.

The first case was examined by my assistant, Dr. T. S. Cullen (*Johns Hopk. Rep.*, vol. vi, Path. No. 869). Criminal abortion had been induced in the fourth month of pregnancy and the patient died of a septic peritonitis in sixteen days. At the autopsy the peritoneum contained several quarts of purulent fluid, and the enlarged soft uterus was removed. On section its walls were found to contain numerous small abscesses; the alcoholic specimen measured 13 by 9 by 6 centimeters, and its cavity was 9 centimeters long and contained six pieces of wood (parts of an elm tent), which, united, formed a perfect cone with a hole perforating its base. The uterine walls were extensively necrotic, and cocci were found everywhere in the vessels and in the thick sheet of fibrin which covered the uterus.

In another case, the physician in attempting to induce an abortion, thrust a wooden tent through the posterior wall of the uterus into the peritoneal cavity; the tent entered the uterine wall at its junction with the cervix, and transfixed it obliquely, emerging through the peritoneal surface near the fundus. The patient was brought to Dr. W. E. Ashton, of Philadelphia, who opened the abdomen (March, 1889) and removed the uterus, tubes, and ovaries. The patient recovered.

The antiseptic preparations for dilatation and curetting consist in a thorough preliminary cleansing of the vagina, as described in Chapter VIII.

I always precede dilatation and curettage by a careful bimanual examination to determine the condition of the

organs and the exact position of the uterus. If the direction of the uterine canal is known it aids greatly the introduction of the uterine dilator.

In the virgin the index finger must be introduced into the vagina slowly and gently, to avoid injuring the hymen. When the finger touches the cervix a pair of tenaculum forceps is introduced and the cervix firmly grasped by its anterior lip. The finger is now withdrawn and traction made with the forceps until the os uteri is seen at the vaginal outlet.

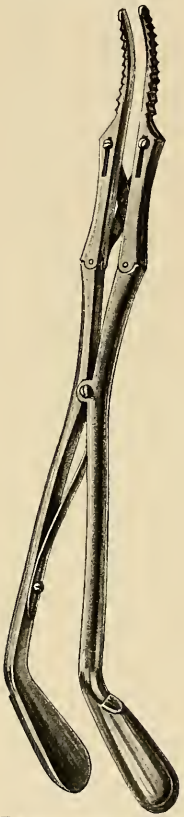


Fig. 273.—Goodell-Ellinger Dilator, with Spring between the Handles, but without a Ratchet.

The corrugations on the blades prevent slipping during the dilatation. ½ ordinary size.

When the orifice is small, or the examining finger large, in order to avoid injuring the hymen the position of the cervix must be determined, without vaginal examination, by a careful rectal palpation; the tenaculum forceps are now introduced into the vagina, and, under the guidance of the rectal finger, the anterior lip of the cervix is cautiously caught and drawn down to the outlet.

In married women and those who have borne children the posterior vaginal wall may readily be retracted by a Sims or Simon speculum, or indeed with two fingers, exposing the cervix, which is grasped with the tenaculum forceps and drawn down.

The smallest dilator is now taken up, poised delicately between the fingers just like a pen, and gently introduced within the external os, and pushed up the canal to the internal os. The dilator must never be grasped with handles braced against the palm of the hand and forced through obstructions. When resistance is encountered, as it commonly is, in passing from the internal os into the uterine cavity, the dilator must be withdrawn a little and gently coaxed up in a slightly different direction, until by repeated efforts, without force, it finally passes the obstruction and slips in.

I have seen a death result from neglect of this precaution and the use of a sharp dilator (see *Amer. Jour. Obs.*, Jan., 1891). The surgeon pierced the posterior wall of the anteflexed uterus at its cervical junction, and tore a wide hole into the peritoneum. He then inserted a coarse sponge tent into the cervix, which projected partly within the peritoneal cavity. The patient died in a few days of peritonitis, in spite of an effort which I made to save her by opening and draining the abdomen. The risk of perforating an anteflexed uterus in this way is so manifest that I can not escape the conviction that such an accident has happened more frequently.

With the blades of the instrument well introduced, I dilate the canal first in one direction, then relaxing the pressure, the blades close and I rotate the dilator a little, gently dilating another portion, and so on, continuing all around the circle back to the first point. The cervix, yielding to these repeated gentle impacts from within on all sides, gradually and equably dilates to the necessary degree without laceration. In this way in a minute or two the canal opens

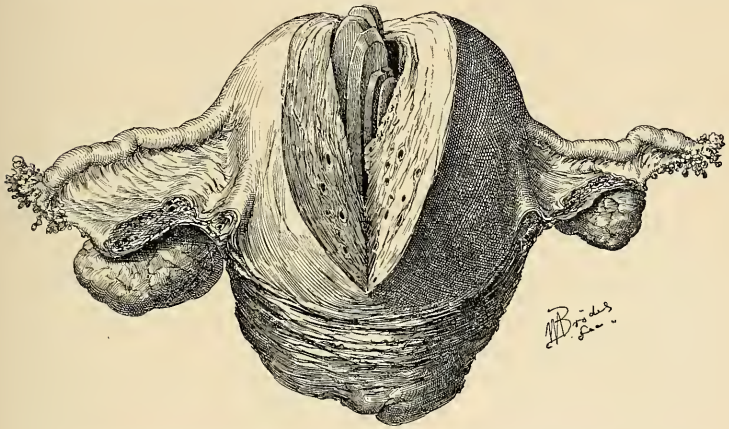


Fig. 274.—Criminal Abortion, with Separated Elm Tent in situ partially perforating the Uterine Wall. Septicemia and Death. Specimen removed at Autopsy.

up enough to admit a larger corrugated dilator, with which the dilatation is continued in like manner from side to side, antero-posteriorly and at all points between. This extent of dilatation, large enough to allow the introduction of a bougie 1 centimeter in diameter, is usually sufficient for the relief of dysmenorrhea or for curettage. A somewhat greater dilatation may be secured by using the largest-sized dilator, but not without risk of too great injury to the cervix. It is unjustifiable to attempt to dilate a cervical canal sufficiently to permit the introduction of the index finger into the uterine cavity, for such a degree of dilatation can only be effected by extensive rupture of the cervix.

Such a method of dilating, by repeated impacts on the cervical canal from all directions, is far better than the common method of opening a dilator controlled by a ratchet or screw, and expending all the force in one direction, until the cervical fibers split and a tear is produced. The objections to this method are the damage done the cervix, the greater danger of septic infection, and the scar left when the rent heals, with the possibility of a carcinoma.

While the operation of dilatation and curettage is usually considered a safe procedure, and is followed by little or no mortality, it may have decided dangers which must be considered.

Normally, the uterine wall is firm and resistant, and even marked pressure made upon it by the sharp curette would not be sufficient to perforate its walls; but occasionally the muscular tissue is thin and friable, and even the slightest pressure suffices to cause a rupture. This is especially liable to occur in curettage after abortion or in septic cases. I have known of three deaths occurring in young women from peritonitis produced by perforation with a curette, and several dreadful accidents have been recorded.

In a case of tuberculosis of the uterus, occurring in my service at the Johns Hopkins Hospital, the cervix was ruptured by the dilator laterally into the

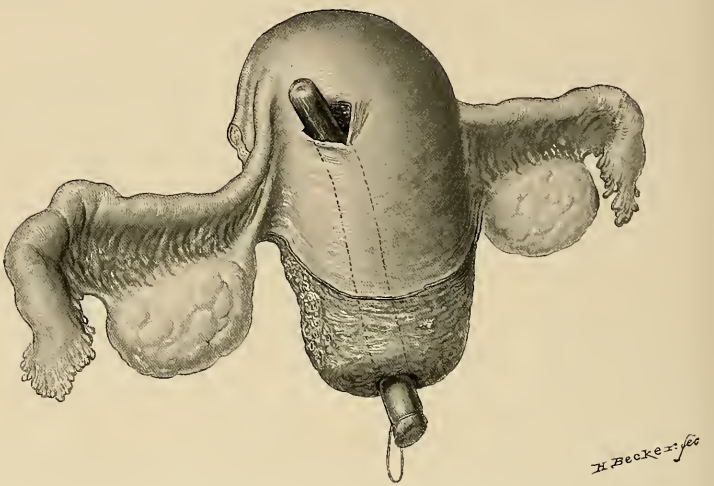


FIG. 275.—UTERUS PERFORATED BY A TUPELO TENT. PERITONITIS, HYSTERO-SALPINGO-OÖPHORECTOMY RECOVERY. OP. BY DR. W. E. ASHTON.

broad ligament and then into the peritoneum, so that a portion of the omentum escaped through the opening. The cervix had been but moderately dilated, when, on starting to curette, the tip of the omentum was seen projecting from the cervix, at once revealing the character of the accident. Abdominal section was at once performed, the prolapsed omentum withdrawn, and the opening into the broad ligament sutured. An unsuspected general tuberculosis of the peritoneum, with tuberculous appendages, was then discovered. The appendages were removed, and the patient made a good recovery. In this case the uterus was thin and softened by the tuberculous process.

In case of perforation of the fundus by the curette, there are two plans of treatment feasible—either to pack the uterine cavity with gauze and allow the opening to close of itself, or to open the abdomen and suture the rent with catgut. Unless the rupture is extensive, I advise the former course: if there is any escape of bowel or omentum it will be safest to do a celiotomy.

Perforation of the fundus with a uterine sound has occurred six times in my personal experience without any serious trouble following the accident, but death from peritonitis followed in a case in the hands of one of my assistants.

In a case seen by Dr. M. D. Mann, of Buffalo (*Amer. Jour. of Obs.*, 1895, p. 603), a young practitioner forcibly dilated the cervix in order to remove the ovum in an early abortion which the patient had induced by means of a catheter. In using a sharp curette and his finger, after clearing out the ovum, he caught hold of and tore a loop of the intestine. Dr. Mann was called in within an hour and a half, opened the abdomen, and found a hole in the center of the fundus of the uterus large enough to admit the finger; the ileum was divided close to the ileo-cecal valve, and was separated from its mesentery fully six inches; the head of the colon was bruised and infiltrated, and the abdomen contained some blood and feces. The patient recovered after the closure of the hole in the uterus, and the inversion of the head of the colon, followed by the removal of the detached bowel and the making of a new ileo-colic anastomosis with a Murphy button.

Dr. J. B. Harvie, of Troy, N. Y., had personal cognizance of a case in which, after dilating the uterus, a young practitioner passed in a pair of forceps to catch the ovum and drew out and cut off six feet of bowel (!) without realizing what he had done.

In a similar case of extensive intestinal injury following the perforation of the uterus with a curette, Dr. C. P. Noble, of Philadelphia, opened the abdomen and resected three feet of the small intestine successfully.

CURETTAGE.

Curettes are used to remove the superficial portions of the uterine mucosa in endometritis; to secure bits of tissue for diagnostic purposes in suspected cancer of the body; to remove portions of an ovum incompletely cast off; and to clean out the broken-down tissue of a cancerous cervix where the disease has progressed beyond hope of a radical cure. Sharp curettes, handled with extreme delicacy, are most serviceable; the blunt curettes often advocated are but insufficient substitutes.

A careful microscopical study of the tissue should follow the removal by the curette in every case, and the following conditions should be looked for:

Normal uterine mucosa.
Acute endometritis.
Chronic endometritis.
Endometritis decidualis.
Mucous polypi.
Remnants of abortion.
Tuberculosis of the endometrium.
Carcinoma of the body of the uterus.
Sarcoma of the uterus.
Cancer of the cervix.

Preparation and Examination of Uterine Scrapings.—In examining portions of the endometrium I use the formalin method introduced by my assistant, Dr. T. S. Cullen (*Johns Hopk. Hosp. Bull.*, April, 1895), which obviates the tedious delays of ten days or two weeks incident to older methods of preparation and permits a diagnosis to be made within fifteen minutes—that is to say, while the patient is still under anesthesia; if necessary, a radical operation may then be performed at once.

The procedure is the following:

(a) Place frozen sections of the fresh tissue in a 5 per cent aqueous solution of formalin for from three to five minutes.

(b) Immerse in a 50 per cent alcohol solution for three minutes.

(c) Place in absolute alcohol one minute.

(d) Wash in water.

(e) Stain in hematoxylin for two minutes.

(f) Decolorize in acid alcohol.

(g) Rinse in water, to which Dr. T. Brown has recently recommended the addition of two or three drops of ammonia, which rapidly brings back the characteristic hematoxylin color.

(h) Stain with eosin.

(i) Transfer to 95 per cent alcohol.

(k) Pass through absolute alcohol, creosote, or oil of cloves, and mount in Canada balsam.

A cylinder of condensed carbonic-acid gas is kept in a room adjoining the operating-room, in order to facilitate the immediate making of the frozen sections, to be passed at once through the routine described.

By securing an early diagnosis in this way the patient is often relieved of the necessity of taking an anesthetic twice, and cases arriving from a distance save from ten days to two weeks of their time in the hospital.

It is easier to cut fine sections after the tissue has been first hardened in the formalin, according to the second plan also recommended by Dr. Cullen, as follows:

The scrapings are placed immediately in a 10 per cent formalin solution, kept in small specimen bottles, always at hand. In two or three hours after they are sufficiently hardened to cut readily, frozen sections are made and left in a 50 per cent alcohol solution three minutes, when the succeeding steps are as described above.

The curetted specimens should be placed in a bottle by themselves and labeled at once, and when the sections are cut no similar open dishes containing sections should be lying about, nor should they be passed through the fluids together with other sections, in order to avoid the terrible mistake of confusing two cases, and so drawing erroneous conclusions. In all my experience of many hundreds of examinations this accident has happened once.

The patient had a uterus of normal size, and was nearly exsanguinated by protracted excessive hemorrhages. I operated upon her for a cancer of the

body of the uterus, diagnosed from curettings. Upon opening the abdomen I found not a cancer, but a small pediculated fibroid tumor, lying in the cervix, which had not been felt during the curettage upon which the diagnosis had been made. It was afterward discovered that the scrapings had been mixed with those from another patient.

Normal Uterine Mucosa.—The standard of comparison for all curetted specimens is the normal uterine mucosa; this presents, microscopically, an even surface covered by a single layer of cylindrical ciliated epithelium. The glands are round or oval on cross section, and in a few places may be seen opening on the surface.

They are usually equidistant, and are lined with one layer of cylindrical ciliated epithelium; hence they appear as reduplications of the surface epithelium. An occasional bifurcation is seen in the deeper portion of the gland. In the floor of the gland there is not infrequently a small titlike ingrowth. Lying between the glands is found the stroma of the mucosa or so-called lymphoid tissue. The cells, however, are much larger, and on close examination bear no resemblance to lymphoid tissue; the nuclei of the stroma cells are oval, vesicular, and appear to best advantage in specimens hardened in Müller's fluid. The arteries of the stroma are usually found in small bunches; the veins are large and single and thin-walled.

The blood in the veins is separated from the stroma cells by but one layer of endothelium. The line of demarcation between the mucosa and the muscle is usually well defined; occasionally, however, a gland penetrates the muscle for some depth, when it is invariably accompanied by a considerable amount of stroma. This dipping of a gland into the muscularis must not be mistaken for a pathological condition.

Fig. 276.—Sharp Curette for removing the Uterine Mucosa. Ordinary Size.

Endometritis.—Curettage for endometritis follows immediately upon dilatation, and is performed in this way: The sharp perforated spoon curette, poised between thumb and first and second finger, is easily introduced through the dilated canal. The whole inner surface of the uterus over the fundus and from fundus to cervix is now carefully scraped, completely removing the superficial portion of its lining membrane in strips and short pieces. The sound basis is recognized by its greater resistance, and a slight grating sensation communicated to the fingers. The separated lining membrane is expelled through the cervix by a series of intermittent uterine contractions; its discharge may also be assisted by using the curette to scoop it out. The hemorrhage after this operation is never serious enough to call for measures to control it. The patient should be kept abed from three days to a week; it has never been my practice to introduce gauze into the uterine cavity.

Acute endometritis is generally found in acute septic processes involving the entire genital tract, but on account of the predominating symptoms

of the other organs, it is usually overlooked. Under any circumstances it is a rare affection.

The surface epithelial cells are swollen often as much as two or three times their normal size, while the adjacent cells may be compressed. There is also a tendency to cell proliferation, and between the epithelial cells are many polynuclear leucocytes and some small round cells. The glands in the superficial portions show similar changes, a swollen epithelium with some tendency toward proliferation, and a small round-celled and polymorphonuclear infiltration; leucocytes are found partially filling some of the gland lumina. The deeper portions of the glands near the muscle are often normal.

The stroma shows superficially much infiltration, with polymorphonuclear leucocytes and small round cells, the infiltration diminishing toward the muscle. Alterations are rarely made out in the muscular tissue beneath.

Chronic endometritis is also rather rare. The prevailing habit of describing all scrapings, particularly because of their abundance in some cases, as examples of endometritis, is greatly to be deplored. It interferes with our getting any satisfactory idea as to the frequency of the real affection, and tends to encourage unnecessary operating. The so-called "fungoid endometritis" is not a pathological entity at all, and the name ought to be expunged from gynecological works.

Chronic endometritis is oftenest associated with old cases of pyosalpinx; it is rarely ever found in the ordinary scrapings. The slight liability of the uterine mucosa to this affection may be ascribed to two factors: In the first place, the tendency of pus-containing tubes is to complete closure at the uterine end, and so shutting off one avenue of infection, and, in the second place, the form and position of the uterine canal is such as to afford good drainage.

The surface of the mucosa may be rather uneven, and the epithelium stunted, low, cylindrical, or cuboidal. The glands are in places diminished in number, and vary much in size; some of them are narrow superficially and distended below. The epithelium of the dilated glands is somewhat flattened.

The stroma is denser than normal, especially in the superficial portions, its nuclei tend to become spindle-shaped, and there is much small round-cell infiltration. There are practically no polymorphonuclear leucocytes to be seen. The stroma in its deeper portions is often normal, and there are no changes in the muscle.

Decidual Endometritis.—This is always found after an abortion in the early months, and is often probably the cause of the abortion.

The decidua shows marked polymorphonuclear infiltration, especially in its superficial portions; the leucocytes are so abundant that the individual decidual cells are separated from one another. Some small round cells usually accompany the infiltration. The deeper portions of the decidua are usually unaltered.

Mucous Polypi.—A mucous polyp is a localized outgrowth of the uterine mucosa forming one or more small tumors within its cavity. The tumors do not often attain a size greater than 2 by 3 centimeters. They occur in a variety

of forms, either fingerlike, round and pediculated, pear-shaped, or like a cock's comb with a broad base.

In one of my cases a flattened ovoid polyp 1·5 centimeter long was found lying in the cervical canal and attached to the fundus by a threadlike pedicle 1 millimeter in diameter and between 4 and 5 centimeters long. The velvety appearance of the polyp, with its slight indentations, resembles that of the uterine mucosa; often small cysts, formed by distended glands, can be seen on the surface.

Fig. 277.—Section of a Glandular Uterine Polyp.

The small figure below shows a section of the polyp magnified three times; the larger section above is magnified seventy times. The dilated glandular spaces are seen lying in the connective-tissue stroma. Specimen 682.

They sometimes give rise to protracted hemorrhages, but as a rule they produce no symptoms at all.

Histologically, the epithelium is the same in character as that lining the uterine cavity with which it is directly continuous.

The entire polyp is made up of uterine mucosa, epithelium, glands, and stroma. The glands are mostly normal, but where they are dilated and form small cysts, the epithelium becomes cuboidal and the cavities contain some desquamated epithelial cells. The stroma, especially near the tips, often shows hemorrhage and edema.

In sharp contrast to the usual isolated mucous polyps just described is the rare general excessive hypertrophy of the mucosa, of which a single instance has come under my notice (A. L., 3476, May 7, 1895).

The entire uterine mucosa was thickened to about three times the normal diameter, and appeared everywhere in the form of flattened domelike elevations,

separated from each other by shallow furrows 2 or 3 millimeters in depth; the microscopic appearance was strikingly like that of malignancy. Microscopically, the excessive growth was limited to the glands, which, although normal in number, were increased in size and markedly convoluted. The stroma was normal.

Remnants of Abortion.—In curetting to remove a dead ovum or an incomplete miscarriage, the chief danger lies in the readiness with which sepsis may invade the upper genital tract. In cases which are already septic, the avoidance of a general infection and the safety of the patient depend upon the complete removal of the ovum, and the efficient drainage established through the dilated cervix. There is no way by which we can thoroughly disinfect a septic uterus. Cases which are not septic will not become so if the operation is aseptically performed, and the aseptic conditions are maintained afterward. When the flow does not begin to diminish within two days after an abortion, or when the temperature rises three or four degrees, I at once advise curettage. The cervix in these cases is usually soft, and dilatation more easily effected in consequence, and not infrequently the cervix is so open as to need no dilatation at all.

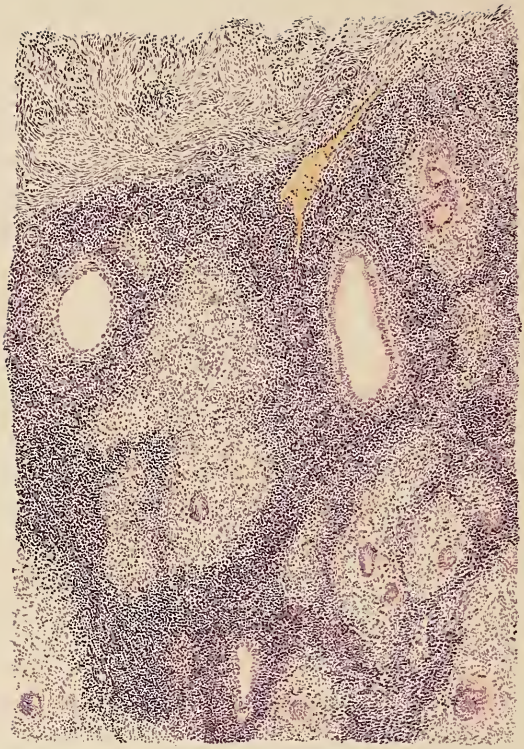
The anterior cervical lip is caught with tenaculum forceps, and a blunt spoon curette introduced and used with gentle force over the whole inner surface of the uterus, loosening and bringing down the membranes which begin to pour out of the os. Undue force must not be used lest the curette perforate the softened uterine wall and pass into the abdominal cavity, exposing the patient to the imminent risk of a septic peritonitis. After loosening the membranes with the curette, a pair of fenestrated placental forceps (see Chap. VI, Fig. 92) is inserted, which brings away the placenta, decidua, and fetus, if not previously expelled, whole or in pieces.

When the canal is large enough, as is usually the case in a miscarriage after the third month of pregnancy, the index finger well sterilized should be introduced and the whole interior of the womb palpated.

Unsuspected pieces of tissue will often be found clinging especially to the placental area. These can be freed by the palmar surface of the finger, assisted by the external hand acting through the abdominal walls, affording a point of resistance. The uterine wall thus bared in places feels almost as thin as paper, and must be gently handled. Where the curetting is difficult and uncertain the entire separation of the remains of the ovum may be thus effected by the finger alone, assisted by the hand making counter pressure through the abdominal walls.

The finger nails must never be used to scrape tissue off from the uterine walls, as such a practice would often introduce sepsis, and if the case was already septic the operator would then be sure to carry the infection away with him to inoculate other patients.

Irrigation of the uterus after curetting is not necessary, unless the contents are septic, when the cavity must be repeatedly washed out with a warm boric-acid solution introduced by means of a curved glass douche nozzle, using the blunt end of the nozzle over the uterine surface to aid in detaching clots and small particles of *débris*. The uterus may be drained for forty-eight hours by



X 70

H Becker, fec.

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DESCRIPTION OF PLATE VIII.

Tuberculosis of the endometrium. This is a typical picture of early tuberculosis of the endometrium. Above is the normal uterine muscle, on the left side is a dilated gland lined with flattened epithelium, while in the middle of the section and at the lower margin two practically normal glands are seen. Scattered throughout the stroma of the mucosa are typical tubercles, most of which show giant cells. The intervening stroma is the seat of marked small-celled infiltration. There are no caseous areas present.

DESCRIPTION OF PLATE VIII.

Tuberculosis of the endometrium. This is a typical picture of early tuberculosis of the endometrium. Above is the normal uterine muscle, on the left side is a dilated gland lined with flattened epithelium, while in the middle of the section and at the lower margin two practically normal glands are seen. Scattered throughout the stroma of the mucosa are typical tubercles, most of which show giant cells. The intervening stroma is the seat of marked small-celled infiltration. There are no caseous areas present.

packing its cavity loosely with gauze, the ends of which are allowed to hang out of the cervix into the vagina; my own practice, however, is simply to place a loose gauze pack in the vagina, which is renewed every twenty-four hours.

Patients should be kept in bed after curetting for abortion for two weeks or longer, to allow involution of the uterus to take place; care of the patient is just as important at this time as in the puerperium after a normal labor.

Microscopic Examination for the Remnants of an Abortion.—We usually have in these cases the clinical history of a recent miscarriage, and the amount of material removed by curettage is often abundant. As a rule, there is no suggestion as to their source in the macroscopic appearance of the tissues; occasionally little villous threads can be seen.

Histologically, the appearance of glandular hypertrophy predominates; the glands are dilated, convoluted, and show little titlike processes springing into their lumina; the epithelium is a little flattened and the stroma of the mucosa shows marked swelling of its cells in the superficial portion, forming typical decidual cells which persist for several weeks after the abortion.

These appearances are suggestive of pregnancy, but a positive diagnosis must rest upon the discovery of villi; these in the early months still show two layers of epithelial covering, the inner of which is made up of cuboidal cells; the outer syncytial layer appears as a ribbon of protoplasm with nuclei distributed through it; this outer layer sends out protoplasmic buds which form the new villi, and in the centers of these buds are found from five to forty nuclei, forming the so-called placental giant cells, because when cut across they present the appearance of a typical giant cell. The interior of a villus is composed of mucoid tissue rich in blood vessels.

In one obscure case nothing was found in the curettings but some glandular hypertrophy, ill-defined decidual cells, and a single free giant cell; this latter structure led to a further searching investigation, which was rewarded by the discovery of villi, confirming the diagnosis of pregnancy.

Tuberculosis of the Endometrium.—In the early stages the epithelium of the surface is intact, the glands normal, and the tubercles are found scattered throughout the superficial portions of the stroma, consisting of aggregations of epithelioid cells; later they are surrounded by small round cells, and at a still later date giant cells are found in the center.

The surface epithelium over a superficial nodule is often somewhat flattened and pale. In a marked case the glands are encroached upon, and it is at times almost impossible to distinguish some of the epithelioid cells from the gland epithelium; in other glands, tubercles are seen partly projecting into and obliterating the cavity; again the gland may be filled with caseous material.

In the most advanced cases where the cavity of the uterus is lined by caseous material, the surface is covered by a necrotic material devoid of nuclei, below which lies a zone of typical tuberculous tissue, consisting of epithelioid cells and tubercles; in the deeper portions a stray gland may survive; where the process has gone deep enough to involve the muscle, the glands are often entirely absent.

Bacilli are found with varying frequency, sometimes sparse, sometimes

abundant, and most numerous in the advanced cases with marked caseation; in my experience they are much more readily found than in tuberculosis of the tubes.

In the early stages of the disease the tubercular process may be entirely unsuspected, and the curettings may look like normal uterine mucosa; but where the disease is advanced, the presence of soft cheesy masses will at once arouse suspicion. Necrotic carcinomatous tissue may present a somewhat similar appearance, but the characteristic branching is found here and does not occur in tuberculosis. In advanced cases the diagnosis may also be reached from an examination of the uterine discharge which contains tubercle bacilli.

On histological examination, the diagnosis of tuberculosis is readily established, as the tissues present the usual tubercular picture. Dr. T. S. Cullen (*Johns Hopkins Reports*, vol. iv, p. 91) reports several cases of tuberculosis of the endometrium occurring in my wards.

It has happened several times in my experience that the tuberculosis has been found in a purely accidental way, as it were, while submitting the uterine scrapings to the routine examination. Again, I have found a tubercular endometrium on curetting the uterus immediately after removing tubercular tubes and ovaries.

Tubercular affections of the endometrium are either miliary, or part of a general tubercular process, or of the chronic diffuse form.

The chronic diffuse tuberculosis is that form with which we have to do; it begins, as a rule, near the fundus secondary to a tubercular tube. The first visible alterations are little yellowish-white nodules under the surface, 1 to 2 millimeters in diameter, which may increase in size and numbers, and then coalesce and break down, forming an ulcer with undermined edges. The disease extends from the endometrium down into the uterine muscle.

Cancer of the Body of the Uterus.—The curette is used in these cases for two purposes: first, to remove some of the lining membrane of the uterus for diagnosis, and, second, to remove as much of the diseased tissue as possible, so as to check hemorrhage and to clean out septic *débris*, in order to give the patient a chance to recruit before undertaking the total extirpation. In both instances the use of the curette is simply preparatory to hysterectomy.

The cancerous tissue breaks down readily under the curette, which must be used with unusual care and with gentler force than in endometritis, to avoid perforating the uterine wall in the more extensively infiltrated areas.

As a rule, the whole endometrium is affected, but where the disease is still localized its position may be recognized by the distinct difference in the sense of touch, communicated through the instrument, between the diseased tissue as it breaks down, and the soft sound mucosa with its firm substratum of normal muscle.

Even the macroscopic appearance of the curettings in carcinoma of the body is quite characteristic, and much valuable information may be gleaned from a careful inspection; while the normal uterine mucosa has a comparatively smooth surface and is usually from 1 to 2 millimeters thick, in the carcinoma the surface, if still intact, has a branching or treelike appearance. This may

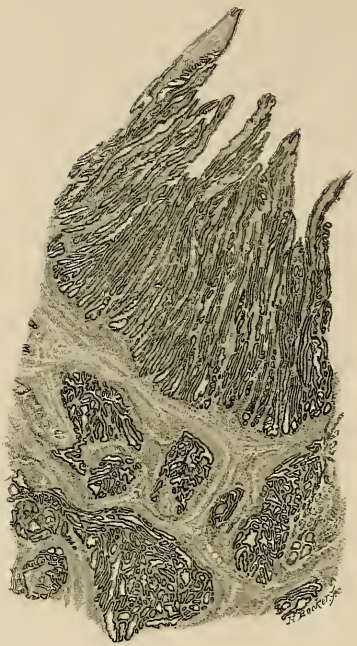
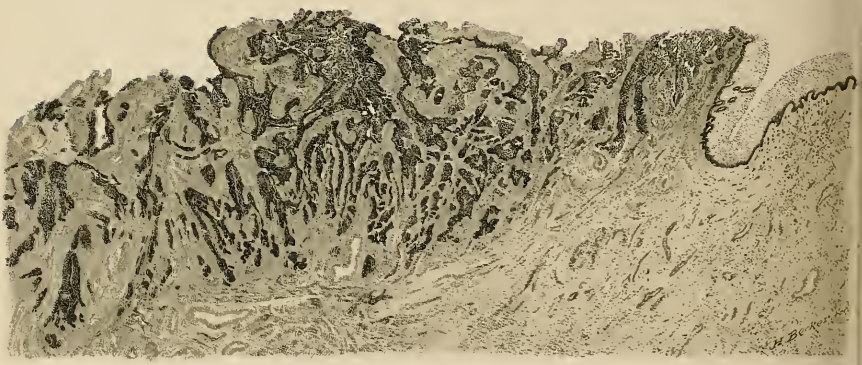


Fig. 1.

X 12



X 8

Fig 2.

H.Beeber, fec

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DESCRIPTION OF PLATE IX.

FIG. 1.—Adeno-carcinoma of the body of the uterus (×12). The section is taken at a right angle to the surface of the uterine mucosa, and the upper border corresponds to the uterine cavity. The thickening of the mucosa is due to the teatlike outgrowths; at the same time there is a growth into the muscle represented by the groups of glands seen in the lower part of the picture. This is an instructive picture, as it shows the early changes, before any necrosis has occurred. Path. No. 559.

FIG. 2.—Epithelioma of the cervix. The normal mucosa, composed of several layers of squamous epithelium, is seen to the right. This ends abruptly and is replaced by masses of epithelium, which penetrate the tissue in all directions. Note the transition of the normal epithelium into that of the new growth, the continuity between the superficial and the deeper portions of the tissue, and the deep stain taken by the carcinomatous cells. The uneven upper surface is due to loss of tissue. Path. No. 169.

DESCRIPTION OF PLATE IX

FIG. 1.—A dense [illegible] of the [illegible]. The section is taken at a right angle to the [illegible] and the upper border corresponds to the uterine cavity. The [illegible] to the tactile outgrowths; at the same time there [illegible] represented by the groups of glands seen in the [illegible]. The [illegible] is a [illegible] picture, as it shows the early changes, before [illegible]. No. 559.

FIG. 2.—Epithelioma [illegible]. Portion of a mass composed of several layers of squamous epithelium, [illegible] to the right. The [illegible] abruptly and is replaced by masses of epithelium [illegible] penetrating the [illegible] tions. Note the transition of the normal epithelium into that of the growth, the continuity between the superficial and the deeper portions of the tissue, and the deep stain taken by the carcinomatous cells. The uneven upper surface is due to loss of tissue. Path. No. 163.

not at first sight be detected, as the mucus tends to glue the little projections together. Nearly all of these little stems or branches have delicate capillaries in their centers. One of the most striking points is the large amount of the tissue removed, together with the size of the individual pieces. Normally only a drachm or slightly more can be removed; in carcinoma, however, from 4 to 8 drachms may come away, and the individual pieces may reach 1 centimeter or more in thickness and are very friable.

In curetting to check hemorrhage the whole endometrium should be scraped as rapidly as possible down to the firm muscular tissue, as by this means the hemorrhage is less than if the instrument is used slowly and timidly. The use of the curette under these circumstances is followed by a firm vaginal pack of iodoform gauze. Hemorrhage is caused in these cases by the superficial necrosis which opens up the vessels or permits them to rupture easily; it is therefore necessary to get well below this tissue when the vessels cease to bleed by their normal contraction.

Cancer of the body of the uterus is found in two forms—epithelioma, made up of squamous epithelial cells, and adeno-carcinoma; not more than eight cases of the former have been observed.

Adeno-carcinoma of the Body of the Uterus.—As stated, abundant scrapings are usually furnished for examination—an amount never found normally.

These often have quite a characteristic appearance even on a microscopic examination; they appear as short, broken, irregular, friable bits of tissue, whitish and waxy in places, with little knoblike projections with coagula between them. Microscopically, the surface has usually disappeared, and the remaining tissue is made up of groups of small and large glands, varying much in appearance; some are lined by one layer of cylindrical epithelium, others by two or three layers, and still others are choked with cells. Large areas of epithelial cells are often found in which the glandular form has almost disappeared, due to an excessive overgrowth of the epithelium in which numerous glands are crowded together.

The stroma between the glands is composed of spindle cells, and shows much small round-celled infiltration.

It is not necessary, as commonly held, to demonstrate a penetration of the muscular layer by the glands in order to make the diagnosis of carcinoma. The diagnosis must rest upon the characteristic appearances above detailed as found in the mucosa alone, and this is fortunate, for the curette rarely penetrates as deep as the muscularis.

Sarcoma of the Uterus.—This rare disease is not often found in the uterine scrapings.

In my experience, the round or the round and spindle-celled sarcomata have been found most commonly.

The macroscopic appearances are not characteristic, but microscopically large areas are found composed of round or of spindle cells, many of them containing nuclear figures and an increased amount of chromatin, as evidenced

by the intense staining of the nucleus; there is also an absence of the uterine glands in these areas. Such a picture is strongly suggestive of sarcoma.

Where the superficial tissue is broken down and the muscularis is invaded by the characteristic cells the diagnosis is more certain.

I have operated in a single instance upon a case of sarcoma of the uterus in which the diagnosis had been made by curettage. No enlargement of the uterus could be detected bimanually, but, relying entirely upon the microscopic examination, I performed vaginal hysterectomy, and found a sarcomatous nodule 1 centimeter (0·4 inch) in diameter in the left horn of the fundus projecting into the uterine cavity. The patient recovered, and has had no return of the disease in over four years.

Cancer of the Cervix.—Curettage for cancer of the cervix is employed for two purposes: First, to remove the septic, breaking down cancerous material, and leave a clean field for hysterectomy; second, to remove as much of the disease as possible where it has advanced too far for complete extirpation.

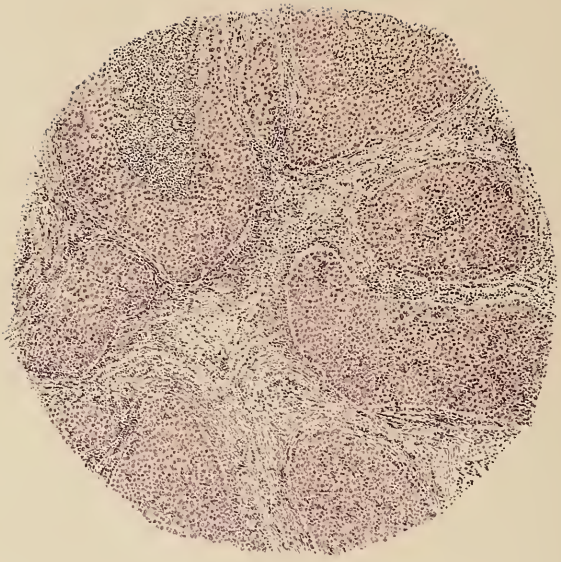
Sometimes the uterus is more or less anchored at the vaginal vault by the extension of the disease into one or both broad ligaments. The amount of this infiltration can be better estimated by a rectal than by a vaginal examination. Such cases of cancer of the cervix in which a broad, hard mass is detected on either side, extending out to the pelvic wall, interfering with the mobility of the uterus, are unsuitable for hysterectomy, and are best treated by thorough curettage. Even those advanced cases with marked cachexia and foul discharges, bedridden and suffering from nausea, will often be much benefited by thorough curettage, which removes the friable, sloughing masses, and leaves in their place a clean, cone-shaped excavation. I have found that the severe pain so often noted in these advanced cases is due to a choked cervix with retention of the discharges, forming a pyometra. Complete relief follows the evacuation of this fluid if the canal is kept open.

Fig. 278.—The Spoon of the Long Sharp Curette for removing the Cancerous Tissue of the Cervix. Ordinary Size.

The two most efficient forms of curettage are the fingers and a long scoop curette on a stout handle. The friable, redundant portions of the disease are best brought out by vigorously using the end of the index and middle fingers as a curette. It is astonishing how much of the affected tissue can be removed in this way. The scoop curette follows the fingers and is held firmly, and used boldly and rapidly, breaking down the diseased tissue under the guidance of the index finger, which locates the points to be curetted, and prevents the instrument from advancing too far in the direction of bladder, rectum, or peritoneal cavity.

The limit of the diseased tissue which can be removed in this way is recognized by the scraping sound and sensation, indicating that a hard base has been reached. Less blood is lost by working rapidly down to the healthier tissue than by a slower procedure, which allows the rigid diseased vessels time to bleed.

PLATE X



X 50

H Beckwer, fec

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DESCRIPTION OF PLATE X.

Epithelioma of the cervix uteri. This specimen was obtained by curettage. It shows a central branching portion, consisting of a stroma with a marked round-celled infiltration, and enclosed in this stroma are epithelial nests composed of groups of polygonal cells. A few dark dots which may be seen in the center of some of these nests are polymorpho-nuclear leucocytes. The central portion of the two upper nests are filled with these leucocytes.

DESCRIPTION OF PLATE X.

Epithelioma of the cervix uteri. This specimen was obtained by curettage. It shows a central branching portion, consisting of a stroma with a number of round-celled infiltration, and enclosed in this stroma are epithelial nests composed of groups of polygonal cells. A few dark dots which may be seen in the centre of some of these nests are polymorpho-nuclear leucocytes. The central portion of the two upper nests are filled with these leucocytes.

When the disease has extended so far that the operator feels uncertain whether the next effort will invade bladder, rectum, or peritoneum, it is important to advance more slowly, controlling the curettage by repeated examinations. A finger in the rectum or a sound in the bladder will assist in determining the thickness of the septum. If the peritoneal cavity is accidentally opened, an iodoform gauze tampon should at once be closely packed within the rent and the operation continued until all septic and sloughing masses have been removed down to a clean wound surface. The vagina is now cleansed, the gauze removed, and a fresh pack inserted, projecting a short distance into the pelvic cavity; this is allowed to remain in place for three or four days, when it is removed and a fresh pack inserted, not quite so far up. The excavated area and the vagina must also be loosely filled with an iodoform gauze pack and protected by the vulvar occlusive dressing.

Two forms of cancerous disease are found in the cervix uteri—epithelioma and adeno-carcinoma.

To make a diagnosis in the early stages of carcinoma of the cervix, it is necessary for the clinician to send the pathologist a wedge of the suspicious portion, which should be at least 1 centimeter in depth; this may readily be removed without pain after injecting a few minims of a 4 per cent solution of cocain deep into the cervical tissue, when two or three catgut sutures may be passed to close in the wound. Where the cervical disease is far advanced the ordinary curettings will be sufficient for the diagnosis.

Epithelioma.—The surface of the cervix is covered by several layers of squamous epithelium, which, however, can be seen penetrating the stroma in the form of fingerlike or branching masses of cells; many of these branches when cut transversely or obliquely appear as round, oval, or irregular groups of cells lying deep in the stroma. On other parts of the surface of the tissue slight elevations are found which consist of a central blood vessel surrounded by little or no stroma and covered externally by numerous layers of squamous epithelium, indicative of an outgrowth of blood vessels and stroma with a disproportionate increase in the epithelial layers.

The cervical glands are usually normal, with the exception that in some cases the squamous epithelium may be found projecting into the lumen of the gland and partly occluding it; in more advanced cases the glands are completely obliterated.

Such a macroscopic appearance affords conclusive evidence of the existence of epithelioma of the cervix.

Adeno-carcinoma.—The disease here first manifests itself inside of the cervical canal, and is often invisible upon inspection and beyond the reach of touch even when it has extended out as far as the broad ligament.

The examination by curettage reveals in most cases an absence of the surface epithelium. When the epithelium is intact, there is sometimes a marked proliferation of the cells which form titlike outgrowths, which, developing in excess, form new glands.

The cervical glands are in some places normal, while in others there is an

increase in the epithelium, and the gland, ordinarily lined by one layer, now shows two or three layers of epithelium. Other glands show titlike epithelial excrescences projecting into their cavities which choke the lumen in the older portions of the disease. The glands appear to run riot in the tissue, interpenetrating the cervix in all directions.

REPAIR OF THE LACERATED CERVIX.

Almost all cervices in parous women show distinct evidence of injuries, which take the form of single, bilateral, or stellate lacerations. These lacerations vary in extent all the way from a slight indentation to a deep rent, completely separating anterior and posterior lips and extending far out into the vaginal vault.

Fig. 279.—Knife-blade Tenaculum for depleting the Cervix.

The blade, set at an angle on the shaft, is prevented from penetrating too deeply. 2/3 ordinary size.

The mere fact of the existence of a tear, however deep, by no means constitutes an indication for operation. I constantly receive patients who have been sent long distances for the surgical treatment of harmless injuries of this kind.

Cases suitable for operation are those only in which the lips are infiltrated, congested, and pouting, oftentimes with choked glands, pouring out a tenacious mucous secretion. A potent reason for operating upon these diseased cervices is the remarkable frequency with which they are found associated with cancer.

The patient, when possible, should be prepared for the operation by rest, hot vaginal douches once or twice daily, and by keeping the bowels regular. Every four or five days the physician should treat the cervix by puncturing any dilated follicles, and relieving the congestion by a scarification, drawing off from 15 to 30 cubic centimeters (½ to 1 ounce) of blood each time.

To deplete the cervix I use an instrument with a short knife blade bent at right angles to the handle to prevent it from penetrating too deep into the tissues. To do this the cervix is exposed with a speculum and caught with a tenaculum forceps, and the knife-blade tenaculum plunged rapidly and deeply into the congested extremity and vaginal surfaces, four or five times in either lip. I have never seen any alarming hemorrhage follow this treatment. Should the oozing at any point prove too persistent, it may be controlled by a suture. After each treatment a pledget of cotton is laid in the vagina saturated with boroglyceride, supported by a wool pack below, and left in place for twelve hours.

With such preparatory treatment carried out every five

or six days an infiltrated everted cervix, so rigid that the lips can not be drawn together, will soften sufficiently for operation in the course of two or three weeks.

There is a condition which is commonly known by the erroneous title of erosion of the cervix, which must be carefully distinguished from laceration.

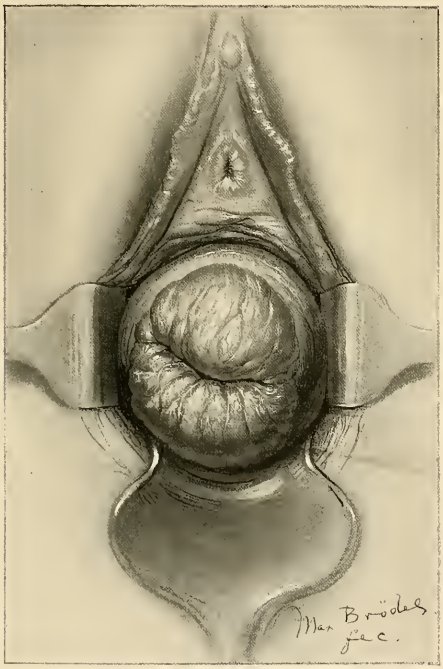

FIG. 280.—SO-CALLED "EROSION" OF THE CERVIX UTERI.

There is no laceration, but an infection of the cervical glands which has caused the mucosa to swell up and roll out into the vagina, partially everting the cervix. Age 20. Gyn. No. 4865. Dec. 12, 1896.

The os forms a wide transverse slit, and the surfaces of both lips are covered with an angry red, glistening, fissured surface, upon which a closer examination reveals the orifices of numerous glands. This is due to an infection of the cervical glands and a swelling of its mucosa, which, having no room inside, is compelled to roll out on to the vaginal surface; it is therefore an eversion of the cervical mucosa.

Operation.—The plastic operation for the repair of a lacerated cervix was devised by Dr. T. A. Emmet (*Principles and Practice of Gynecology*, Philadelphia, 1884, p. 466).

The posterior vaginal wall is retracted by a Sims or Simon speculum, the cervix exposed, and its anterior and posterior lips each caught in the center by a

Fig. 281.—Bilateral Laceration of the Cervix, with Puffy, Infiltrated Lips.

Fig. 282.—Incisions into the Angles of the Laceration extending down through the Scar Tissue.

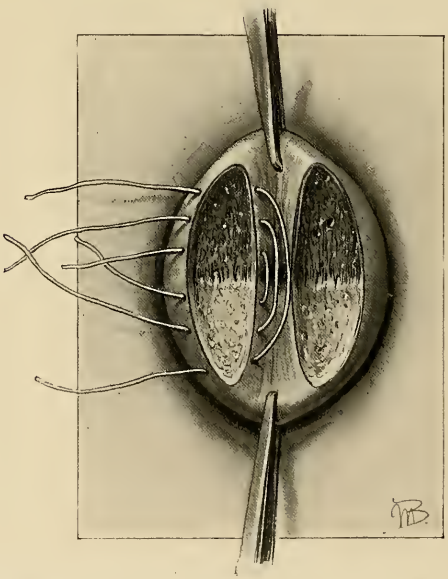

Fig. 283.—Denudation of Both Lips for Plastic Union. The Sutures laid in place on the Right Side but not tied.

pair of tenaculum forceps and drawn toward the vaginal outlet. Retractors on both sides hold back the lateral walls and expose the angles of the tear.

There are two steps in the operation: First, the denudation of the lips; second, the approximation by suture.

Denudation.—The accumulation of scar tissue in the angles of the rent between the lips must always be removed; serious disturbances have arisen from forcibly uniting the lips over such a rigid fibrous plug. To make sure of this, I commence the denudation by an incision into one of the angles entirely through the scar until the sound tissue below is reached. This limits the depth of the denudation in the angles of the tear. I next outline the area of denudation with a sharp knife, by deep incisions on both anterior and posterior lips. The outline extends from each end of the incision in the angle out to the end of the lips. If the tear is bilateral a similar incision is made in the angle of the opposite side, and the area to be removed is similarly outlined on the lips of that side. A strip of mucosa ½ centimeter wide must be left between the lines of incision for the cervical canal. The outlined area is now denuded by catching the tongue of tissue between the incisions with rat-toothed forceps and removing it completely with knife or scissors. A serious and not uncommon error is to denude by shaving off the surface of the cervix on its vaginal side. The lips of a cervix so held together present a good external appearance, but a sound introduced within the canal demonstrates at once that the apparently normal cervix is but a pouch with a thin septum of vaginal tissue on each side, and the cervical tear is no more repaired than it would be if a suture were simply passed through the ends of both lips and drawn up and tied.

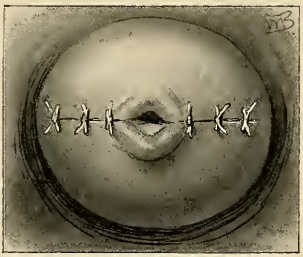

Fig. 284.—The Cervix after all the Sutures are tied on Both Sides.

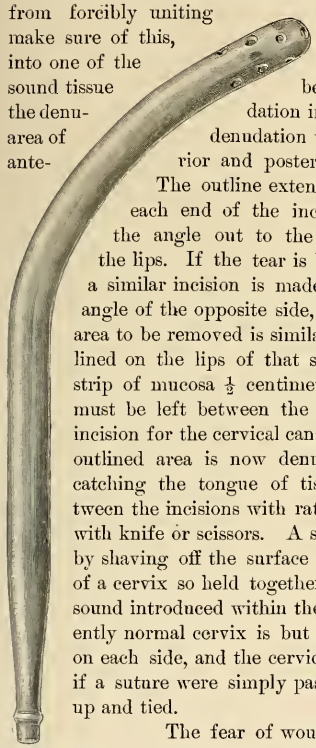

Fig. 285.—Glass Irrigator for washing out the Vagina and the Uterus.

The irrigator is sterilized by boiling and kept standing in a carbolic-acid solution. ⅓ ordinary size.

The fear of wounding a circular artery in denuding the cervix is groundless. Any vessel which may be cut will readily be controlled by bringing the lips firmly together.

Sutures.—The proper sutures are silkworm gut or catgut. The sutures are introduced by means of a stout medium-sized needle and a carrier. As a rule, two or three silkworm-gut sutures on each side are enough; fine superficial catgut sutures are used between them for accurate union.

The first silkworm-gut suture is introduced up at the angle, entering upon the vaginal surface and coming out on the uterine surface of one lip, and reëntering on the uterine surface and coming out at the corresponding point of the opposite lip. All the sutures are best introduced

first on both sides, and then tied successively from above downward. In case the vaginal outlet is operated upon at the same time, the assistant will find it easier to locate the loop for removal of the sutures if they are clamped with perforated shot instead of being tied. Fine superficial catgut sutures are used to secure accurate approximation between the silkworm-gut sutures. All the silkworm-gut sutures are now cut about 2½ centimeters (1 inch) long, to facilitate their removal later.

A loose gauze pack is placed in the vagina to absorb the discharges for the first two or three days, after which it is removed and the outlet simply protected by boric-acid powder and a vulvar pad. If there is any discharge after this the vagina may be douched out daily with a weak menthol, soda, and borax solution. It will not be necessary to catheterize as a rule.

Where no operation has been performed at the vaginal outlet, the cervical sutures may be removed in ten days or two weeks. When the outlet has been repaired, the cervical sutures need not be touched for four weeks or longer. The sutures are most readily exposed and removed with the patient in the knee-breast or in the left lateral posture.

CHAPTER XV.

PROLAPSE OF THE UTERUS.

1. Definition.
2. Forms of prolapse: *a*. Entire uterus. *b*. Cervix. *c*. Vesical diverticulum. *d*. Prolapse without vesical diverticulum. *e*. Rectal diverticulum. *f*. Enterocele. *g*. Prolapse with complete tear.
3. Accurate description of cases necessary.
4. Causes of prolapse: *a*. Congenital. *b*. Strain. *c*. Childbirth.
5. Symptoms and complications.
6. Operative treatment: *a*. Simple prolapse: 1. Supravaginal amputation of cervix. 2. Resection of lax outlet. 3. Anterior colporrhaphy. 4. Suspension of the uterus. *b*. Complicated prolapse: 1. Complete tear of septum. 2. Prolapse of rectum.
7. After-treatment.

Definition.—Prolapse of the uterus and falling of the womb are terms applied to a hernia, sometimes appropriately called "sacro-pubic hernia," occurring at the vaginal outlet, in which the uterus lies within the hernial sac.

Although the term "falling of the womb" is sanctioned by long usage, it is seriously misleading, inasmuch as it implies nothing more than a simple displacement of the uterus, which in fact never occurs alone, but is always associated with eversion of other important structures, usually the vaginal walls and a part of the bladder, these organs hanging together out of the vulvar cleft below the pubic arch, like a large mucous pouch.

An illustration of an extreme form of prolapse, representing the most advanced degree attainable, is furnished by one of my patients, a woman twenty-two years old, with complete eversion of both vaginal walls, and complete prolapse of the retroflexed uterus as well. The sketch shows the relations of the sac as viewed from the side.

Forms of Prolapse.—Under the comprehensive title "prolapse" are gathered a variety of interesting forms which may, however, be arranged under two cardinal divisions—prolapse of the entire uterus, and prolapse of the cervix only.

In the first case the uterus descends as a whole, the fundus sinking *pari passu* with the cervix, following it out as it passes beyond the vaginal outlet; in its descent the uterus occupies an infinite number of positions between the normal anteflexion, and a condition of complete extrusion.

In the second case the fundus of the uterus descends but slightly in the pelvis, while the cervix, advancing more rapidly, escapes at the outlet, with the everting vaginal walls; this form of prolapse involves only the lower extremity of the uterus and is therefore incomplete.

A good illustration of the elongation of the cervix just above the vaginal vault is afforded by the relations of the parts in one of my patients.

Fig. 286.—Complete Prolapsus of the Uterus and Vagina, forming a Large Mucous Pouch Eroded in Dark Areas.

The patient, a negress, is seen from behind, in order to expose the sac better.

Here there was a little atrophic cervix at the end of a prolapsus hanging 7 centimeters (3 inches) below the vulva. The sac was but 10 centimeters (4 inches)

in circumference. The length of the uterine canal was 11 centimeters (4¼ inches), and the body of the uterus lay entirely within the pelvis. A diverticulum of the bladder entered 3½ centimeters (1½ inch) into the sac, while the rest of the bladder extended 9 centimeters (3½ inches) up into the pelvis. On returning the sac, nothing was apparent but a relaxed outlet and a cystocele of moderate size.

This remarkable displacement owes its occurrence to a ductile condition of the supravaginal portion of the cervix, where it joins the uterine body, allowing it to be drawn out from 3 to 6 centimeters (1 to 2½ inches) longer than normal.

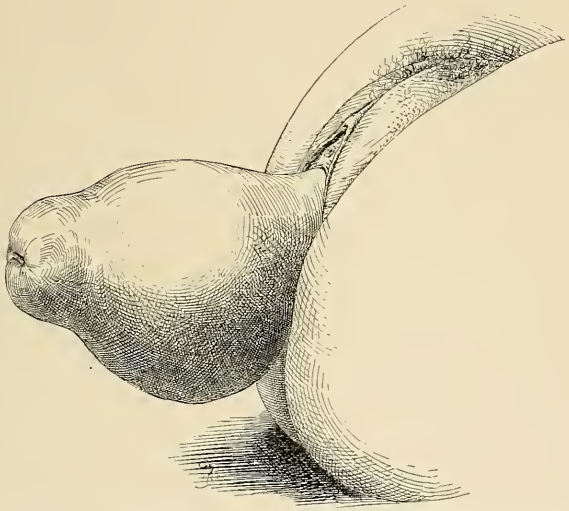

Fig. 287.—Complete Prolapse of the Vagina and Uterus, with Retroflexion. Note the narrow neck at the junction with the body and the prominence posteriorly. M. K., 653.

Variations of these two cardinal divisions of prolapse are formed by the presence of a longer or shorter bladder diverticulum, or even by the absence of any portion of the bladder within the sac.

A rectal diverticulum may be found in the prolapsed posterior vaginal wall, but is one of the rarer complications. The presence of small intestines in the sac in front of or behind the uterus (anterior or posterior enterocele) is an unusual complication; it is most rarely found in front, as this space is usually filled by the bladder.

Prolapse of the uterus with complete rupture of the recto-vaginal septum is also rare. The rarest of all forms is that of complete prolapse with rupture of the septum and prolapse of the rectum.

In investigating the relations of the body of the uterus to the sac, in complete displacement, the fundus will be found in some rare instances lying either in marked anteflexion or in marked retroflexion.

The Vesical Diverticulum.—The bladder, in close anatomical relation with the cervix, almost always accompanies the uterus in its descent. A part of the bladder only is involved in most cases, the greater portion still remaining within the pelvis, attached to the pubis and lower abdominal walls by its suspensory ligament. The bladder is thus divided into two lobes, with constriction at the neck of the prolapse. In one of my cases the intrapelvic portion was so large that the sound entered 11 centimeters ($4\frac{1}{2}$ inches) and struck the sacrum. The lobe in the sac is no longer under the control of the vesical muscles, and therefore is incompletely emptied. On this account urine will accumulate and cystitis arise from its decomposition, and even calculi may be formed.

Fig. 288.—Prolapse of the Uterus, showing the Intermediate Stages between the Uterus in Anteflexion and in Complete Prolapse.

First the uterus descends a little and drops into retroflexion; then it descends farther and the flexion is straightened out; then the cervix appears at the vaginal outlet, to escape beyond it in the next stage; and, finally, the whole uterus lies outside enclosed in the vaginal sac.

In one of my cases, a woman of sixty-eight, a large sac hung out at the vulva 12 by 9 by 8 centimeters (5 by $3\frac{1}{2}$ by 3 inches). The vagina was completely everted, and the uterus lay entirely within the sac. In the middle of the sac, in the diverticulum of the bladder, lay a large calculus. The intra-pelvic portion of the bladder contained a second stone of equal size. She had also passed three small calculi before I saw her. The calculi were removed by an incision 4 centimeters ($1\frac{1}{2}$ inch) long through the prolapsed anterior vaginal wall, beginning 3 centimeters (1 inch) above the cervix. The mucous membrane of the bladder was found thick and inflamed and covered with false membrane in places. The incision was closed at once with silkworm-gut sutures, and the prolapse operated upon at the same time by the method about to be described. The wounds all healed and the patient was entirely relieved.

The urethra sometimes presents a marked deviation from its normal direction, the external orifice being displaced forward and upward, while its canal curves down into the sac.

Involvement of the ureters in the displacement may give rise to hydroureter and hydronephrosis. From the frequent and futile efforts of the bladder

to expel the residual urine, its walls may become enormously hypertrophied; in other cases they may stretch and become thin.

Prolapse without Vesical Diverticulum.—Although rare, prolapse without vesical diverticulum is occasionally found, the bladder remaining entirely within the pelvis, being separated from its uterine connections. An

Fig. 289.—Partial Prolapsus; Eversion of the Anterior, Posterior, and Lateral Vaginal Walls. The vaginal canal is seen in the middle, and the cervix is still invisible within the pelvis.

interesting case of this character entered my clinic in April, 1891 (*see Johns Hopkins Hospital Report in Gynecology*, vol. iii, p. 311). The accompanying figure represents the appearance at the time of the first operation. The patient (M K., 653, April 4, 1891) was thirty-two years old, of slight build, weighing less

than one hundred pounds, married ten years, and the mother of three children —nine, seven, and three and a half years old. Both cervix and perineum were torn in an unassisted first labor, and a protrusion at the vulva was noticed then,

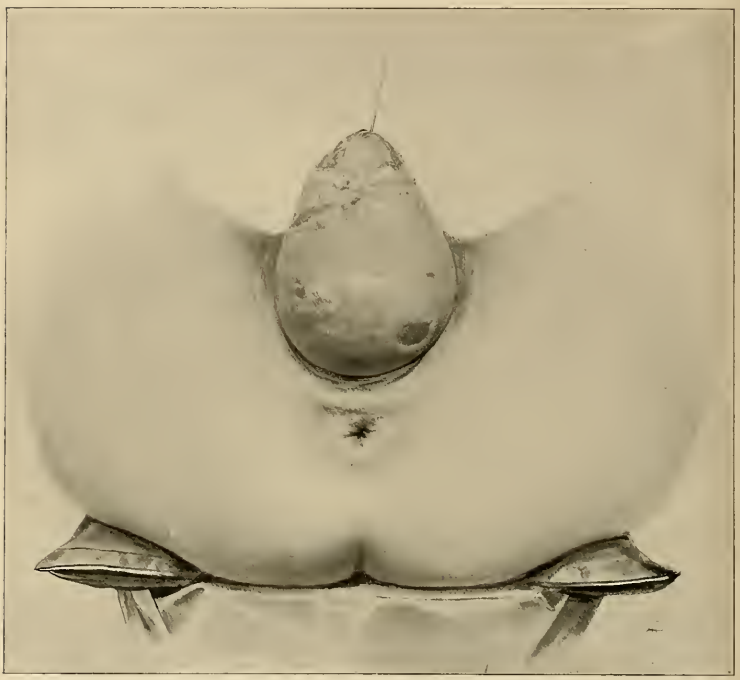

Fig. 290.—Complete Prolapse of the Vagina and Uterus, with Retroflexion of the Prolapsed Uterus, as is evident from the Domelike Prominence on the Under Surface of the Sac.

The lacerated everted cervix and areas of ulceration are plainly seen.

which increased after the birth of a second large child; after this she suffered from excessive constipation, frequent micturition, and dragging pains, and the effect of the third labor was a prolapse which hung 10 centimeters (4 inches) below the vulva.

I found at my first examination a large sac between the thighs dependent from the vulvar orifice, and the anterior wall of the vagina everted from cervix to urethral orifice, the vagina posteriorly, on the contrary, presenting a depth of about 7 centimeters (3 inches) within the pelvis. The uterine cavity measured 7 centimeters (3 inches) in length. The body of the uterus was still within the pelvis in a direct line with the axis of the sac. There were no apparent elonga-

tion or thinning of the supravaginal cervix felt through the sac wall. The anterior and posterior part of the prolapse were distended with soft, irregular masses, gurgling on pressure, and tympanitic on percussion. These masses were easily reducible and were evidently coils of intestines. The urethra lay just beneath the pubic arch. Upon introducing a sound within the bladder, it entered the pelvis 8 centimeters (3 inches) in the median line, and 9 centimeters ($3\frac{1}{2}$ inches) on either side, but no part of the bladder entered into the sac.

I should explain the absence of vesical diverticulum in this way. The tendency of the bladder when markedly distended is to assume the spherical or ovoid form, which accommodates the largest amount of fluid in the smallest space. In a prolapse, in the process of formation, the upper lobe of the bladder in expanding constantly exerts traction upon the lower lobe and tends to draw it up out of the sac into the pelvis, by which means the cellular attachments between

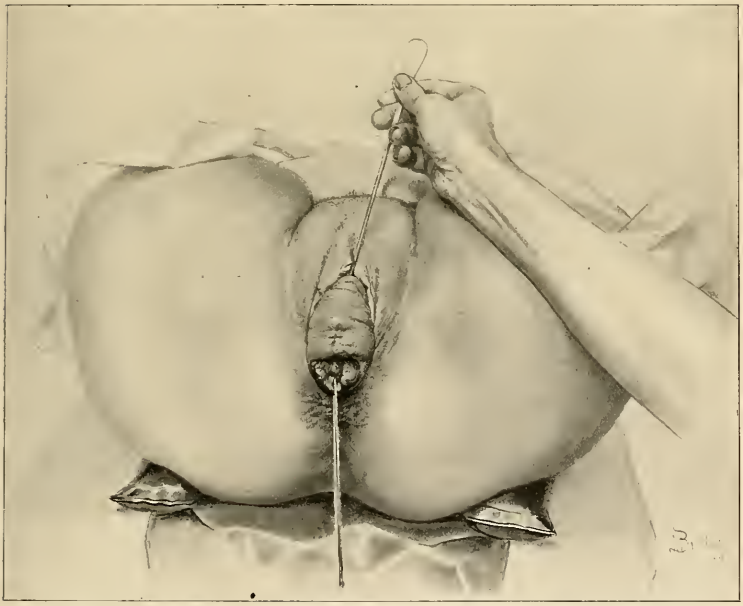

Fig. 291.—Partial Prolapse of the Uterus and Vagina, with Elongate Lacerated Cervix.

The sound is introduced into the bladder to show the altered direction of the urethra and the vesical diverticulum in the sac. The light spot plainly shows the position of the end of the sound in the bladder.

uterus and bladder are stretched and yield more and more, until the separation is complete and the whole bladder comes to lie free in the pelvis. This separation of the uterus from the bladder may go on progressively with the descent

until the prolapse is complete. With the bladder thus lying in the pelvic cavity, while the uterus is prolapsed, the vesico-uterine has become transformed into a utero-vaginal pouch in front, analogous to the recto-uterine one behind.

In but one case have I seen the bladder lying entirely within the prolapse, without any portion in the pelvis or attached to the symphysis. At a subsequent examination, when the bladder contained more urine, it was found extending back toward the sacral hollow.

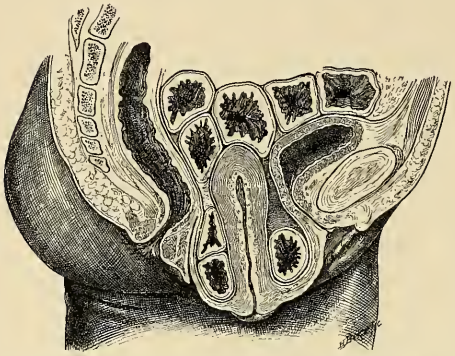

FIG. 292.—PARTIAL PROLAPSE OF THE UTERUS, WITH PARTIAL EVERSION OF THE POSTERIOR VAGINAL WALL AND COMPLETE EVERSION OF THE ANTERIOR VAGINAL WALL.

The cervix is elongate. The point of special importance is the complete detachment of the bladder from its uterine and vaginal attachments, with the presence of the intestines in the sac both anterior and posterior to the uterus (vaginal enterocele).

In addition to the form of enterocele thus described, another form in which the intestines crowd into the sac posterior to the uterus is more frequently found.

A rectal diverticulum is rarely found in the prolapse, although it may happen, and a considerable fecal stasis be discovered at this point. The relation of the anterior wall of the rectum to the sac may be readily ascertained by introducing the finger within the bowel. These various possible complications must all be noted before operation on account of the danger of opening the peritoneum or the bowel.

Complete tear of the recto-vaginal septum is not often found with prolapse; this is due to the fact that the direction of the tear for the most part is central, and so does not involve the levator ani muscle to any great extent, leaving the outlet well supported. In a small percentage of cases, however, the association is observed.

An unusual complication is prolapse associated with vesico-cervico-vaginal fistula. I operated on such a case April 9, 1892. The patient (K. W., 1320) was fifty-three years old, and had a large prolapsus sac with an irregularly torn posterior cervical lip; the anterior lip was gone, and in the midst of a mass of scar tissue in its place was a fistula 2 millimeters in diameter. The cervix was elongated, the fundus uteri remaining in place in the pelvis. She had been operated upon unsuccessfully twenty-one years before by Prof. Nathan Smith, of Baltimore, and had become a confirmed morphine eater. I made the classical oval denudation on the vaginal mucosa 3 centimeters (1 inch) long, funnel-shaped, with the bladder mucosa at the apex, and united the edges of the wound from side to side with interrupted silkworm-gut sutures. The

whole operation was peculiarly easy with the parts lying displaced exteriorly. She was carefully watched during her convalescence, and both the morphine habit broken and the fistula cured.

One of the rarest complications is that presented by a fifty-year-old patient, who had a prolapse with hypertrophic elongation of an infiltrated lacerated cervix, and just below the cervico-uterine junction a complete atresia of the uterine canal.

Prolapse cases differ so widely in their individual features that all operators should make note of the following characteristics:

Dimensions of the prolapsed sac.

Appearance and position of the cervix.

Presence of ulcerated areas.

Complete or incomplete eversion of both anterior and posterior vaginal walls.

Length of uterine canal, noting whether the cervical portion is drawn out.

Exact position of the fundus uteri—in the pelvis or in the sac.

Relations of the bladder to the sac.

Relation of the rectum to the sac.

Position of the peritoneal pouch, posterior to the sac.

Presence of intestines in the sac.

Appearance of the outlet when the sac is returned.

Pelvic measurements, to explain if possible the cause of a difficult labor.

Causes of Prolapse.—Congenital defects in the vaginal outlet and pelvic floor may supply the factors necessary for the formation of a prolapse which may be found at birth. Protrusion of the pelvic viscera has been observed from the strain of a fall.

But the conditions essential to the production of a prolapse are most frequently found after multiple pregnancy. The large, heavy uterus following a puerperal infection, by its weight alone predisposes to prolapse where the woman has gone to work too soon. The direct causal relationship between labor and prolapse is shown by thirty-five of my cases in which there was but one who had had no pregnancy, and here the prolapse was but partial.

Twenty-seven women of whom I have accurate notes had had an average of 3·8 children. Nine of these women had borne children after the appearance of the prolapse.

A tight obstetric binder, by throwing the uterus into retroposition, also favors prolapse. If the binder is used, it must under no circumtances be applied tightly within the first ten days after labor. To aid the uterus in regaining its normal size the patient should remain in bed for two weeks, during which time the physician should from time to time assure himself of its position by palpation through the abdominal walls, drawing the fundus forward if he finds a tendency toward retroflexion. It is best for her not to lie much in the dorsal position, but to turn in bed as often as she wishes, assuming any comfortable posture. Cases of prolapse will also be avoided if retroflexion and relaxed outlet receive timely treatment.

Prolapse owes its origin therefore to an insufficiency of the intrapelvic uterine supports associated with a weakness of the pelvic floor.

A tight, well-closed vaginal outlet, depending upon the integrity of the anterior part of the levator ani muscle, is the most important factor in retaining the uterus within the pelvis. This muscle controls the outlet and prevents prolapse in three ways: (1) It retains the normal outlet in its position forward under the pubic arch, out of the line of abdominal pressure; (2) it gives to the outlet the size and form of a narrow slit, preventing the protrusion of the pelvic viscera; (3) it directs the axis of the vaginal canal forward instead of directly downward, so that the intra-abdominal pressure strikes the pelvic floor at a right angle.

If these functions of the levator ani are impaired or destroyed by extreme dilatation or laceration of its fibers, the vaginal outlet is no longer supported, but drops open and falls back toward the sacrum, and the canal assumes a direction more or less in a direct line with the abdominal pressure, the first effects of which are to crowd the adjacent anterior and posterior vaginal walls down into the outlet, still further distending it.

If the body of the uterus is retained within the pelvis by its broad ligament attachments, as the cervix descends, the portion between the cervix and the body becomes drawn out and thin, a condition readily diagnosed by squeezing the sac between the fingers, when the upper cervix is felt in the middle like a long, thin cord.

The essential intrapelvic supports of the uterus are those which tend to keep its upper pole (the fundus) in front, and its lower pole (the cervix) in the back part of the pelvis. The attachment of the vesico-uterine peritoneal folds high up on the anterior face of the uterus serves to hold the fundus behind the symphysis, while the utero-sacral muscles at the opposite pole serve to hold the cervix back. So long as these supporting structures remain intact, displacement can not occur. If, however, the utero-sacral folds relax, the cervix drops away from the sacrum in the only possible direction, down the vagina. The body of the uterus then remains no longer cushioned upon the upper surface of the bladder, but at once begins to hang as a dead weight, and is forced step by step down upon the pelvic floor by the force of gravity, combined with the intra-abdominal pressure. In the descent the cervix is involved first and the fundus next, and it is only a question of time when the prolapse will be complete.

Retroflexion of the uterus is often but an initial step in the formation of prolapse, which will occur when the retroflexion is associated with a relaxation at the vaginal outlet.

Symptoms and Complications.—I find that in 35 of my cases the average age was forty-two years, and that only 4 were below thirty, 2 being but nineteen years old; 10 were between thirty and forty, 8 between fifty and sixty, and 13 between forty and fifty.

The most distressing symptoms of prolapse are backache and a dragging sensation in the pelvis and lower abdomen, producing a general feeling of weakness; locomotion is often painful—as one patient expressed it, she always "felt

as if she could go no farther." Sitting is sometimes painful. Frequent urination is common; the bowels are often constipated and the appetite poor.

From stagnation of urine in the vesical diverticulum intense cystitis is sometimes found. The bladder walls first become thickened and the ureters are compressed. The infection often travels up to the pelvis of the kidney, producing pyelonephrosis and death. In rare cases calculi are found in the pouch.

In one of my cases there was a complete prolapse with retroflexion and a myoma on the posterior wall of the fundus. This was about 3 centimeters in diameter and made a distinct elevation on the everted vaginal surface.

The vaginal mucous membrane covering the sac loses its rugose appearance, becomes smooth, hypertrophied, and callous. Rubbing on the thighs and garments often causes ulcers with deep, sharply defined borders.

Operative Treatment.—The normal supports of the uterus and vaginal outlet can never be perfectly restored. Therefore that operation is best which offers the most efficient substitute. I prefer the following procedure: A resection of the relaxed vaginal outlet, restoring its caliber, changing the direction of its axis, and changing its position, associated with a supravaginal amputation of the cervix; in bad cases the abdomen is opened and the uterus suspended to the anterior abdominal wall.

The resection of the vaginal outlet alone is not sufficient when there is a ductile cervix, which will afterward worm its way out of the smallest canal; amputation of the cervix therefore deprives the uterus of its leader, as it were, and is always necessary except when it is unusually small or senile.

Hysterectomy is not necessary to cure prolapse, and if the operations upon the outlet and cervix are skillfully performed, it will not often be necessary to suture the uterus to the anterior abdominal wall. Where there is extreme relaxation, and the outlet has not been satisfactorily lifted up by the resection, a suspension of the uterus to the anterior abdominal wall is then advisable (see Chapter XXV). This, however, will never be sufficient by itself.

Amputation of the Cervix.—To amputate the cervix both anterior and posterior lips are caught with tenaculum forceps and pulled well out of the body, or instead of tenaculum forceps, two long, stout silk sutures may be passed through both lips of the cervix and used as tractors. A circular incision is made immediately above the cervix through the vaginal wall and the uterus pulled downward, while the vaginal vault is stripped off with the thumb and first and second fingers pressing against the cervix, and rubbing the vagina up in front and behind. The separation is always incomplete at the sides where the vessels enter the uterus. Injury to the bladder will be avoided by directing the force of the separation movement toward the cervix, and by occasionally inserting a sound into the bladder in case of doubt as to its exact relations.

The amount of cervix bared is 5 to 6 centimeters (2 to 2½ inches). The uterine vessels on each side of the cervix are now tied as high up as possible by a catgut ligature passed close to the side of the cervix. This materially lessens the hemorrhage in the subsequent steps. It is not necessary to expose the

peritoneum either in front or behind, although no harm will be done if it is opened.

The cervix is now amputated; it is first split from its external orifice to the upper limit of the denudation, after which the lips are drawn apart and a stout curved needle, carrying a catgut suture, is entered at the anterior vaginal

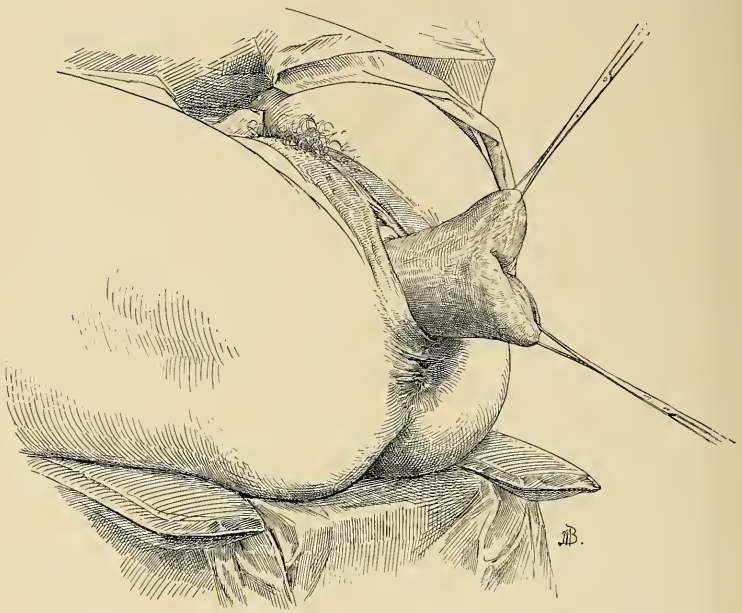

FIG. 293.—PARTIAL PROLAPSE OF THE UTERUS, WITH ELONGATE HYPERTROPHIED CERVIX.
The cervix is drawn down and held for the circular amputation, the first step in the operation.

wall close to the incision, carried under any oozing points in the loose cellular tissue in its track, and made to emerge on the mucosa in the cervical canal 4 or 5 millimeters below the angle of the slit. A similar suture is passed through the vaginal wall and the posterior cervical lip. After this several other sutures are passed on either side of these, and the cervical lips are then amputated in such a manner as to leave the canal the most prominent portion on the stump. The vaginal mucosa is then drawn in to the cervical mucosa by means of these sutures, which are now tied.

The elliptical openings in the vaginal vault to the right and left of the cervical canal are closed by three or four catgut sutures, bringing vaginal mucosa to vaginal mucosa, and passing under the deep parts of the wound, so as to include all bleeding vessels in their embrace. These sutures must be so applied as not

to leave any pockets beneath the surface, as blood is certain to accumulate and distend such spaces, causing infection, which will work its way to the surface at a later date in the form of an abscess.

The only large abscess I have ever seen in the cellular tissue anterior to the uterus was in a patient who had been operated on for prolapse at another clinic, and came to mine with high fever and severe pain, when I discovered and opened an abscess between the uterus and the bladder containing about 150 cubic centimeters (5 ounces) of pus.

Accurate superficial approximation of the wound at the vault is secured by fine catgut sutures between the deep ones.

This first step in the operation does not occupy longer than ten or fifteen minutes.

Resection of the Vaginal Outlet.—The resection of the vaginal outlet in these cases is in general similar to that described in Chapter X. The only important difference lies in the greater length and breadth of the triangles of denudation extending up into the vaginal sulci, thus resecting a larger area of the vagina. It is both more difficult and awkward to outline the area to be exsected within the vagina, on account of the laxity of the tissues and the fact that the well-defined posterior column has disappeared, and in its place is a thick, wrinkled, redundant mass. The line between anterior and lateral walls is fortunately distinct, affording a guide for the outer border of each triangle, just under and parallel to it. The undenuded tongue in the middle, which is left to form the floor of the new vagina, must be made narrow as well as long.

Fig. 294.—Operation for Prolapse of the Uterus by Amputation

Amputation of the cervix at 1, oval resection of the anterior vaginal wall at 2, restoration of the vaginal outlet at 3, and suspension of the uterus at 4.

Anterior Colporrhaphy.—While in a large percentage of cases the anterior vaginal wall is well supported by the resection of the posterior vaginal wall, occasionally the "cystocele," or prolapsed bladder, persists in pouting out at the vaginal orifice, which in course of time it dilates, and so destroys the effect of the operation.

An anterior colporrhaphy for the relief of the cystocele is indicated only in cases of extreme relaxation.

The essential step in the operation for cystocele is the removal of an oval piece of tissue large enough to reduce the hernia and to support the base of the bladder without encroaching upon the proposed field of operation upon the posterior wall.

The operation for cystocele should follow immediately upon the amputation of the cervix, and so forms the second step in the train of three operations—namely, amputation of the cervix and closure of the vaginal vault, resection of the anterior vaginal wall for cystocele, and resection of the relaxed vaginal outlet.

The cervical and the urethral extremities of the cystocele are grasped with tenaculum forceps, pulling in opposite directions and drawn down into the vaginal outlet, while the lateral walls of the vagina are held away by flat retractors.

An oval incision, 4 to 6 centimeters long and $2\frac{1}{2}$ to 3 centimeters broad, through the entire thickness of the vaginal mucosa, outlines the area to be denuded. If the denudation is made too broad the suturing of the posterior vaginal wall in the next step will be difficult.

The separation of the flap which has been outlined may be effected by loosening one of its ends and then completing the detachment by a blunt dissection

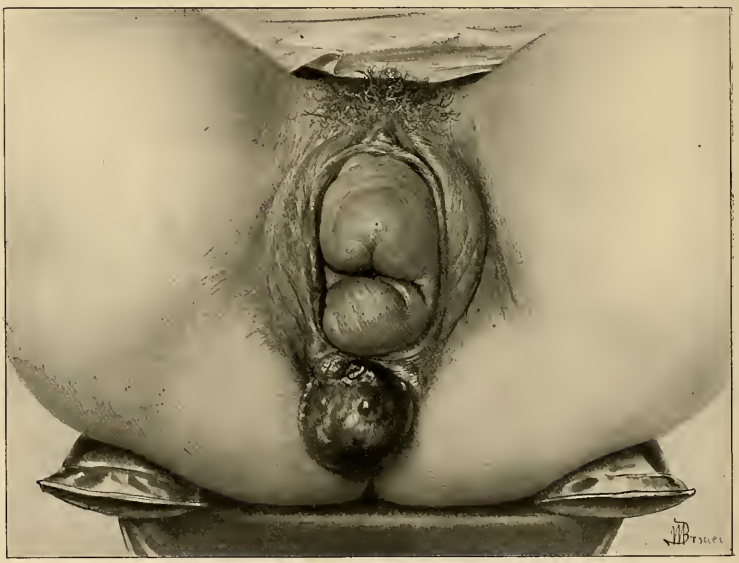

FIG. 295.—PROLAPSE OF THE UTERUS, VAGINA, AND RECTUM, WITH COMPLETE RUPTURE OF THE RECTO-VAGINAL SEPTUM. M. W., PHILADELPHIA.

with the fingers; constant care must be taken not to tear the bladder wall which is exposed. The wound made in this way does not usually bleed much, and any hemorrhage may be controlled by the interrupted silkworm-gut or catgut sutures, introduced from side to side across the axis of the oval denudation, about a centi-

meter apart. The sutures must not penetrate the bladder or catch the ureters. On tying the sutures only a linear wound is left. They may be removed in about two weeks.

Suspension of the Uterus.—In those cases in which the vagina has been completely everted the lax outlet is resected with difficulty, and there still exists a marked tendency of the uterus and the upper part of the vagina to bear down upon the repaired outlet. A decided mechanical advantage will be secured by making a small abdominal incision just above the symphysis pubis, and attaching the posterior surface of the uterus to the anterior abdominal wall by three permanent sutures, in the manner described in Chapter XXIV. The manifest advantages of this step have been insisted upon first by Dr. G. M. Edebohls and then O. Küstner.

Prolapse of the Uterus with Complete Rupture of the Recto-vaginal Septum.—Where the laceration is complete, tear of the recto-vaginal septum deviates markedly to one side or the other, the lateral fibers of the levator ani muscle may be ruptured as well, and prolapse occur. If the tear has extended above the sphincter area, there may be also a prolapse of the rectum. The treatment of this complex condition is similar to that just described, with the exception of the restoration of a ruptured instead of a relaxed vaginal septum in the manner described in Chapter X.

CHAPTER XVI.

VAGINAL HYSTERECTOMY.

1. Indication for vaginal hysterectomy.
2. Preparation of the patient. *a.* Preliminary curetting.
3. Operation: *a.* Traction ligatures. *b.* Collaring cervix. *c.* Tying off one broad ligament. *d.* Delivery of uterus. *e.* Tying off the other broad ligament. *f.* Thorough inspection of field. *g.* Dressing.
4. After-treatment: *a.* Changing pack. *b.* Removing ligatures.
5. Accidents and complications: *a.* Hemorrhage. *b.* Ligation of ureter. *c.* Rupture of bladder. *d.* Injury to the small intestine. *e.* Pelvic abscess. *f.* Ovarian tumor. *g.* Incomplete enucleation of the disease.

The removal of the entire uterus by the vagina through the inferior pelvic strait has been the operation most frequently performed in the past for cancer of the cervix, or of the cervix and fundus together, or of the fundus alone.

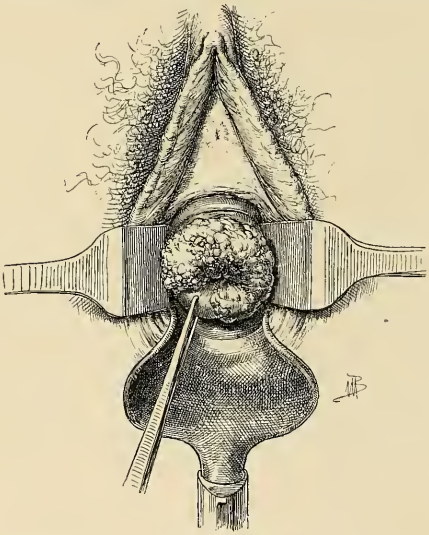

Fig. 296.—Vegetating Epithelioma of the Cervix.

For the last three years my own practice has been to limit the indications for vaginal hysterectomy, choosing in preference the more radical enucleation through the abdomen, for by the vagina only the uterus and little or none of the adjacent broad ligaments can be removed, and so carcinomatous tissue is often left behind which might have been removed by a more careful dissection from above.

Vaginal hysterectomy is still indicated in fat women, whose thick abdominal walls form an almost insuperable obstacle to a complete operation from above. It is not because the difficulty in removing the uterus by the abdominal method is so great in these cases, but the fact that a wide exsection of the broad ligaments

and removal of the pelvic glands is almost impossible, on account of the mechanical hindrances offered by the thick walls and the deep pelvis.

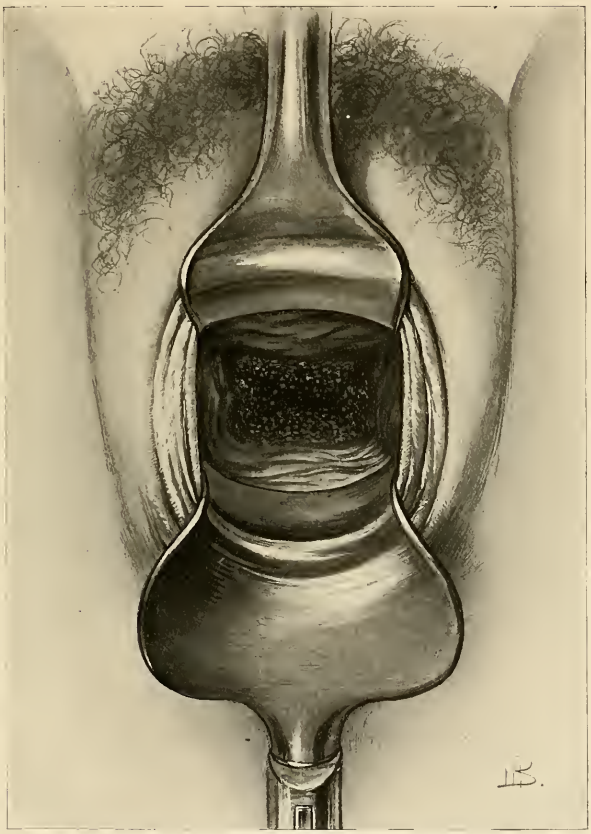

Fig. 297.—Epithelioma of the Cervix without Vegetation.

The vaginal vault is converted into a flat granulating surface. The cervical opening is seen in the center.

Preparation of the Patient.—The patient must be duly prepared by rest, baths, vaginal douches, and above all by a thorough evacuation of the bowels.

If the cancerous disease has advanced to the sloughing stage, or so far as to cause any odorous discharges, or to form a mass protruding into the upper vagina, the danger of sepsis will be greatly increased unless the field is first

cleansed by a thorough curettage, removing as much of the diseased tissue as can be scraped away with a sharp curette (see Chapter XIV). If the vagina is packed every two days after doing this, in a week or ten days the patient will be ready for the radical operation. In an urgent case the curettage may be done just before the uterus is removed.

Operation.—The patient is brought to the edge of the table in the lithotomy position, with the limbs well flexed and the buttocks resting on the perineal pad. The assistant then shaves the external genitals, washing them well, together with the vagina, and curettes away all redundant cancerous masses with fingers and scoop unless this has been already done.

The posterior vaginal wall is then retracted with a large Sims or Simon speculum, exposing the vault of the vagina and the cervix. If the vaginal outlet is narrow, hindering a view of the cervix, a greater degree of dilatation may

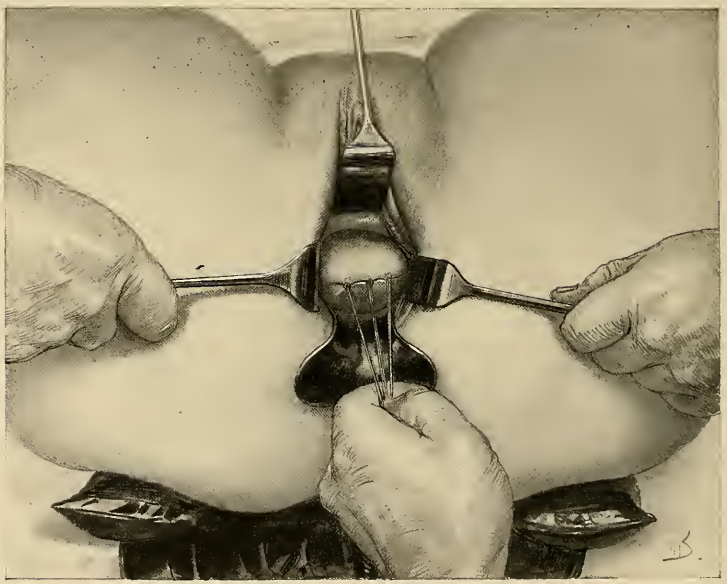

FIG. 298.—VAGINAL HYSTERECTOMY FOR CANCER OF THE UTERUS.

The uterus and cervix curetted thoroughly and the cervix sewed up with stout silk sutures left long for traction. The field of operation exposed by retractors.

be secured by boring in the hand with the tips of the fingers held together, making a conical dilator, or, better still, by using a conical rectal dilator, 6 centimeters in diameter at the base. If the rigidity can not be overcome in this way, one or two deep lateral incisions through the posterior commissure and

extending around one or both sides of the rectum and up into the vaginal sulci, will give the necessary enlargement. The hemorrhage from the surfaces thus incised is rarely great enough to call for the use of forceps or ligatures.

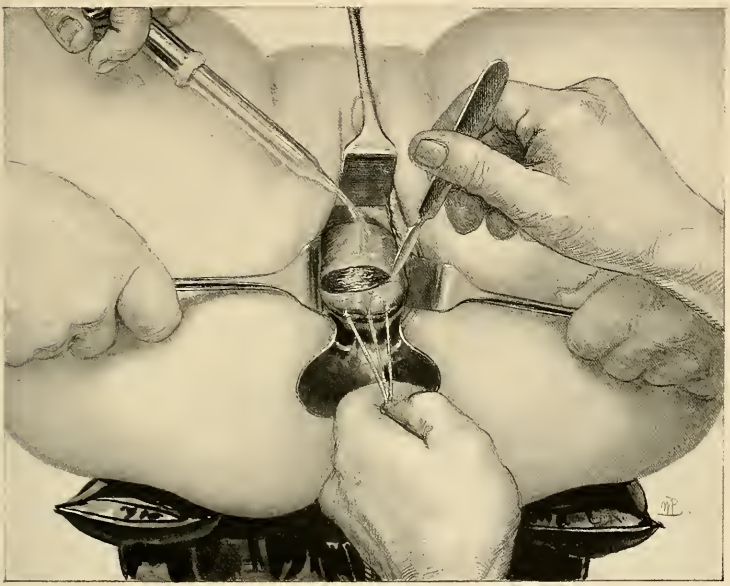

Fig. 299.—Vaginal Hysterectomy.

Beginning the operation by cutting the cervix loose from the vaginal vault, under continuous irrigation.

Continuous irrigation is used to keep the field clear of blood during the first part of the operation, until the peritoneum is opened.

The vault of the vagina and the cervix being exposed as described, the anterior lip of the cervix is caught by tenaculum forceps and drawn down; the posterior lip is also caught, and a stout needle is passed through the anterior and posterior lips, carrying a heavy silk suture about 40 centimeters (16 inches) long. Three or four of these ligatures are passed, and each one tied tightly, drawing the lips firmly together and completely closing the cervical canal and covering in the diseased area, to prevent the escape of any of the intra-uterine contents over the wound area during the enucleation. The ligatures are left long to serve as tractors, and enable the operator to hold the uterus down near the outlet, and to keep pulling it farther and farther down, delivering it gradually as its attachments are severed.

The cervix is first drawn down toward the vaginal outlet as far as it will

come, often outside, and an assistant on either side holds back the lateral vaginal walls with a retractor so as to prevent them from hiding the field of operation. The operator, pulling on the traction ligatures, now makes a circular incision around the cervix and through the entire thickness of the vaginal vault, not less than 2 centimeters ($\frac{3}{4}$ inch) distant from the margin of the disease. The Paquelin or galvano-cautery may be employed in this stage of the operation, instead of a knife, to check the oozing. Moderate bleeding from its margins may be disregarded until the close of the operation. More profuse bleeding should be controlled at once by ligatures passed through the vaginal walls, so as to grasp the vessels.

The knife or scissors are now laid aside, and the operator begins to push up and peel back the cellular tissue from its cervical attachments in front and be-

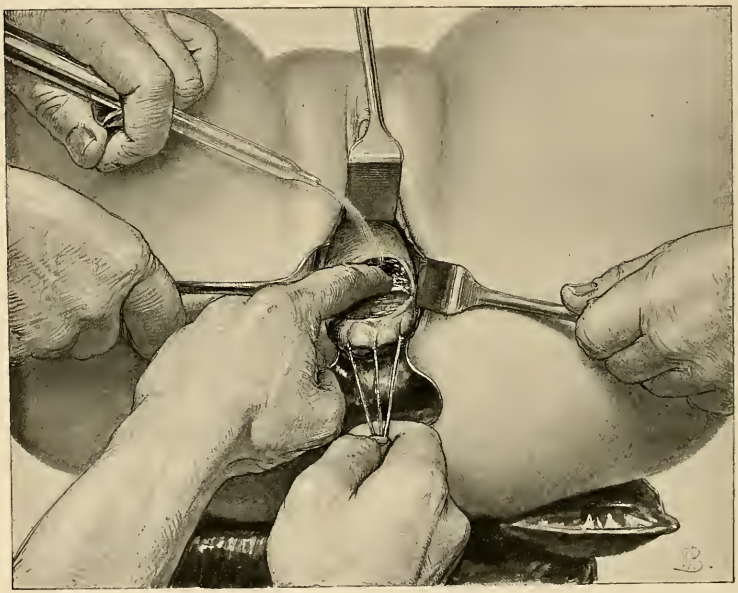

FIG. 300.—VAGINAL HYSTERECTOMY.

The finger is engaged in pushing up the bladder, detaching it from the cervix.

hind the cervix with index and middle finger. There is usually no resistance and rarely any serious hemorrhage, for the important blood vessels lie in the broad ligaments at the sides. Care must be taken in pushing back the tissues and freeing the cervix to keep the ball of the finger always directed toward the cervix. If the separation is carelessly performed and this precaution neglected,

there is danger of perforating the bladder or unexpectedly entering the peritoneum, especially if the disease has extended in either of these directions. As soon as the peritoneum behind the uterus is reached, the fact is readily recognized by the fluctuation of a little fluid in Douglas's *cul-de-sac*, or by the smooth anterior and posterior surfaces gliding over each other. It is opened by catching a fold of it with forceps and making a small cut into it with scissors; one index finger is then thrust in, enlarging the opening, and then the other index finger is introduced, tearing the incision as wide as possible from side to side, well out to the bases of the broad ligaments.

Fig. 301.—Aneurismal Needle, with Left Curve for passing Ligatures through the Broad Ligaments in Vaginal Hysterectomy.

As soon as the peritoneum is laid open the irrigation must cease. A sterilized sponge, or pledget of gauze with string attached, is now pushed into Douglas's *cul-de-sac* to prevent the entrance of fluids or the escape of *débris* from the field of operation up into the peritoneum. A pair of artery forceps, clamped at the end of the string, distinguishes it at once from the ligatures applied to the broad ligaments.

The anterior vesico-uterine fold of peritoneum is next reached in like manner after completely detaching the bladder from its uterine connections. It is also recognized by the gliding of its peritoneal surfaces over each other. An opening is made by pushing in a pair of sharp-pointed scissors under the guidance of the index finger, spreading the handles and withdrawing them. The index fingers are then introduced as just described and the hole enlarged out to the broad ligaments on either side. This leaves the uterus hanging in the pelvis attached by the broad ligaments alone.

The anterior peritoneal fold may sometimes be more readily reached after the lower parts of the broad ligaments have been ligated and severed from the cervix, permitting a greater downward displacement of the uterus, and making this part of the peritoneum more accessible.

The accident of pushing the finger through the bladder will be avoided by frequently introducing a sound into the bladder as the operation progresses, to determine its exact position, and the thickness of the intervening wall. An accidental rent in the bladder at once shows itself by a sudden gush of urine into the vagina. This is most apt to occur when the disease has progressed through the cervix into the bladder wall. A fistula made in this way should be closed, after paring the edges to remove the disease, with interrupted silk sutures, when the enucleation of the uterus is completed. If this operation is performed immediately, it is rarely unsuccessful.

The next step in the enucleation is to tie off the broad ligaments with stout silk ligatures, introduced by a strongly curved blunt aneurismal needle. In introducing the first ligature—say on the right side—the cervix is drawn strongly to the left, and the right vaginal wall held out of the way by a retractor. The left index finger is placed beside the cervix, behind the broad ligament, and the aneurismal needle, armed with a ligature, is passed through, from before back-

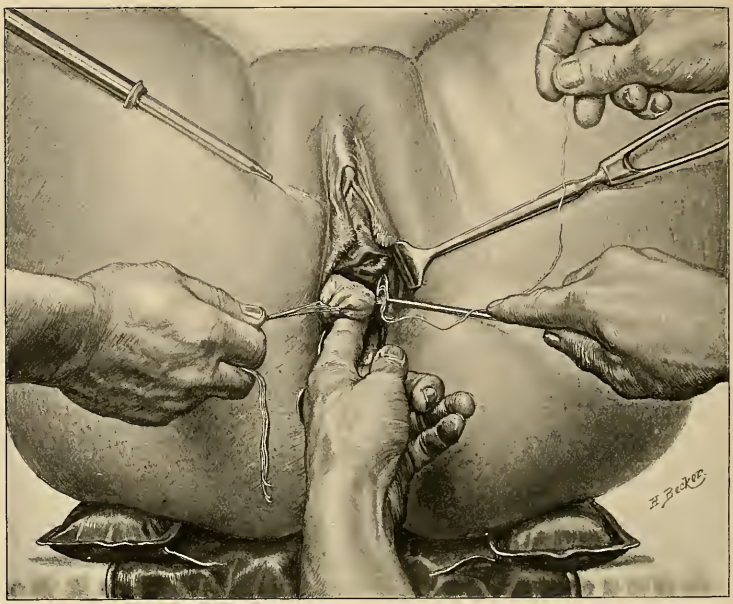

FIG. 302.—VAGINAL HYSTERECTOMY.

After freeing the bladder in front and opening the *cul-de-sac* behind, the base of the left broad ligament is exposed by pulling the cervix to the right, and tied off by passing a stout silk ligature in an aneurism needle.

ward, onto the tip of the finger. This ligature includes a bunch of tissue about a centimeter in diameter, and is entered about a centimeter distant from the cervix, out toward the pelvic wall. The loop of the ligature is caught with a stout, blunt tenaculum, pulled out, and the needle is withdrawn. The ligature is tied at once, as tightly as possible, and drawn aside, and the broad ligament divided between the ligature and uterus, nearer the latter. All cutting is done with scissors, carefully snipping the tissues of the broad ligaments as they are drawn forward on the index finger. As soon as a little oozing of blood is seen to follow a cut, it means that an area of tissue is uncontrolled and another ligature must be inserted in a similar manner just above the last. The assistant must use the retractor with care, so as not to pull on the ligatures already tied. After introducing two or three ligatures in this way, one above the other, the cervix is drawn to the opposite wall, and the base of the left broad ligament ligated and severed in like manner.

FIG. 303.—THE END OF THE STOUT BLUNT TENACULUM USED FOR CATCHING THE LIGATURE AND DRAWING IT DOWN IN VAGINAL HYSTERECTOMY.

An extensively infiltrated cervix occupies a considerable space in the narrow pelvis, and in consequence lies in close contact with the ureters. In such cases, as advised by Pawlik, a bougie or a catheter should be placed in each ureter before the operation. The exact position of the ureter is thus constantly evident to the fingers throughout the enucleation, and injury to the organ is avoided with ease and certainty. I have in this way several times avoided this accident. In one patient, after removing a large cancerous uterus, I found a separate mass in the left broad ligament, which I proceeded to enucleate with forceps and scissors, actually dissecting it off from the ureter, which was bared for 7·5 centimeters (3 inches), without injury, it being plainly defined the whole time by a bougie 2·5 millimeters (0·1 inch) in diameter.

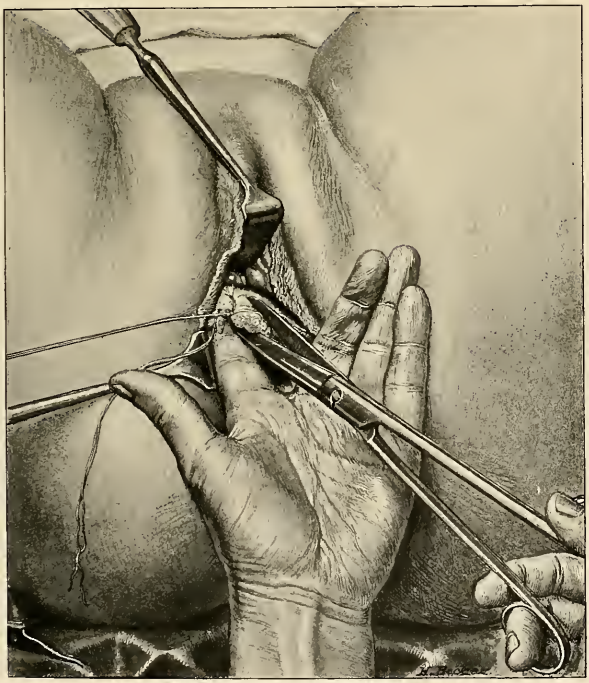

Fig. 304.—Vaginal Hysterectomy.

Freeing the right broad ligament from the uterus. The cervix lies to the left; the first ligature to the base of the broad ligament has been tied and hangs loose; the second ligature, including the uterine artery, has been tied just above the first as shown, and the scissors are just about to divide the broad ligament between the ligature and the right border of the uterus.

Moderate traction may be made upon the ligature when tied, assisting in exposing the area to be divided by the scissors; but as soon as the division is

effected all traction must cease at once, lest the ligatures be pulled off. The uterine artery should be included in the second or third ligature applied. As soon as the peritoneum is opened the index finger will find the artery pulsating

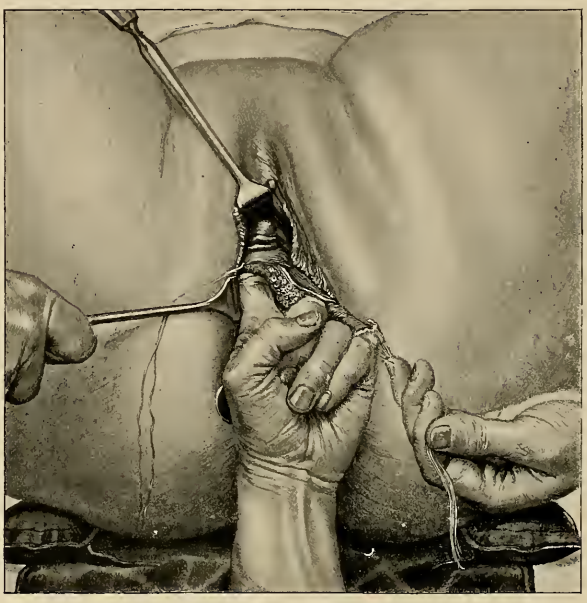

FIG. 305.—VAGINAL HYSTERECTOMY.

The cervix and uterus pulled well over to the left. The right broad ligament has been tied all the way up to the top, which will be tied next. The index finger is hooked behind the top of the broad ligament, pulling it down into view for the application of the last ligature. The round ligament and the tube are seen at their uterine ends.

beside the cervix near the internal os. Its exact position once fixed serves as a guide in estimating the amount of tissue to be included in the ligatures in order to catch it in the second or third. The artery, when laid bare, is easily distinguished as a large, white, tortuous trunk with a lumen 2 or 3 millimeters in diameter, strongly pulsating on its proximal side. As soon as the uterine arteries of one side are secured and severed from the uterus the operator continues to tie off the remainder of the broad ligaments on that side up to the top. When near the top of the broad ligament the finger is passed over the tube close to the uterine cornu, which is hooked down into view and tied.

If the cancer affects the body of the uterus, or there is a pyosalpinx or other pelvic inflammatory disease complicating it, the ligatures should be placed on the outer pelvic side of the ovaries and tubes which are removed together with the uterus. It is more difficult to complete the operation in this way with the

removal of the ovaries and tubes, because the ligatures placed nearer to the pelvic wall are not so easily tied, and are more apt to slip off. The ligature at the top of the broad ligament must be tied with especial care, and the tissue cut at a distance from it, to avoid the risk of its slipping off. As soon as the whole of the right side of the uterus is freed, two fingers are inserted, the fundus caught from behind, and the body of the uterus slowly and carefully delivered sidewise through the opening in the vaginal vault, down through vagina and out into the vulvar cleft, where it hangs attached by the upper part of the left broad ligament. The enucleation is now completed by tying off the opposite side from above downward with two or more ligatures.

It is possible by removing the uterus in this way, from above downward, to apply the ligatures at a safe distance from the side which is most diseased; for this reason, in cases of advanced disease, it is best not to apply more than a single ligature below on the worst side.

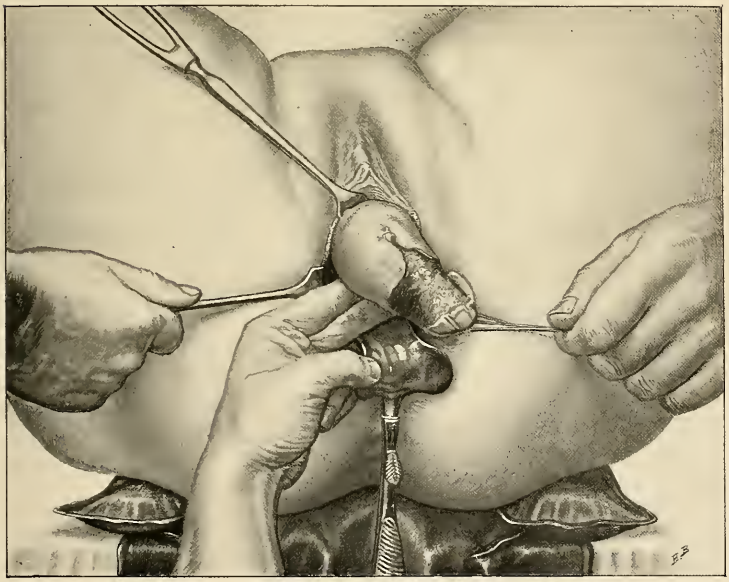

Fig. 206.—Vaginal Hysterectomy.

The uterus entirely freed on the right side and brought out onto the vulva. The remainder of the left broad ligament is now tied from above downward.

As soon as the uterus is removed, the operator takes the sponge from the pelvis and separates the ligatures into right and left groups, holding them without traction, while an assistant pours a hot sterilized normal salt solution, 43·3° C.

(110° F.), into the vagina, and cleanses the lower pelvis with a sponge held in the forceps. The irrigation is continued until the water returns perfectly clear.

If omentum, or a loop of intestine, falls into the vagina, it must be carefully pushed back. While washing out the lower pelvis he must inspect the peritoneum as well, in order to discover and remove any coagula lodging there.

The next step is the investigation of the condition of all the ligatures and the search for bleeding points. A slight traction of the upper ligatures, aided by a sponge pushed into the peritoneum, and then partially withdrawn, brings the broad ligament forward, and exposes first one part of it and then another. Any ligature which seems loose must at once be replaced by transfixing the broad ligament at that point. A few fine silk ligatures are usually required to control small vessels under the first ligatures, just below the base of both broad ligaments. A persistent flow from a hemorrhoidal vessel in the recto-vaginal septum must also be controlled by a ligature placed beneath the bleeding point. The wound area underlying the base of the bladder but rarely bleeds.

The ligatures on either side are now tied in two bunches, and the ends cut off just within the vagina.

As a final step, the pelvis is dried with a small sponge, and a dressing applied of strips of iodoform or sterilized gauze, 45 centimeters (18 inches) long by 5 centimeters (2 inches) in breadth. To insert the gauze, the operator, taking the packer, pushes a strip in between the ligatures until the whole space between the broad ligaments is loosely filled out. The vagina below is also packed with gauze somewhat firmly to prevent the intestines from escaping in this direction. This packing of gauze supports the small intestines, omentum, rectum, and bladder, and drains off any fluid into the vagina. Too tight a pack does not drain well. A loose pack, on the contrary, favors prolapse of the bowel into the vagina. I lost one patient through a loose pack, from peritonitis, due to the infection of a knuckle of intestine forced down beside the pack. It is a good plan to unite the peritoneum in the middle by one or two sutures, leaving a little opening on either side for drainage, supporting the intestines and lessening the liability to prolapse. Iodoform and boric-acid powder is dusted freely into the vaginal outlet as the speculum is withdrawn.

The urine is now drawn, and, if clear, conveys the assurance that the bladder has not been injured. Bloody urine may indicate an injury to the bladder or ureter. A roll of sterilized absorbent cotton is applied over the vulva, held in place by a T-bandage.

A f t e r - t r e a t m e n t.—When the effects of the anesthesia have worn off, it is not necessary to keep the patient on her back. She will be greatly relieved from time to time by being gently turned over on one side or the other; after a few days she may turn on her face and urinate in this posture. At first the catheter should be used three or four times daily. The bowels should be moved on the third day by a laxative pill, followed by a warm enema of oil and soapsuds, or of glycerin and oil, 180 centimeters (6 ounces). During the evacuation she must avoid straining. If the fecal matter does not easily pass out, the nurse

must assist with her fingers. After this, a movement must be secured every other day.

The diet during the convalescence should consist for the first two or three days of liquids, followed by soft foods, nourishing soups, toast, soft boiled eggs, oyster soup, various starchy foods, etc.

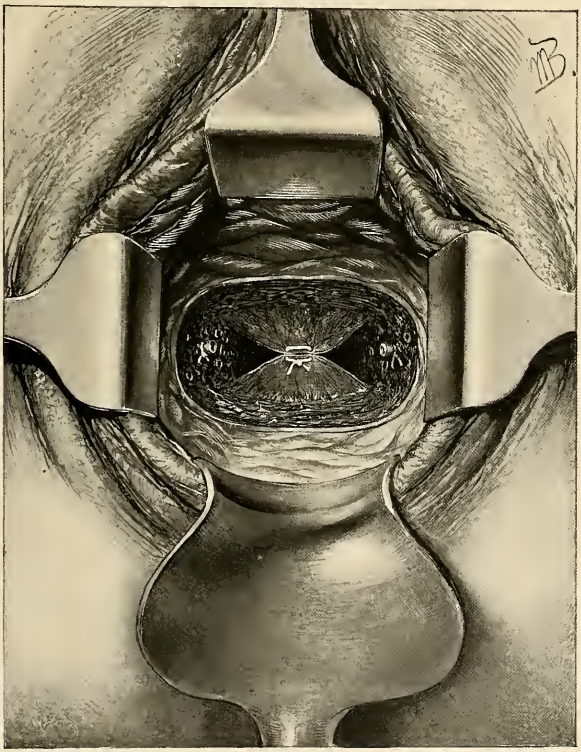

FIG. 307.—VAGINAL HYSTERECTOMY.

The uterus removed, the ligatures on the uterine arteries seen on either side. The anterior and posterior peritoneal layers are brought together in the middle by one suture. The long ligatures on the broad ligaments are left out of this picture.

Pain following the operation is often entirely absent and is rarely unbearable. Hypodermics of morphine should be used sparingly to relieve severe pain during the first twenty-four hours.

If the pack continues dry, and there is no discharge from the vagina, it may be left there five days or longer. To remove the pack the patient is brought

with the buttocks to the edge of the bed with the thighs flexed. The operator slips a narrow Sims speculum into the vagina, retracting the posterior wall, and with dressing forceps draws the strips of gauze out from between the ligatures. As soon as the strips are removed the vaginal vault must be cleansed with pledgets of absorbent cotton, and a fresh pack inserted.

No vaginal douches of any kind should be used until three weeks have passed, when a 3 per cent warm carbolized douche or boric-acid douche may be given once or twice daily, using a short nozzle and taking great care not to push it too far in. When silk ligatures are used the discharge is sure to become odorous sooner or later, and the vagina must be cleansed more frequently. The ligatures loosen and come away with a little traction, in bunches, in from four to six weeks. It is a good plan not to wait for them to become detached, but in the course of three weeks to expose and remove them with forceps and scissors. These sutures can be removed most easily with the patient in the knee-breast or Sims posture.

In eighteen days the patient may sit in a reclining chair a little while each day, and after this gradually increase her movements, until after four weeks, when she is able to be up all day. At this time an examination will show that the vaginal vault is closed, and the wound area has contracted down to a transverse granulating linear scar, with the granulations more abundant at each end. After six or eight months this whole line has contracted still more, until it is a thin white cicatrix, closing the vault.

After a hysterectomy the patient should avoid hard work, heavy lifting, and prolonged exertion for several months. Recovery of health is usually rapid; within a few months a pale, emaciated woman often regains all her lost vigor. But the surgeon still has a duty to perform in continuing to watch these cases, examining them at first at intervals of two or three months, and later every six months, in order to detect at once any recurrence of the disease. It will occasionally be necessary to cut out a small area of recrudescence in the vaginal vault, which will be detected at an early stage by this careful inspection.

In two instances in which the uterus was enucleated without removing the uterine tubes or the ovaries I found at a later date the vault of the vagina occupied by dark red, funguslike masses, which at first sight suggested a rapid return of the disease; on removing these, however, they proved to be the uterine tubes inverted through the incision at the angles, exposing to view their inner mucous lining.

The accidents and complications that arise during vaginal hysterectomy are:

1. Hemorrhage.
2. Ligation of one or both ureters.
3. Rupture of the bladder.
4. Injury to the small intestine.
5. Pelvic abscess.
6. Ovarian tumor.
7. Incomplete enucleation of the disease.

Hemorrhage.—The various sources of hemorrhage are the hemorrhoidal, uterine, ovarian, and vesical arteries and veins. Slight hemorrhage from small arteries is usually easily controlled by clamping them for a time with forceps; if they continue to bleed they must be ligated with fine silk or catgut. Hemorrhage from such large vessels as the uterine and ovarian arteries may prove embarrassing from the constant flow of blood which obscures the field; the difficulty of managing it increases the greater the distance of the bleeding point within. Such a hemorrhage is most apt to arise from cutting too close to one of the ligatures, so that the short bunch of tissue in its grasp slips from under the constricting loop. The worst form of hemorrhage is seen where the effort has been made to grasp the entire broad ligament in a clamp. This form of hemorrhage is treacherous, because it is liable to occur some hours after the operation.

The following instruments and accessories should always be within easy reach to meet such an emergency: A Sims speculum, two long flat retractors, dressing forceps, three sponges in holders, six artery forceps, perineal pad, iodoform gauze, transfusion apparatus, and a liter of normal salt solution. A hypodermic injection of strychnin ($\frac{1}{30}$ grain) should be given at once.

To control the hemorrhage the patient is put under chloroform and brought to the edge of the bed under a good light, or, better still, placed on a table. As soon as she is sufficiently relaxed by the anesthetic, the operator must proceed rapidly, as prolonged anesthesia is especially dangerous in the shock following an extensive hemorrhage.

The saturated gauze pack is removed, and with fingers and sponges on holders the vagina and pelvis are rapidly cleared of the large clots which sometimes extend high up into the abdomen as far as the umbilicus. By gentle traction upon the bunches of ligatures, the broad ligament of one side and then that of the other is drawn into view and the loose ligature loop found and the broad ligament clamped. If active hemorrhage is going on, the quickest way to detect its source is to introduce a clean sponge on a holder between the broad ligaments and leave it there for a few seconds. The deep blood stain in one spot reveals the corresponding position of the hemorrhage. If, however, the precise area can not be determined by inspection, the broad ligament on the bleeding side should be caught by traction forceps, introduced under the guidance of the index finger, and drawn down step by step until the bleeding point is seen. As soon as discovered, a pair of artery forceps is applied, or several forceps in rapid succession if needed, until the whole area is under control. If the patient is much shocked by loss of blood, the quickest and most satisfactory plan is to leave the forceps in place for from thirty-six to forty-eight hours, without attempting to apply a ligature. When a large area of the broad ligament has slipped up into the pelvis and the bleeding is active, and proper assistance is wanting, a bold and successful method of finding the bleeding vessels is to take a pair of bullet forceps and carry them up into the pelvis, guided by the touch; the broad ligament is then seized and drawn down into view, and so clamped from end to end with artery forceps. The operator must constantly bear in mind that an active hemorrhage almost invariably arises from one of four vessels, the two uterine and the

two ovarian arteries; each one of these must be inspected in searching for the source. A persistent exhausting hemorrhage may also arise from patulous atheromatous vessels in the septum between bladder and cervix or between cervix and rectum. One of my patients nearly lost her life from a slow continuous oozing from a small vessel of this sort.

Where the mucous surfaces are blanched by the hemorrhage, the respiration quickened, and precordial distress felt, and there is a rapid, thready, scarcely perceptible pulse, or even where there is only well-defined shock, infusion of a liter of salt solution under the breasts should be resorted to during the operation.

Ligation of one of the Ureters.—This is an accident to which a beginner is peculiarly liable, and comes from passing the first ligatures too far out from the cervix toward the pelvic wall.

The most skilled operator may make this mistake, when the cervix is unusually enlarged by cancerous infiltration, diminishing the distance to the pelvic wall, and bringing the cervix and the ureters into an abnormally close relationship. In such cases the only absolute assurance of safety lies in a preliminary sounding of the ureters, by placing a flexible bougie in each one, where it remains until the operation is over (see Chapter XIII). By this means, as soon as the peritoneum is opened, the ureter can be felt at once against the side of the pelvis like a hard, firm cord, which the bougies keep splinted out upon the pelvic wall at the greatest possible distance from the cervix. The extreme importance of placing a sound in the ureters has been repeatedly illustrated in my cases where the ureter has been bared for one or more inches by a careful dissection.

Rupture of the Base of the Bladder.—This accident will not occur in an ordinary vaginal hysterectomy if the uterus is freed from its vesical attachments by constantly directing the end of the finger toward the cervix. Occasionally the operator will be surprised by discovering that the disease has extended beyond the cervix and involved the base of the bladder, which breaks down, allowing the finger to enter the bladder in the enucleation, in spite of every precaution. This accident is signalized by a gush of urine mixed with blood. The exact location of the tear should at once be determined, either with the finger, or by introducing a sound into the bladder through the urethra, and bringing the point out through the hole.

Care must be taken during the further steps of the operation not to convert a small rent into a large ragged opening. If the danger of further rupture is imminent, while using the finger, the remainder of the bladder may be dissected off from the cervix with forceps and scissors. As soon as the extirpation of the uterus is complete, the rent in the bladder should be exposed by a little traction on its peritoneal fold, and if there is any suspicion of infiltration, the margins of the rent should be liberally excised and the fistula closed by interrupted silk sutures, not including the mucosa, and the vesical peritoneum drawn down over the closed fistula and attached to the anterior vaginal wall, thus burying the fistula and relieving it of any tension as the bladder distends with urine.

After such a complication, the urine should be drawn every four hours for two or three days. If the approximation is good, this operation is almost invariably successful, and a vesico-vaginal fistula will not complicate the convalescence.

Injury to the Small Intestine.—The small intestine may be injured where adhesions to the uterus have been formed, in consequence of pelvic peritonitis of tubal origin, or from extension of cancer of the body of the uterus to the contiguous viscera.

By palpation on opening the peritoneum and a careful separation of adhesions, any serious injury to the bowel will usually be avoided, and its lumen will not be opened unless invaded by the disease; in such a case the best plan is to draw the affected loop of bowel down out of the pelvis, cut out the diseased area, and close the opening by sutures. Such cases as these ought not to be operated on through the vagina if the extent of the disease is suspected beforehand; an abdominal incision reveals the exact condition, which can then be dealt with under actual inspection.

Pelvic Abscess complicating Vaginal Hysterectomy.—Vaginal hysterectomy, where there is an abscess in one or both tubes and ovaries, is made more difficult by the fixation of the uterus through the inflamed adherent lateral masses, which interfere with the downward displacement. The danger of general peritonitis is also enhanced by the contamination of the pelvic peritoneum by the escaping pus. The best plan of procedure is to go on as far as possible with the enucleation of the lower part of the uterus without rupturing the abscess, and then to protect the peritoneum thoroughly with a gauze pack while evacuating the pus with an aspirator.

When the peritoneum is opened, gauze should be packed on all sides in protecting the abdominal cavity.

If the abscess involves but one side, the unaffected side should be freed first and the uterus brought out, when the affected tube and ovary may be removed with the uterus by introducing two fingers and separating the adhesions and drawing the organs outside, and then ligating and cutting, first the ovarian vessels near the line of the pelvic brim and continuing on down the broad ligament until the whole mass is freed.

If the abscess has ruptured and its contents escaped over the peritoneum and the wound, some of the pus should at once be examined under the microscope for organisms, and if any of the various pyogenic cocci are found in abundance, the sponging out should be more thorough, washing the whole pelvis with extreme care, and a more abundant gauze drain should be placed higher up within the pelvis at the end of the operation.

If the enucleation is impeded by an ovarian tumor, this should be freely opened and evacuated and drawn out in a collapsed condition and the ligatures applied to the broad ligaments as usual.

Incomplete Enucleation.—An incomplete enucleation is the result of an operation undertaken by mistake when the disease is too far advanced for radical treatment, and I know of nothing more unsatisfactory than the discovery,

after the operation is well under way, that a portion of the disease has advanced beyond the possibility of removal. One may find a nodular mass adhering by a broad base to the pelvic wall, or an infiltration of the upper part of the broad ligament through which it is necessary to cut to free the uterus; or, again, the uterus may be so friable as to break down as soon as it is handled, leaving a ragged infiltrated area extending into the broad ligament.

Separate masses plastered on the pelvic wall must be let alone, for complete extirpation is here impossible, and the attempt would excite a hemorrhage which might easily become uncontrollable.

Where the broad ligament is found widely infiltrated after the operation has advanced too far to be abandoned, the uterus must be removed as nearly as possible in one piece and any remaining cancerous areas with friable tissue energetically curetted, the hemorrhage checked with forceps left on from twenty-four to forty-eight hours, the pelvis washed out with the utmost care, and an extensive gauze pack inserted, completely enveloping the infiltrated area on all sides.

CHAPTER XVII.

INVERSION OF THE UTERUS.

1. Definition and description.
2. Various forms: *a*. Acute. *b*. Chronic. *c*. With fibroid tumor.
3. Diagnosis.
4. Prognosis.
5. Treatment—reposition: *a*. By manual efforts. *b*. Vaginal amputation of the uterus. *c*. Panhysterectomy. *d*. Küstner's method—opening Douglas's pouch and incising the sac and reinverting.
6. Inversion due to malignant disease.

The uterus in inversion is turned inside out, so as to form a hollow tumor projecting into the vagina; its walls are externally the uterine mucosa, internally the peritoneum, and between the two lie the muscular coats of the uterus. The uterine end of the tubes and the utero-ovarian ligaments enter into the pouch formed by the inverted peritoneum, and the ovaries and outer ends of the tubes lie just above it. The sac within is not more than 2–2.5 centimeters ($\frac{4}{5}$ to 1 inch) deep, and its orifice forms a narrow slit or a puckered orifice opening into the peritoneum.

Various Forms.—Various forms of inversion exist which it is important to recognize, as the mode of treatment differs in each.

Acute inversion is the form found immediately after labor; it is often due to unskilled efforts in delivering the placenta by traction upon the cord. This is oftener seen by the obstetrician than by the gynecologist.

The chronic form is either simply a survival of the acute form or is slowly produced in a non-puerperal uterus along with the expulsion of a tumor attached to its walls; this is the form which is most frequently seen in our gynecological clinics.

The commonest cause of inversion is a submucous fibroid tumor attached to the fundus uteri. The mechanism of its formation under these circumstances is the relaxation of the uterine cavity below the tumor, produced by expulsive efforts like those of labor, by which the tumor is finally forced into the vagina, dragging with it the attached portion of the uterine wall.

If the tumor is submucous and becomes pediculated, the peritoneal surface of the uterine wall undergoes no displacement and there is no inversion; if, on the other hand, the tumor remains sessile, as it descends the whole thickness of the uterine walls and the peritoneum may follow, creating on the peritoneal surface an indentation, at first slight but becoming more and more deeply depressed until complete inversion is brought about by the escape of the tumor into the

vagina or even out onto the vulva, when we have inversion with prolapse. The tumor causing the inversion need not arise from the fundus, but may be attached to a lateral wall. It may be that only a part of the uterine wall is involved in the inversion, as in a specimen I saw in the collection of Prof. Werth, of Kiel, where there was a little inverted peritoneal pit projecting into a pediculated myoma while the rest of the uterus appeared normal. It has been suggested that a partial inversion of this sort might be brought about artificially by traction on the tumor at the time of operation, but that such was not the case here was evident from the delicate bands of peritoneal adhesions stretching from side to side inside the inversion sac, showing that it had existed for some time.

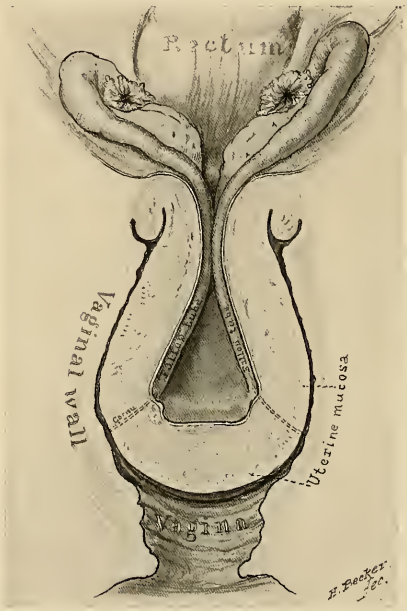

FIG. 308.—INVERSION OF THE UTERUS, SHOWING THE INVERTED UTERINE BODY FILLING THE UPPER VAGINA, AND THE CERVICAL RING THROUGH WHICH THE INVERSION HAS TAKEN PLACE.

The ovaries and the uterine tubes lie at the entrance to the inversion funnel.

An inversion is sometimes found in which the tumor producing it has sloughed off. I had a case in which this mode of production was evident from the transverse linear scar 3 centimeters long on the inverted fundus, with fine cicatricial lines radiating out from it in all directions.

Diagnosis. — The commonest symptom of inversion is hemorrhage, which occurs with great ease from the exposed mucosa. In puerperal cases the hemorrhages date from the last labor, and are usually particularly severe just after it.

The patient often comes to the gynecologist with a high degree of anemia, and complains of a tumor which she, and often her physician, have mistaken for a cancer.

It is best to make the examination under anesthesia, when a thorough investigation of all the associated conditions may also be made. The diagnosis is easy if a red, bleeding, pyriform tumor, about 3 centimeters in diameter, larger below and contracted above, is found filling the vagina; by bimanual palpation a depression is distinctly felt entering the tumor on its peritoneal surface, and the absence of the uterus in its normal position is demonstrated. When the inversion is complete the cervix can not be distinguished at the vaginal vault, which seems to be continuous

with the tumor. If the inversion is incomplete the cervix remains as an enlarged ring, and a sound may be pushed into it for a short distance up to the neck of the sac.

In the case of a tumor projecting into the vagina with a partially inverted uterus, the uterine attachment of the tumor presents a depression which may be felt through the rectum. When the inversion is partial any undertaking to enucleate the tumor in ignorance of this complication is most hazardous; the peritoneum has been opened under such circumstances and the life of the patient lost, through the tendency of the uterine wall thus cut through to retract out of sight and to bleed into the peritoneal cavity. The difficulty of getting hold of the edges of the wound, together with the injury and exposure of the peritoneum, made such an accident one of the gravest mishaps which formerly could befall a gynecologist. The proper plan now in event of such an accident would be to open the abdomen immediately and deal with the bleeding area directly by suture.

The rule, therefore, in every case of a submucous myoma, is to assume that an inversion does exist until the contrary is proved by a careful rectal and bimanual examination—palpating the peritoneal surfaces of the uterus over the point of attachment of the tumor.

The prognosis of an inversion left to itself is unfavorable. But few cases undergo spontaneous reposition, the hemorrhages endanger life, and ulceration of the exposed mucous surface may give rise to sepsis. In one instance recorded there was a spontaneous amputation of the body of the uterus. (R. M. Murray, *Edinburgh Medical Journal*, vol. xxviii, p. 901.)

Treatment—Reposition.—The most satisfactory plan of treatment is by a reposition of the displacement. This is usually easy in a puerperal case seen soon after its occurrence, when with the thumbs or fist an indentation is started at the most prominent part on the wall of the inverted sac, and by continuing to push up in the axis of the pelvis the depression is made deeper and deeper, until reinverted tissue, acting as a wedge, enters and dilates the cervix and passes into the pelvis, when the replacement is shortly completed. The difficulty of keeping the uterus up in its place is often greater than that of returning it. To hold it in place, an iodoform gauze pack may be introduced within the cavity, filling it, and supported by a vaginal pack, which is changed from day to day, until by contraction and recovery of tone the danger of recurrence is past.

When the inversion is caused by a tumor attached to the fundus, it will usually be sufficient to take away the tumor to bring about an immediate return of the uterus to its normal shape. On account of the facility with which reposition occurs under these circumstances, it is important to pass all the sutures necessary to close the wound and stop bleeding before detaching the tumor; otherwise the bleeding surface once reinverted can not be reached.

In chronic cases one of the following three plans of treatment may be adopted:

First, by manual efforts.

Second, by vaginal amputation.

Third, by opening Douglas's pouch and incising the sac from fundus to cervix and reinverting.

Manual efforts at reposition should be made first. To do this, the tumor is squeezed with one hand to make it longer and smaller, and then pushed with the other hand, like a wedge, up into the cervix, through which it gradually returns in the reverse order of its formation, if the effort is destined to succeed. Another way is to grasp the tumor in the full hand, slipping the extended index and middle fingers of the same hand inside the cervical ring to dilate it, at the same time attempting to push the uterus up through the dilated ring. The other hand makes counter-pressure simultaneously through the abdominal wall, over the ring, helping to roll the cervical tissues back over the neck of the uterine tumor.

The difficulties in the way of a manual reposition are usually insuperable; they arise from the altered rigid fibrous character of the uterine tissue, with vascular engorgement and edema, as well as from the fact that the rigid neck of the inverted peritoneal sac is so much smaller than the body of the uterus which is to pass through it.

The surgeon is not warranted in making prolonged forcible attempts at manual reposition on account of the inevitable bruising of the tissues and the danger of laceration at the cervix. In a case of marked fatty degeneration of the uterine walls of six and a half years' standing, Dr. A. Martin, of Berlin, perforated them in attempting to effect a manual reduction; the patient died in collapse a few days later (*Path. und Therap. der Frauenkränkheiten*, 3d ed., Wien und Leipzig, 1893, p. 158).

A most natural suggestion to the surgical mind, in the present stage of abdominal surgery, upon the failure of manual efforts, would be to open the abdomen, to dilate the contracted canal from within by fingers and dilators, and then to push the uterine body up from the vaginal side through the enlarged canal into its normal position; this has been tried, but has not proved very successful.

I note a failure of my own in a case of long-standing inversion with prolapse, in Philadelphia, eight years ago. The proposed plan was to open the abdomen and expose the neck of the inverted sac, and then to stretch this with strong dilators, and with the help of an assistant to force the body of the uterus up through the enlarged neck of the sac, producing reposition. I had further intended to prevent the recurrence of the inversion and prolapse by stitching the fundus to the anterior abdominal wall (Suspension of the Uterus, Chapter XXIV).

I opened the abdomen and exposed the narrow slit-like orifice at the site of the inversion, but my utmost efforts to make any impression upon the opening with fingers or dilators were unavailing, and I was obliged to abandon the attempt and relieve the patient by amputating the uterus through the vagina.

On the other hand, a successful operation of this kind was performed by Dr. T. G. Thomas, of New York, in September, 1869 (*Amer. Jour. of Obst.*, vol. ii). The patient was put under ether, when an assistant so forcibly lifted the uterus

up against the abdominal wall that the intestines were displaced and the cervical ring could be felt. A small incision was then made in the median line of the abdominal wall down on to the ring, opening the peritoneum. The operator now grasped the inverted uterus in the vagina, and at the same time introduced a powerful steel dilator into the neck of the sac on the peritoneal surface. The dilatation proceeded easily and rapidly, and the uterus was reinverted and restored to its normal form in twenty-seven minutes. The patient recovered and left her bed on the eighth day.

The second method, vaginal amputation of the uterus, remains a satisfactory alternative in case of failure of the preceding means.

After a thorough cleansing of the field, the uterus is enveloped in sterilized gauze, grasped, and drawn down and exposed by pulling back the posterior vaginal wall with a speculum, so that the neck of the sac at the vaginal vault is accessible. The amputation is now begun by cutting two flaps at the neck of the inverted uterus, one anterior and one posterior, just below the vault of the vagina. Before the peritoneum is opened, three or four stout silk ligatures are passed with a large curved needle completely through the uterine stump in an antero-posterior direction.

The peritoneum is now cut through in front, and by continuing the incision cautiously out to the sides, the uterine arteries and veins are found, clamped, and tied as high up as possible with fine silk. An assistant keeps up a strong traction on the ligatures to keep the stump from inverting into the peritoneum. The operator now takes the ligatures one at a time and ties them tightly, bringing the lips of the stump firmly together. Additional deep sutures must be passed, if necessary, to check bleeding and secure accurate approximation. The stump closed in this way soon slips through the cervix and a partial reinversion is established.

The most important point to bear in mind throughout, is that the ligatures passing through the stump must keep the lips of the wedge-shaped incision firmly approximated even after reinversion has occurred. A dry dressing should be kept in the vagina; the sutures may be removed in ten days or two weeks.

Complete vaginal hysterectomy (panhysterectomy) may be performed by opening Douglas's pouch from side to side and the vesico-uterine pouch in front, and then hooking the index finger around one side of the cervix and passing a succession of ligatures through the tissue intervening between the finger and the vault, tying each ligature, and cutting between it and the cervix, taking care not to cut too near the ligature. The amount of tissue severed is small and the uterine artery is soon ligated; an additional ligature must be applied to its free end.

The opposite side is ligated in like manner, and the uterus freed. The bladder does not enter the inversion sac. If there is no bleeding, the peritoneal surfaces of the wound may now be drawn together with a running suture, the ligatures arranged on the right and the left side, and the vault of the vagina packed with iodoform gauze.

Prof. O. Küstner's method of reposition in chronic cases resisting

simpler methods of reduction (*Centralb. f. Gyn.*, 1893, No. 41) is in entire accord with the recent developments of gynecological surgery, and promises success in cases which it has hitherto been found impossible to treat in a conservative manner. I have not yet had a case upon which I could try it, but, in view of the apparent feasibility of the plan, I give the details of the operation. It is briefly this: The peritoneum is opened posterior to the uterus and the neck of the sac is incised, relieving the constriction and making it large enough to push the fundus through. The steps are conducted in the following manner:

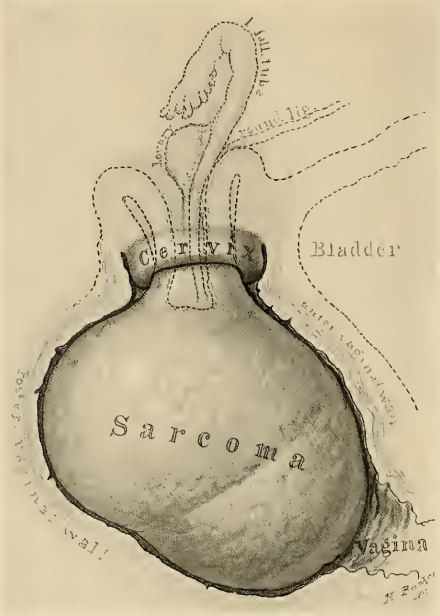

Fig. 309.—Inversion of the Uterus due to Sarcoma. Hysterectomy, recovery. San. Jan. 19, 1897.

First, a wide transverse incision in Douglas's *cul-de-sac* opening the peritoneum.

Second, the introduction of the index finger through this opening into the inversion funnel of the uterus, and separation of any adhesions found.

Third, a longitudinal incision through the posterior uterine wall, as nearly as possible in the median line. This begins about 2 centimeters below the inverted fundus and ends about 2 centimeters above the os externum, and extends all the way down to the peritoneum.

Fourth, reinversion of the uterus by fixing the funnel with the index finger in Douglas's pouch, and pressing in the fundus with the thumb of the same hand.

Fifth, suture of the uterine incision by deep and superficial sutures passed on the peritoneal surface.

Sixth, closure of Douglas's *cul-de-sac* with sutures.

Inversion due to Malignant Disease. — Inversion due to a malignant tumor of the fundus is rare, and I have seen but one case. The patient (J. H. B., No. 410, San., Jan. 19, 1897) presented herself on account of a fetid, watery, blood-tinged discharge which had continued for about a year with hemorrhages at intervals.

I found the whole vagina above the levator ani filled with an ovoid mass about 8 by 6 by 4 centimeters, flattened antero-posteriorly, and attached at the

cervix by a pedicle 2·5 centimeters in diameter. The external os formed a sharp rim around the pedicle, and the depth of the canal was from 2 to 2·5 centimeters.

Bimanually the uterine body was found absent, and in its place was a pit which entered the cervical ring, close to which both ovaries could be felt, the left one entering it for a short distance. The ovoid body filling the vagina was made up of the inverted uterine body and a sessile tumor of a light grayish color covered with little tags of tissue.

In grasping this mass it broke down, and was so friable that the entire enucleation had to be done with the fingers. There was no capsule at all, and no line of demarcation between it and the uterine tissue at the base, covering an area of 2·5 by 2 centimeters, where the uterus appeared white and non-vascular. The fundus went up through the cervix after seventy-two hours, upon releasing a pair of forceps detaining it, so as to obviate the risk of a hemorrhage, which could not be controlled by suture in the friable tissue.

The tumor removed was broken up into a number of irregular pieces, and was easily penetrated by the fingers in all directions, without any hard or resisting nodules; the tissue toward its base had an edematous appearance and was longitudinally striate and tore in shreds, like the meat of a crab's claw.

A microscopic examination showed that the tumor was a spindle-celled sarcoma. A complete abdominal hysterectomy was therefore done a week later, after which the patient recovered.

CHAPTER XVIII.

VAGINAL EXTIRPATION OF SUBMUCOUS MYOMATA AND POLYPI.

1. Description and position of myomata.
2. Symptoms: *a.* Hemorrhage. *b.* Pain. *c.* Suppuration.
3. Diagnosis: *a.* History. *b.* Palpation. *c.* Difference between fibroid polypi and cancer.
4. Treatment—extirpation: *a.* Selection of cases. *b.* Cutting through the pedicle. *c.* Removal of sessile submucous fibroids: (1) Piecemeal, with forceps and scissors; (2) by splitting the capsule; (3) by both these methods combined; (4) by celiotomy.
5. Complications: *a.* Hemorrhage. *b.* Sepsis. *c.* Rupture of uterus. *d.* Death from exhaustion.
6. Polyps.

Description and Position of Submucous Myomata.—Quite often a myomatous tumor, originating in the submucosa or interstitially in the uterus, is carried, in the course of its development, down into the uterine cavity, where it is found attached by a broad base or by a pedicle of varying length. The tendency to develop in this way is greatest where there is a single tumor, which may vary from the size of an egg to that of a mass big enough to choke the pelvis. Small submucous myomata are also occasionally found associated with large interstitial and subserous tumors. The tumor, which lies at first concealed in the uterine cavity, may, in the course of time, be extruded through the plastic cervix until it comes to lie partly or wholly within the vagina, or even outside the vulva, where it may be found associated with an inverted uterus or with a long, slender pedicle. Large sessile tumors are sometimes grasped so firmly by the cervix, when only partially delivered out of the cavity of the uterine body or into the vagina, as to show a deep encircling furrow at the point of constriction at the internal or external os. The pedicle of such a tumor may be attached to any part of the uterus from fundus to cervix. The most usual position is an attachment to the body just above the cervix.

The submucous myoma in the early stages is covered by the mucosa, which gradually becomes thinner, and not infrequently entirely disappears in places. This atrophy is due to pressure and attrition. The uterine mucosa between two adjacent submucous myomata is frequently thickened because it is protected from pressure. Apart from these inequalities in the thickness of the mucosa it is usually unaltered in other respects. Occasionally, however, the mouths of the glands become occluded, and small cysts develop; in one of my cases the uterine cavity was studded with clear lenticular cysts, and some of them were 8 millimeters in diameter. The presence of submucous myomata does not preclude the possibility of endometritis or tuberculosis, or of other changes in the mucosa,

such as carcinoma and sarcoma. Cysts found in the middle of such tumors lined with cylindrical ciliated epithelium have been explained as originating in a portion of the glandular tissue nipped off early in the development of the tumor.

Symptoms.—The most characteristic symptoms are hemorrhage and pain. The hemorrhages are often excessive, and make the woman extremely anemic. They are worse at the menstrual periods, but may last for weeks or months together. The pains arise from the expulsive efforts of the uterus trying to push the foreign body without the cervix; they are severe, intermittent, and expulsive in character, like those of labor; they often continue for years. Occasionally cases are observed where the pain has been slight, or absent altogether, and the only symptom is hemorrhage. A thin serous oozing from the mucous surface, resembling that of early cancer, may be the first symptom to call the woman's attention to her condition.

Most myomata are interstitial in their beginning, and only become subserous or submucous as they grow, depending upon their situation and the resistance encountered.

The myomatous tumor takes its origin in a little muscular whorl which is poorly vascularized, and secures its blood supply from the capillaries of its periphery, which send their branches into the tumor along its connective-tissue septa. As the tumor increases in size the vessels are thickly crowded together around its periphery, and as it becomes submucous it pushes down toward the uterine cavity and begins to infringe upon the mucosa. It crowds this against the opposite wall, and thins it out until it loses its normal characteristics and the vessels are exposed; then hemorrhage occurs. At first there is but slight increase in the length and quantity of the menstrual flow from the erosion of the mucosa. A real hemorrhage first takes place when the mucosa is so thin that the underlying leashes of vessels which belong to the tumor itself are infringed upon. Then a large vessel may rupture, or many smaller ones, simultaneously, during the menstrual congestion. The vessels form a deeply injected corona around the projecting myoma at its periphery, and the hemorrhage is largely from this area, after the most prominent portion of the tumor has been thinned down to its non-vascular area. In the advanced stages of the submucous tumors the freest hemorrhage is therefore on the border line between the thicker mucosa and the attenuated envelope of the tumor. As a rule, these submucous tumors produce a corresponding cup-shaped depression on the opposite uterine wall, and in the depression formed by the projecting tumor the same vascular phenomena are found. I have made these deductions from a careful study of this subject by Dr. J. G. Clark.

Often, when a total extirpation of the uterus has been made for multiple myomata, all the symptoms have really been due to a small submucous tumor projecting into the uterine cavity and causing the hemorrhage. If such a tumor is removed by a thorough curettage, little or no further trouble may be experienced unless another tumor pushes down under the mucosa.

A small pediculated tumor may descend into the vagina with each menstrual period and return into the uterus afterward, in this way appearing intermittently.

A large tumor choking the pelvis often gives rise to serious pressure symptoms on the part of the bladder and rectum. The pedicles of small tumors may in time become so attenuated as to break, allowing the tumor to escape spontaneously. Larger masses sometimes become necrotic, and break down into a fetid, gangrenous, suppurating mass, which extends up into the center of the tumor like a wedge, producing fever and cachexia with profound exhaustion. Several of the worst septic cases I have ever seen have been of this kind. In one the tumor had disappeared, and left behind only its muscular and mucous covering, which hung limp out of the cervix.

Injection of the blood vessels of myomata of the uterus clearly explains why sloughing and necrosis of the submucous tumors occur, for their internal blood supply is almost invariably poor, and frequently even before they reach the

FIG. 310.—PEDICULATED SUBMUCOUS MYOMA BROKEN DOWN AND COLLAPSED.
The sloughing mass of tissue hanging out of the vulva is soft and flaccid, like a wet rag.

mucous or serous surfaces a necrotic or calcareous core is found. If the tumor becomes submucous, and the wreath of vessels and the mucosa are eroded away, either sloughing from a necrobiosis or suppuration from infection may occur.

Diagnosis.—The diagnosis is made from the history of intense menstrual pains and excessive flow, and by a direct examination which reveals the presence of a rounded tumor in the vagina or just inside the cervix. By passing the

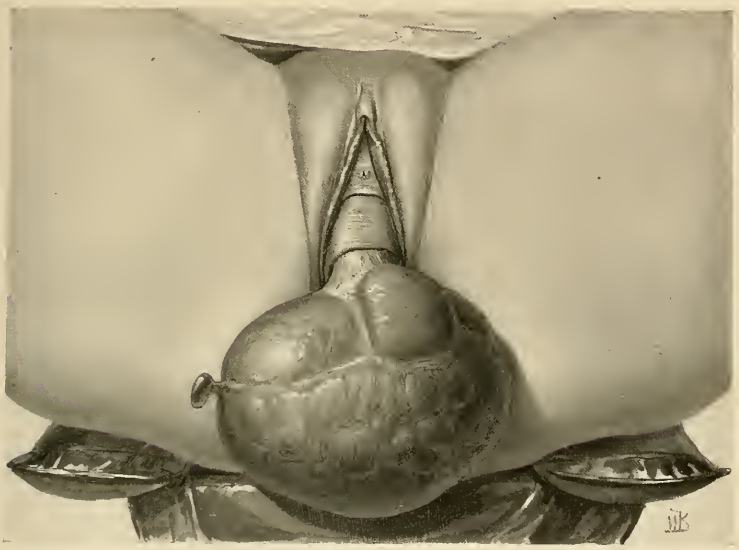

Fig. 311.—Pediculated Submucous Myoma, with Partial Inversion of the Uterus.

finger round it on all sides, the tumor is found to be smooth and to have a pedicle within the uterus; if the tumor is still retained within the uterine cavity, its pedicle may be demonstrated by passing the sound around on all sides. A differential diagnosis must be made between the myoma, of which we speak, and the uterus inverted, either whole or in part. This can only be done by careful palpation of the peritoneal surface of the uterus, by abdomen and rectum bimanually, when, if there is any inversion, the corresponding depression on the peritoneal surface will be felt. If a satisfactory examination has not been made, it must be repeated with the patient anesthetized. A mistake may be made in diagnosis by confusing submucous myoma with a cancerous cervix. I have several times had polyps brought to me with the diagnosis of cancer. This error is the more pardonable when the patient has frequent hemorrhages and acquires a somewhat cachectic look, and where there is a sloughing of the myoma with frequent discharges. This will be avoided by observing the density of the myoma in contrast with the friable cancer. The smaller myomata are quite smooth on the surface, while the larger only are nodulated. The myoma presents a distinct, well-rounded tumor, contracted above to a pedicle which enters

a canal; the cancer is a tumor whose broad attachment is not within the uterus but to the cervix, and often to one lip. It has a peculiar friable hardness, and when advanced tends to infiltrate laterally.

The differentiation between a small submucous myoma which can not be seen or felt, and a cancer of the body of the uterus, may be extremely difficult to make from the clinical history and examination. By splitting the cervix up on both sides, and so opening the uterine cavity, the myoma may be readily seen and felt, but this will not be necessary if the endometrium is curetted and examined microscopically, when the characteristic changes are always found in cancerous cases; the same difficulty may be experienced in differentiating a myoma from a small sarcoma. I have dwelt fully on the microscopic signs of the malignant tumors in Chapter XXX.

A myoma still within the cervix has a characteristic feel, just like a smooth ball in a cup, and it may sometimes be rotated, showing that it has a narrow pedicle above.

A myoma sessile within the uterus will be diagnosed without difficulty if the cervical canal is large enough to admit the index finger, which is introduced and palpates the convex surface of the tumor, while the uterus is held down by a pair of bullet forceps grasping the anterior lip of the cervix; or, if necessary, by using the other hand in making counter pressure through the abdominal walls.

A sound may be employed in the uterus in the same way when the canal is too small to admit the finger. By noting the increased depth of the uterine cavity and tracing its irregular form with the sound moving about within it, and by palpating *per rectum* and *per abdomen* at the same time, an accurate idea is gained of the size and location of the tumor.

Treatment.—The treatment of a submucous myoma is by extirpation. The method will vary according as it has or has not a pedicle, and according to the site and the size of the tumor, and may be either by the vagina or by the abdomen.

In determining whether or not to operate by the vagina, there should be no hesitation about attacking by this avenue pediculated tumors and those which are sloughing. It is sometimes necessary to remove by the vagina large submucous fibroids which are sloughing or causing profuse hemorrhages, even when the uterus contains also many other interstitial and subserous tumors. The immediate indications under these circumstances are fully met by such a palliative procedure, relieving the dangers to life and health; it is then left for the patient to regain sufficient health and strength to undergo a further abdominal operation if needed.

Suppurative disease of the appendages is a contraindication to the vaginal extirpation of sessile myomata, as the manipulation of the uterus may originate an attack of peritonitis; in the experience of Freund, a pyosalpinx ruptured in this way was the cause of a fatal peritonitis.

If the uterus is of great size and the patient is suffering from the pressure, the whole mass is better removed at once by the abdomen. In cases of sessile myoma in women who are near or beyond the menopause it is better to do an

abdominal hysterectomy than to risk a difficult vaginal enucleation of the tumor alone.

When the pedicle is long and attenuated, from 1 to ½ a centimeter, and can be easily reached in the vagina, it may be simply ligated 2 or 3 centimeters from the tumor and divided with scalpel or scissors close to the tumor, and a dry dressing placed in the vagina. An attenuated pedicle which can just be reached within the uterus may be safely treated by torsion, grasping the tumor with museau forceps and slowly turning it until the pedicle breaks off. I have also followed the plan of clamping the pedicle within the uterus with an ordinary pair of artery forceps and then cutting the tumor away and leaving the forceps *in situ* in the midst of a gauze pack for forty-eight hours; after this there is no more danger from hemorrhage, and they are removed.

Fig. 312.—Large Pediculated Submucous Myoma hanging Outside the Vulva.

A stout pedicle, 2 centimeters or more in diameter, may be grasped with bullet forceps, or held by passing two or three sutures through it near the tumor, to prevent retraction when the tumor is removed, and then cut through in such a way as to make anterior and posterior flaps, taking care to do the cutting on the convex surface of the growth. After removal of the tumor the sutures are tied, bringing the flaps together to control bleeding. By observing the principle of effecting the separation on the surface of the tumor, instead of following the natural inclination, which is to amputate the pedicle as high up as it can be reached, the danger of cutting the uterine wall and opening a partially inverted peritoneum is obviated. When the tumor is so large as to fill the vagina, pre-

venting easy access to its pedicle, it is a good plan to seize it with a pair of obstetric forceps and bring it outside, using the forceps as in delivery of a child's head when it has reached the pelvic floor. But if the woman is unmarried or has not borne a child, the attempt to drag a large tumor through the outlet will cause an extensive rupture. I saw a case of this kind in a single woman with Dr. A. K. Minich, of Philadelphia, in 1883, where the tumor was about 6 centimeters in diameter, and it was necessary to suture the perineum after delivering the tumor.

In such cases it is better to make a clean cut through the hymen down beside the rectum to remove the tumor and then to close the cut again. The écraseur is valuable for removing those pediculated tumors lying within the uterus where the pedicle can not be reached in any other way. The tumor is grasped and fixed with museau forceps, while a loop of strong twisted piano wire attached to the écraseur is slipped over the forceps and up over the tumor on to its pedicle. The loop is then rapidly reduced to the size of the pedicle, after which the screw is slowly turned, until the pedicle is cut through. It may be necessary in such a case to divide the vaginal cervix on both sides in order to expose the tumor before it can be grasped and removed with the écraseur.

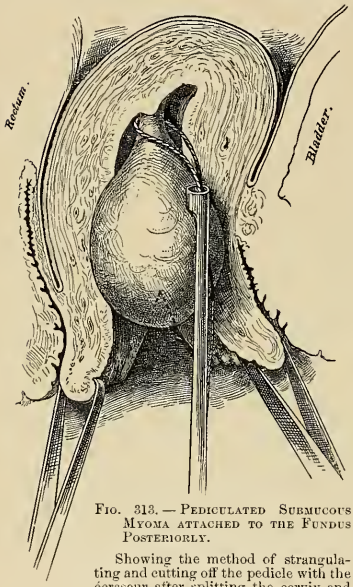

FIG. 313. — PEDICULATED SUBMUCOUS MYOMA ATTACHED TO THE FUNDUS POSTERIORLY.

Showing the method of strangulating and cutting off the pedicle with the écraseur after splitting the cervix and holding its lips apart to expose the tumor.

Sessile submucous fibroids may be attacked in a variety of ways, either removing them piecemeal with forceps and scissors, or they may be enucleated entire by splitting the capsule, or by both methods combined, or, if the tumor is entirely within the uterus and as large as a child's head, it will better be removed by an abdominal incision. The last plan was adopted by Dr. A. Martin, of Berlin, in an operation which I saw, and which is described by Dr. W. Nagel in the *Centralblatt für Gynäkologie*, July 31, 1886, under the title *Exstirpation eines grossen polypösen Myom des Corpus uteri durch Laparotomie.* The tumor measured 16 by 12 by 9 centimeters.

When a portion of the tumor projects from the uterus, or the cervix is sufficiently dilated to allow it, it may be removed piecemeal (morcellement) by grasping the presenting part firmly with the museau forceps and cutting boldly in beside the forceps with knife or stout scissors, removing as large a

wedge-shaped piece as possible; the part adjacent to this is then caught and pulled more into view and attacked in the same manner. After several such wedges have been removed, the cutting may be continued more deeply into the tumor, when the sides will collapse, allowing the remainder to be easily shelled out or cut away. If the tumor is covered by a capsule, it is best to incise this broadly and strip it back before attacking the tumor itself. The latter part of the enucleation may often be easily completed by the fingers, but it is safest to stick to the instruments and to strip the tumor out of its base with blunt scissors, sound, or spatula, while keeping up the traction with the forceps.

Fig. 314.—Sickle-shaped Stout Knife used in Extirpating Large Submucous Myomata.

When the tumor is so dense that the scissors make but little impression on it, the enucleation may be more rapidly effected by cutting out wedges with a sharp sickle-shaped knife, like that shown in the figure; this has the advantage of burying itself deeply in the tissues and cutting as it is drawn toward the operator.

In order to expose a tumor which can not be reached through an undilated cervix the vaginal vault is exposed by retractors, and the anterior and posterior cervical lips caught and held apart with tenaculum forceps, while a deep incision is made on each side, splitting the entire cervix up into the uterine cavity. This lays bare the tumor, which is carefully explored with the finger or a sound to determine its size or location. If it is interstitial the capsule is split from end to end and worked back with a blunt instrument on all sides, so as to expose as much as possible of the fibroid mass beneath. The most accessible portion is now grasped with stout museau forceps and forcibly drawn down, while a wedge-shaped segment is removed with knife or scissors. In this way piece after piece is extracted, until the tumor has been sufficiently diminished in size for the rest to be withdrawn through the cervix.

Hemorrhage is, as a rule, only moderate, and occurs at once after the extirpation. The reason why profuse hemorrhage rarely occurs after these operations can be well demonstrated by the injected specimens, which show that there is no large artery present; as soon also as the tumor is removed the contraction of the uterine muscle acts as an efficient hemostatic.

At the completion of the operation the uterus is thoroughly washed out with warm water, the incisions in the cervical lips closed with silkworm-gut sutures, and the vagina packed with iodoform gauze.

If a sloughing fibroid has been extracted, it is best not to try to unite the

cervical lips, but to pack the uterus with gauze, to be removed in two or three days and followed by daily irrigation.

The plan of splitting the capsule and enucleating the tumor with a blunt instrument is also well adapted to large sessile cervical fibroids. In a case (C. V. B., 3295) upon which I operated Jan. 30, 1895, the anterior cervical lip was occupied by a large dense fibroid tumor choking the entire vagina; the posterior lip was high up in the pelvis and intact. The tumor was sessile, with a base of attachment extending from a point halfway down the anterior vaginal wall to a point high up on the uterus.

A sagittal incision 6 centimeters (2½ inches) long was made over the most prominent portion, through the vaginal capsule, which was half a centimeter thick; the sides of this incision were then peeled back to right and left and the exposed white nodular fibrous surface grasped with forceps and pulled upon, while the enucleation was continued with a blunt instrument, peeling the tumor out of its fibrous investment, which extended above the vault of the vagina up under the bladder as high as the internal os uteri. There was a little bleeding from the bottom of the large hole made in the vaginal vault, which was easily controlled by a continuous buried catgut suture, approximating the sides and diminishing the size of the cavity. The external incision appeared collapsed and irregular and could not be neatly approximated in one line, so I brought it together by a single silkworm-gut, purse-string suture. A dry dressing was applied and an uneventful recovery ensued without suppuration.

Complications.—The following complications may occur in consequence of these operations: Hemorrhage, sepsis, rupture of the uterus, and death from exhaustion.

Hemorrhage is usually moderate, and if the bleeding area can not be seen and controlled by ligature, the flow may be checked by a firm pack of wool or sterilized non-absorbent cotton left in the uterus from twenty-four to thirty-six hours.

I have in four instances encountered a hemorrhage after the removal of a fibroid tumor attached to the fundus which was persistent in spite of the adoption of all ordinary means to control it. The first case was in Philadelphia, Feb. 3, 1889. The patient (M. R.), already almost exsanguine from the constant flow from the pediculated fibroid, bled so fast after the removal of the tumor that I feared she would die at once. I therefore packed the uterus with gauze and completely closed the vaginal cervix with silkworm-gut mattress sutures, passed through both lips and tied tightly. This stopped the flow, and in forty-eight hours I cut the sutures and removed the pack.

I have done the same thing since then in three similar cases in the Johns Hopkins Hospital with a like result. There were no symptoms after this closure pointing either to the damming up of blood in the uterus or to its escape out through the uterine tubes onto the peritoneum in any of the cases.

Sepsis may readily arise after the extirpation of a sessile tumor if the technique is imperfect, and it is most liable to occur when the tumor is deep-seated and difficult of access. I lost under these conditions an elderly woman with a

tumor 3 centimeters (1¼ inch) in diameter at the fundus, firmly fixed and hard to get at. The tumor was much torn and the removal was incomplete, and, in spite of careful cleansing and an intra-uterine pack of iodoform gauze, she died within a week of sepsis.

Rupture of the Uterus.—The gravest accident liable to occur in removing these growths, when they are sessile and intimately connected with the uterine muscle, is rupture or puncture of the uterine wall. This is most serious when the tumor is out of sight in the uterine cavity, because the injury may take place without its becoming evident. Such an accident, fortunately now quite rare, was much commoner when the spoon saw was used to detach the tumor from its bed.

Rupture has occurred once in my experience, with a fatal result (S. L., 1441, June 21, 1892). The tumor, which was about the size of an apple, was situated in the right lateral wall of the uterus, and was removed with great difficulty by torsion and morcellation. The temperature reached 103° the day immediately following the operation, but from that time gradually subsided until it became about normal on the seventh day. There was a persistent bloody oozing and several hemorrhages, the largest being about three ounces. The patient then became irritable and complained of sharp pain in the lower abdomen; up to the eleventh day the pulse and temperature continued about normal, when the pulse quickly became very rapid and small and the temperature fell to 96°, and death ensued within a few hours. The autopsy showed a ragged hole through the uterine wall between the leaves of the broad ligament. Cultures from this area and all the organs were negative.

Anatomical diagnosis of this case: Sapremia; sloughing mass of tissue in the uterus; perforation of uterus into broad ligament; mucous polypus of uterus; submucous myoma; fatty degeneration of heart, liver, and kidneys; general marked anemia.

Death may occur shortly after the operation if the patient is already in a state of profound exhaustion when seen by the surgeon. I lost a feeble old woman, already greatly reduced by hemorrhages, in this way; she had a simple pediculated fibroid as large as two fists, and its removal was rapidly accomplished without difficulty and without any hemorrhage, but she simply died of exhaustion within twenty-four hours, in spite of all sorts of stimulation.

Polypi.—Polypi are soft growths produced by a hypertrophy of the uterine mucosa, often associated with an endometritis, and frequently found in fibroid uteri. Their histological peculiarities are described in Chapter XIV.

The size varies from that of a pea to that of a walnut, and rarely they are larger. Those within the uterine cavity are usually found near the tubal ostia and are more commonly sessile.

Cervical polypi are most frequently pediculated, and protrude from the external os. Upon pressure they often recede into the uterus.

Symptoms.—Hemorrhages are the only clinical sign of polypi. These are rarely severe, and the patients are most often brought to the consultant through the fear of a tumor.

These growths should never be neglected, on account of a liability to malignant changes. Extirpation and a careful microscopic examination is always indicated. If the growth is readily accessible the pedicle should be ligated with a strand of catgut and excised. Those higher in the uterine cavity can be more easily treated by dilating the cervical canal and removing, either by torsion or by écraseur.

CHAPTER XIX.

THE UTERUS AS A RETENTION CYST.

1. Definition.
2. Causes.
3. Symptoms.
4. Diagnosis.
5. Treatment: *a*. Hematometra. *b*. Pyometra. *c*. Physometra.

Definition.—The conversion of the uterus into a sac containing fluid or gas is caused by the occlusion of the lower genital tract at any point from the cervix down. When the uterus alone forms the sac, it is most likely to contain blood during the early childbearing period of life; or pus, and rarely pus with gas, during the later childbearing period and after the menopause.

The sac so formed is made up of the more or less thinned-out uterine walls, and is lined everywhere by the uterine mucosa. The formation of such a sac is brought about by the closure of the three avenues by which the uterus communicates with its neighboring cavities—namely, the uterine openings into the uterine tubes and the cervical canal. When the occlusions are found in the vagina and at the outer extremities of the uterine tubes, the uterine retention cyst then forms but one part of a large irregular sac, the rest of which is made up of the vaginal and tubal cavities with free communications from one to the other.

The names of these conditions, applied from the nature of their contents—"hematometra," "pyometra," "hydrometra," and "physometra"—are really misnomers, and will be misleading unless it is expressly borne in mind that the terms are used for clinical convenience, merely to designate a prominent feature of an affection of the cervix or of the vagina. The real disease, on the other hand, is that which effects the closure, and causes the accidental sequelæ of accumulation and distention above it.

The terms pyuria and pyosalpinx, equally unscientific, are used in exactly the same way, purely for clinical convenience.

Causes.—The causes of retention cysts are various. They may be due to congenital malformation of the vagina, or to the occlusion of one half of a bicornute uterus, or to operative interference with the cervix by knife, cautery, or écraseur, or to an extensive traumatism of the vagina during labor, or to an

endocervicitis, or to cancer of the vaginal cervix blocking the canal and preventing the escape of the secretions from the upper part of the cancerous area.

I have found a pyometra above a cervical cancer so often that I always have it in mind, and if a patient complains much of pain in the lower abdomen I examine for it carefully. It is evident, as the history of the cases shows, that the accumulation takes place gradually from week to week, or with each menstrual period. In cases of vaginal and cervical atresia following the menopause there is no accumulation above, and no symptoms arise unless there is a senile endometritis. I have seen cervical atresia of this kind in a prolapsed uterus and in a large fibroid uterus. Hennig reckoned that three per cent of all women over the climacteric had this acquired atresia.

The size of the sac will depend upon the activity of the secretion and the length of time the obstruction has lasted. It may be a small one, containing but a few cubic centimeters of fluid, incapable of producing any symptoms, or it may attain a great size, even filling the lower abdomen.

Symptoms.—The symptoms produced arise both from the degree of the distention and the nature of the contents. When the sac is tense, constant pain is felt in the lower abdomen, which is too sore to bear pressure, and with this are apt to be associated urinary and rectal disturbances, together with a variety of nervous phenomena common to many pelvic diseases. The pain itself is apt to vary in intensity, and at the menstrual period is paroxysmal, each attack being accompanied by the most intense suffering.

If the cervical or vaginal passage is not perfectly closed there will be a little dribbling leakage of pus or blood, evident on inspection. When pus is retained there may be a moderate fever.

Diagnosis.—Upon making a digital examination, the diagnosis is usually easy if there is a considerable accumulation distending the uterus and it feels like a tense bag; it is more difficult if there is much disease at the point of occlusion and but little accumulation above it, and in this case, as I shall point out, the symptoms deserve a most careful consideration.

To make a thorough examination it is best to put the patient completely under the influence of an anesthetic. The bowels should be well emptied and the bladder catheterized. It also aids greatly in the palpation of a uterine cyst, which may be flaccid and not clear in its outlines, if the patient is first put in the knee-chest position for about three minutes to dislodge the small intestines, skeletonizing the pelvic viscera, as it were. The examination is then continued in the dorsal position.

By the finger inserted in the vagina the point of the occlusion below is fixed as vaginal or cervical, and whether fibrous or cancerous. A vaginal inspection may reveal one or two minute orifices, showing that the closure is not complete.

The extent of the occluded area, whether due to a contraction or a thickening, and the position, size, and relations of the sac itself, must be studied by the bimanual, rectal, and abdominal examination.

With a finger in the vagina and a finger in the rectum, the lower limit of

the atresia at which the rectal palpation is to begin is fixed. Then placing the hand on the abdomen, both to furnish a plane of counter pressure and to aid in palpating, the rectal finger investigates the atresic area above its lower vaginal limit and palpates the uterine body on all sides. A uterus even moderately distended, so as to hold from 50 to 100 cubic centimeters of fluid, lies more or less median and assumes a globular form. Its walls feel tense, rounded, and elastic, often conveying at once the impression of extreme distention.

The dangers of this condition, if left undisturbed, are rupture and general infection; rupture has occurred into the peritoneal cavity, bowel, and bladder. Occasionally such sacs will open spontaneously through the cervical canal.

Treatment.—The treatment in all cases is operative, and holds two objects in view:

First, to evacuate the contents of the sac, and

Second, to keep a channel of normal caliber open into the vagina to prevent a reaccumulation. (For atresia of the vagina and congenital forms see Chapter XI.)

The evacuation is always easy, but it is often most difficult to keep the channel patulous in the cervical region.

Hematometra.—Hematometra is an accumulation of blood within the uterine cavity, brought about by a congenital or an acquired occlusion of the cervix, vagina, or hymen.

In operations to remove the cervical stricture the vagina must first be carefully disinfected, and extreme care taken throughout not to convey the slightest infection into the uterine cavity; then, if a small opening exists, a uterine sound is passed in and, assisted by a finger in the rectum, carried up into the sac. If this succeeds, a small-sized dilator is next introduced and the opening enlarged so as to let the fluid out; this is followed by a larger dilator, until the opening is quite patulous; the evacuation of the fluid may be hastened by mopping out the uterine cavity with iodoform gauze. It is not necessary to wash the uterus out—the less done to its cavity the better. An iodoform-gauze pack is put into the vagina and changed every two to four days. After a week or ten days the vault of the vagina is exposed, and a dilator of the Hegar pattern passed up into the uterus. This is repeated every two or three days for some weeks to insure the canal's remaining open.

If the closure is complete, then the sac must be opened by pushing a large trocar and canula up through the atresia as near as possible in the position of the cervical canal, under the guidance of a finger in the rectum resting on the lower part of the sac. As soon as the trocar is taken out the fluid escapes, and on withdrawing the canula the dilators of different sizes, from small to large, may be used, so as to open the cervix from side to side well up into the uterine sac. The anterior and posterior lips of the fibrous cervix are then excised and interrupted sutures passed through the part of the uterus just above this, drawing it down and attaching it to the anterior and posterior vaginal walls. A pack is then put into the vagina and the wound allowed to heal.

Pyometra.—Pyometra is usually due to a cancer of the cervix blocking up the canal, or to an endocervicitis causing adhesions between the cervical surfaces. Then pyogenic organisms gain access to the retained fluid, and an accumulation of pus results. I have also seen a large fibroid uterus with an intact mucous surface filled with a pale, thin pus, which poured out on amputating the cervix. Pus in considerable quantities is also often discharged from a large uterus containing a sloughing fibroid tumor. It is my intention here, however, to dwell only upon the cases in which the quantity is sufficient to distend the cavity, forming a retention cyst. The ages of five of my cases of pyometra were fifty-seven, sixty, sixty-one, sixty-two, and sixty-seven years, respectively.

The treatment is first to open up the canal and let out the pus, then wash out thoroughly, drain, and keep the passage open. Where the pyometra is due to a senile endocervicitis, a part of the cervix, or a pit at the vaginal vault, representing the cervical canal, can usually be distinguished in the midst of a granular area. Through this the uterine sound may be passed with slight force, followed by dilators, letting out the pus. The uterine cavity is then washed out with a warm saturated boric-acid solution; after this an iodoform-gauze drain should be placed in the uterus, to be removed the next day, after which the cavity is kept open and disinfected by washing it out daily with a 1–10,000 bichloride of mercury solution, using a long, curved glass tube for the douche nozzle. Nitrate of silver solutions of 10 or 5 per cent strength should be applied to any granulating areas about once in five days.

It is not enough simply to dilate the canal and let out the pus, for these cases show a strong tendency to relapse, and must be kept under observation for a long time. The following was a typical case: Mrs. S., sixty-seven years old, had ceased to menstruate at fifty, and had remained perfectly well until within a year, when she was taken with violent pains in the lower part of the abdomen, which she thought were neuralgic. She had fever at the same time, and was so prostrated that she had to go to bed for five weeks, when a slight fetid discharge began to issue from the vagina, and she felt better. This came only when she was up, and was greatest in the morning.

I found a smooth senile vagina and a diminutive cervix with an obliterated canal. The uterus, felt *per rectum*, was tense and globular in form, and as large as a two and a half months' pregnancy. A dilator was easily passed through the closed cervix and 180 cubic centimeters (6 ounces) of thick, fetid green pus escaped. The canal was well dilated and kept open, and she was at once free of all pain and began to improve. She left me, returning several weeks later with some discomfort, when I found the canal contracted, and let out 30 cubic centimeters (1 ounce) of thick pus mixed with blood. After this the canal was kept open by passing dilators at intervals.

When cancer of the cervix is the cause of the occlusion and pyometra, the treatment must be different, and is directed both to the cancerous condition as well as to the pyometra. If the disease has not spread too far beyond the uterus a total extirpation must be performed (see Chapter XXX), in this way curing

the trouble by removing it. If the cancerous affection is too advanced to admit of this radical treatment, a thorough curettage must be made under anesthesia, removing as much of it as possible, and opening a wide channel up into the uterine cavity.

In one of my patients who had a long, irregular cervical canal obstructed by cancer, considerable difficulty was experienced in relieving her of her intense pains attributed to the progress of the malignant disease, until I learned the direction of the canal so well that an irrigating catheter could be passed with ease, and after that the pains disappeared and the irrigation was kept up daily for some months until her death.

Physometra.—Physometra, or tympany of the uterus, is a term used to designate a collection of gas in the uterus usually found in pregnancy or the puerperal condition and associated with sepsis. In gynecological cases the physometra is a rare accompaniment of a pyometra, probably due to the presence of gas-producing bacilli.

I have seen but three cases of physometra, two complicating large sloughing submucous fibroids, and one associated with a pyometra due to a cancerous cervix.

Physometra due to Cancer.—The patient was a black woman, sixty-one years of age, sent me by Dr. C. M. Cheston, of West River, Md., in July, 1890. Although she ceased to menstruate ten years before, she had had hemorrhages for two years. She had no leucorrhea, but complained of a burning feeling across the back and abdomen, and the hemorrhages, which continued, as a rule, for two days, and were followed by a watery discharge. She had several times been insane.

The cervix was high up in the vagina and fixed to the left pelvic wall, and on its right side, easily felt through the vagina and thin abdominal walls, was a globular fluctuant tumor about 10 centimeters (4 inches) in diameter. The cervix was the seat of a cancerous degeneration measuring 3 centimeters (1¼ inch) in diameter, from which numerous shreds of tissue hung down into the vagina with excavated areas between them, freely bleeding when touched. The cancerous tissue was first broken down with the fingers, followed by a sharp curette, and the base, which was superficial, was thoroughly cauterized; it appeared to be one of the slow-growing cancers of old age.

On making a bimanual examination to locate the fundus, the vaginal finger suddenly entered a large smooth cavity, and this was signalized by an audible report like the pop of a gun, and rush of gas out of the sac, followed by 90 cubic centimeters of thick, intensely fetid pus (pyo-physometra). (See Fig. 315.)

The body of the uterus was distended to the size of a four months' pregnancy and its thin walls collapsed without contracting. The sac was douched out with a weak bichloride solution, and the vagina packed with iodoform gauze.

During her convalescence the patient became actively delirious and left for home in twelve days, and subsequently died in an insane asylum.

Physometra due to Sloughing Fibroid Tumors.—In January, 1887, I saw a colored woman, a patient of Dr. H. Williams, of Philadelphia, who was extremely emaciated and hectic, with a dry tongue and a pulse of 140. The abdomen was as large as that of a woman eight months pregnant, tense and tender. Palpation showed that the uterus was converted into a mass of fibroid tumors, but the percussion note over the mass was

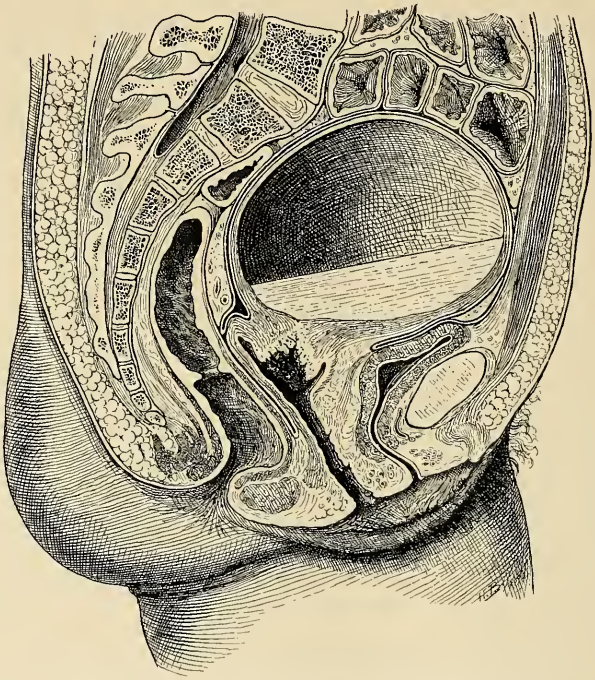

Fig. 315.—Pyo-physometra due to Occlusion of the Cancerous Cervix.

Note the thin distended uterine wall, containing pus in the lower part of its cavity, with a large gas space above. An explosion of gas took place as soon as the instrument broke through the barrier at the cervix.

tympanitic. At the operation I introduced my hand into the uterine cavity and easily removed a sloughing fibroid which would fill a one and a half liter measure, and then broke through the thin septum of a second large sessile fibroid tumor, when two liters of intensely fetid pus escaped, with large quantities of gas. The pulse after the operation was 184; the patient was free from pain and lost no blood, but she died a week later worn out by the prolonged suppuration.

Physometra in Pregnancy.—The commonest of all forms of physometra is that met with in pregnancy or in the puerperium. It is oftenest observed in women with narrow pelves, where labor is protracted and where manual or other operative interference has been found necessary, and is always due to an infection by a gas-producing bacillus.

It is still the common impression that the gas in the uterus is due to the entrance or introduction of air from without, or to the formation of gas blebs in a dead fetus macerated in a moist medium. For example (C. Bamberg, Inaug. Dissert., Halle, 1877), in the case of a primipara with prolapse of the cord, the patient was put in the knee-elbow posture and the cord replaced. The next day the patient had a chill, the pulse rose to 124, and the temperature was 41·4° C., and percussion over the uterus yielded perfect tympanitic resonance. The child was perforated and delivered, and after the escape of the head a quantity of extremely foul gases poured out of the vagina with the fetid waters.

The child is always dead, and the waters, as a rule, ruptured when the tympanites is found.

The true cause of the tympany is the bacillus aërogenes capsulatus, and this is well shown by a case investigated by Dr. George W. Dobbin, the first case in which the bacillus has been demonstrated ante-mortem (*Puerperal Sepsis due to Infection with the Bacillus Aërogenes Capsulatus*, *Johns Hopkins Hospital Bulletin*, Feb., 1897).

The patient, a Polish woman, had been in labor for two days, attended by a midwife. She was found by Dr. Dobbin in a state of extreme exhaustion, with a pulse of 130 to 140, and with a large dead fetus impacted in a pelvis, with a true conjugate measuring approximately 8 centimeters ($3\frac{1}{5}$ inches). There were no regular labor pains, and there was a continuous escape of gas and frothy fluid from the vagina. A sweetish offensive odor was noticeable about the bed, and a distinct bubbling, crackling sound could be heard. The child was delivered by a craniotomy, and immediately following the delivery a large amount of offensive gas escaped from the uterine cavity. Great numbers of the bacillus aërogenes capsulatus were demonstrated in the fetus, placenta, and uterine lochia, and a fatal prognosis was given.

Death occurred on the third day after delivery. No autopsy was allowed. Dr. S. Flexner saw the patient six to eight hours before death, and endeavored in vain to find any evidences of the formation of gas in the tissues remote from the genitalia. But six or seven hours after death the appearances presented were those of extensive gas formation everywhere in the soft tissues and serous cavities, and from the nose and mouth frothy bloody serum exuded, which in cover-slip preparations showed the characteristic bacilli.

This is a confirmation of the prediction made by Welch and Nuttall that many of the cases of supposed entrance of air into the uterine sinuses would be found to be due to infection with a gas-producing micro-organism.

The diagnosis is made by percussing the tympanitic, distended uterus, sometimes helped by noticing the escape of fetid waters mingled with little gas bubbles. The uterus may contain a small quantity of gas, which always assumes

the highest position in turning the patient; in other cases the uterus is so distended that the danger of rupture seems imminent, and breathing is greatly embarrassed by pressure on the diaphragm.

The treatment is to empty the uterus as soon as possible, without reference to the child, which is already dead, and then to wash out the uterine cavity with an antiseptic douche, such as carbolic acid, 3 per cent, and to repeat the douches frequently enough to sterilize and keep sterile the genital tract.

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