

There is nothing so much to be dreaded as an attack of so-called cholera morbus in an elderly person. In such a case we should at once turn our attention to the kidneys, to find out what their condition is. Something also of this kind undoubtedly occurs in those cases which heretofore have been regarded as simply an acute exacerbation of the original chronic malady. I think that I have repeatedly, in patients whose kidneys were in a cirrhotic condition, warded off the worst results after threatening symptoms, such as fever, mental clouding, Cheyne-Stokes breathing, vomiting, and the like, had manifested themselves, by the prompt administration of mercurial cathartics, followed every two or three hours by ten grains of urotropin combined with ten grains of sodium benzoate. In my experience urotropin does not cause untoward symptoms if sodium benzoate is given along with it. Of course, hot saline rectal irrigation also should be used, as in a case of scarlatinal suppression. Against the presence of the colon bacillus in the kidneys urotropin is at least as much of a specific as it is against the bacillus typhosus.

In all cases of chronic interstitial nephritis our prognosis must always be uncertain, because we can never be sure how much working kidney substance these patients may still have. Not uncommonly the most unlooked-for improvement in the action of the kidneys will occur, and then continue until it is suddenly cut short by some error of diet, such as a too hearty meal of meat, particularly if taken at night. With reference to this point we may remark that there is an apparent difference in the activity of proteid metabolism between the day and the night hours. We have a whole series of affections, marked chiefly by nervous disturbances, which are evidently due to various toxæmias, and which are all characterized by being worse in the early morning hours. Many cases of melancholia and of migraine, and all cases of Graves' disease show this peculiarity. In Graves' disease the twenty-eight symptoms, aside from the goitre and exophthalmos, which I have found to be characteristic of this singular malady, are, without exception, worse in the morning. In my notes I have records of no less than eight who could not write or sew in the morning, but could do so in the evening. In all such cases of melancholia, migraine, or Graves' disease, I enjoin entire abstinence from red meats, especially beef, and most of all at night. Then again the first attacks of gout and of peptic asthma always occur after midnight. I have repeatedly noticed that many patients can take beef at breakfast or at lunch, but if they take it at evening dinner it is sure to cause a very troubled sleep. All these particulars should be borne in mind when we aim to regulate the life of a man who comes to us with a high-tension pulse and rigid arteries.

The chemistry of these night-generated poisons is yet to be worked out, but there can be no doubt that they have much to do with changes which take place in the alimentary canal, changes connected with the nitrogenous elements of food, particularly the red meats; and every person with cirrhotic kidneys should be enjoined, like an asthmatic, not to eat heartily after midday.

For the rest, I may say that the greatest remedy for auto-infection and the best prophylactic against the manifold dangers of chronic interstitial nephritis is life in the open air. Such a case needs a milder climate in winter, just as much as any bronchitic or phthisical patient does. Intestinal antiseptics are of the greatest value; and, as to special medicinal remedies, I have great faith in the employment of gr. $\frac{1}{4}$ of bichloride of mercury, t.i.d. for one week out of three weeks, and of small doses (not more than five grains) of sodium iodide t.i.d., to be taken for prolonged periods.

There can scarcely be a stronger contrast than that which exists between the clinical features of a typical case of chronic interstitial nephritis and those of an equally typical case of chronic parenchymatous nephritis. The first is most commonly a disease of middle or of past middle life, and is associated with the changes of advancing years. Parenchymatous nephritis, on the

other hand, attacks the young oftener than the aged, and is not infrequent among children. In kidney cirrhosis albuminuria is usually insignificant in amount, repeatedly is absent, and at no time is of much import as such. In parenchymatous nephritis albuminuria is steadily present and abundant. But, above all, in interstitial nephritis the patient is never waterlogged, unless from consecutive heart disease. In parenchymatous nephritis there is from the beginning a tendency to a general leakage of water into the tissues, so that it often appears first in the face instead of the feet, and the mechanism of this dropsy remains, up to the present time, wholly unexplained. Along with these conditions, anæmia occurs early and is persistent, so that in view of all these differences there can be little doubt that the systemic poisoning in the one disease is quite different in kind from that in the other.

The anatomical changes in the kidneys in these two forms of nephritis are equally contrasting. The capsule of the tough cirrhotic kidney is found to have become almost an integral part of the shrunken organ. It so dips into and adheres to the kidney substance that we have to tear away bits of this if we wish to strip off the membrane. The capsule of the large white kidney is stripped off the soft organ as readily as the rind is from an orange. It is true that these changes are not uniformly restricted to diseased kidneys of either kind, and interstitial changes may be found in parenchymatous nephritis; furthermore, kidneys which are white but not large are not uncommon. But the clinical differences still remain as marked as ever; and, moreover, in the white kidney we find conditions which readily explain why those patients are so difficult to relieve or cure. The glomeruli are pressed upon by masses of the round cells, which fairly stuff Bowman's capsules, and the tubules are choked with every kind of debris.

Now it would seem that if we only had in the kidney the double circulation of the lung, all this ruinous accumulation might be got rid of. We have interstitial pneumonia, if the lung exudates are not removed, just as we have interstitial nephritis also in the kidney if it remains clogged with inflammatory exudates; but interstitial pneumonia is rare, because in the lungs we have the double currents of the pulmonary artery and of the bronchial arteries, and between them the immense exudates of a croupous pneumonia are got rid of, usually before the stuffed air cells are damaged. In the kidneys, on the other hand, we have the one renal artery, which answers to the pulmonary artery in the lungs, and nothing more. To expect that the kidney capsule will allow enough blood-vessels to enter through it to help absorption would be even less warranted than to expect help from the blood-vessels of the pleura to assist in the removal of the inflammatory exudates in the air cells.

We seem, in this condition, to have an obstacle which wears the aspect of a mechanical obstruction quite insuperable to our ordinary medical remedial measures. The attempt to increase the outflow of watery urine by prescribing diuretics for the relief of the dropsy oftener fails than succeeds. We may temporarily succeed by trying one diuretic after another, but the cause of the dropsy remains and the œdema returns just the same as ever. All we can do, then, is to throw upon the skin and bowels the task of working vicariously for the kidneys; but in the majority of instances we make no real headway. Some patients with chronic kidney disease, with dropsy and persistent albuminuria, recover; but whether they do so on account of our therapeutics, or whether they recover spontaneously, we cannot tell.

Such conditions would suggest the advisability of having recourse to surgical measures of relief for the embarrassed renal circulation, and this subject has of late been prominently brought to the attention of the profession by Dr. George M. Edebohl, of New York. In a communication published by him in the *New York Medical Record*, March 28th, 1903, he gives reports of 51 patients, 29 females and 22 males, in whom he had performed decapsulation of the kidneys for chronic nephritis of the inter-

stitial, diffuse, and parenchymatous forms. Of these, 39 cases were more or less benefited, including 19 completely cured, none being considered cured unless they had been for six months free from any signs in the urine of diseased kidneys. For further particulars the reader should consult his paper; but there can be no doubt that this procedure was successful in a sufficient number of patients with serious renal changes to merit its extended trial by other operators.

That the beneficial result followed upon a freer circulation within the kidneys, upon the removal of the constricting capsule, there can be no doubt; but whether an additional factor exists in the development of a new supply of blood-vessels formed in the perirenal tissue after the capsule has been removed, is doubted by Dr. Harold A. Johnson, of San Francisco,¹ who decapsulated the kidneys of ten dogs and examined the kidneys at various dates after the operation. He states that a new capsule is formed about the kidneys without the development of any considerable anastomosis between the renal and the perirenal vessels. The objection to this observation is that the results of such an operation upon healthy kidneys in dogs scarcely prove that a new capsule will be formed in human subjects with kidneys so embarrassed in their circulation that new channels can be taken advantage of whenever possible, as commonly happens in hepatic cirrhosis.

In the management of a case of general renal dropsy, with abundant albuminuria, I may add that I have repeatedly observed that the kidneys start up, as it were, and carry off the water when milk and a fluid diet are given up, and solid food, including meat, given instead, with a restriction of liquids. The effects of such a change in regimen, however, should be watched carefully.

As to diaphoresis, the subcutaneous infiltration makes the skin tense and glossy, and thus closes the sweat ducts whose opening on the surface is at an angle. A thorough oiling of the skin, therefore, before using our diaphoretic measures, makes the action of the sweat glands much more effective.

William H. Thomson.

URAL; URALUM.—This drug is also known as *chloral-urethane*, and, as its name implies, it is a compound of urethane and chloral. It occurs as a white crystalline body, readily soluble in alcohol, but almost insoluble in water. It is decomposed by hot water.

Ural was introduced by Dr. Poppi, of Bologna, in 1889, as a better hypnotic for neurotic patients and the insane than are most of the drugs employed for this purpose. He considered it to be more active than urethane and more safe than chloral, and better borne by the stomach. In the hands of others it has not furnished such favorable results, and has not secured any position as a hypnotic remedy.

Beaumont Small.

URANIUM ACETATE AND NITRATE, UO₂C₂H₃O₂·2H₂O and UO₂(HNO₃)₂·6H₂O, are yellow crystalline salts which are soluble in water, and have been employed to some extent in diabetes in dose of 0.01–0.02 gm. (gr. $\frac{1}{4}$ – $\frac{1}{2}$). It is claimed that they stimulate the sugar-consuming cells of the body. The acetate has also been used as a catarrh snuff or in solution as a nasal douche. They are powerful drugs, and there is very little clinical evidence in favor of their employment at all.

W. A. Bastedo.

URESIN is a double citrate of lithium and urotropine, which, according to Kudintseff and Soanki, has the power of diminishing the excretion of uric acid and of dissolving gravel. The dose is 1 gm. (gr. xv.).

W. A. Bastedo.

URETERS, PATHOLOGY OF.—**MALFORMATIONS OF THE URETERS.**—The ureters take their embryonic origin from the lower part of the Wolffian duct. Malforma-

tions of the ureters are, on the whole, not very rare. If the kidney of one side is absent the ureter of the same side is generally absent also. Sometimes, however, in this case the ureter may exist, and then usually as a small duct. Absence of one kidney and ureter has been observed without any other malformation of the urogenital tract but kryptorchismus. Usually, however, in such cases other malformations are present, and uterus unicornis, absence of the vas deferens and a seminal vesicle, or a malformation of one side of the prostate, have been found.

Both kidneys and both ureters may be missing; in one case of this kind the fetus lived ten minutes after birth. In cases in which the kidney was but incompletely developed, the ureter also showed incomplete development. In one such case the ureter did not reach the bladder; in another it had an abnormally small lumen.

A partial duplication of the ureter is not rare, especially in its upper part. Double ureters usually unite before they enter the bladder. A perfect duplication of the ureters is rare; in such cases the points of entrance into the bladder are generally near each other. They may, however, end as much as 1.5 cm. removed from each other. Double ureter is sometimes combined with a horseshoe kidney; in such a case three or even four ureters may apparently originate from one kidney. Sometimes two ureters end in two separate parts of one kidney on the same side. In this case the ventral ureter connects with the lower and ventral kidney, the dorsal ureter with the dorsal kidney, situated nearer the diaphragm. The first ureter enters the bladder at a higher level than the second ureter. This arrangement is similar to the one found in a doubling of the Wolffian duct. In the case of doubling of the ureter the pelvis of the kidney may also be double, or may be single; the latter occurrence is, however, much less frequent. Double ureters may be found on both sides or on one side only.

Of clinical importance are congenital valvular projections of the mucous membrane of the ureter, which are sometimes met with. These may be found in all parts of its course, especially, however, at the place of its entrance into the bladder and pelvis. If the concavity of such projections is directed toward the kidney they may obstruct the flow of urine and cause hydronephrosis. Such valves may become fixed by external adhesions. Congenital torsion of the ureter may have a similar significance.

Besides a valvular obstruction a congenital stenosis or atresia has been found, especially in the lower part of the ureter. It may be followed by a great dilatation of the upper part of the ureter and by a forward bulging of its lower part either outside or inside the bladder. In the latter case such a diverticulum may cover the internal meatus of the urethra. Such diverticula of the ureter have, however, also been found in cases in which the ureter was patent.

The ureters may enter the pelvis of the kidney in its centre instead of at its lowest point. Under these conditions the collection of urine in the lower part of the pelvis may entirely occlude the opening of the ureter. A similar result may be produced if the insertion of the ureter into the pelvis is an oblique one. A projecting part of the ureter may become pressed against the opposite side of the wall of the ureter by the collection of urine. Instead of running straight down to the bladder the ureter may be bent in its further course so that it forms an angle.

The ureter may enter the bladder higher up than is normal, or it may end in the urethra (colliculus seminalis), in the vesiculæ seminales (in the male), or below the external meatus of the urethra and in the uterus or vagina (female). A double ureter may have one normal and one abnormal ending.

INFLAMMATION OF THE URETERS.—Inflammation of the ureters rarely starts in the ureters themselves. This may, however, be the case if a calculus becomes impacted in a ureter, or if during labor the ureters become compressed and injured. The mechanical lesion may be

¹ *Annals of Surgery*, April, 1903.

followed by a secondary infection with micro-organisms. Usually inflammation of the ureters is secondary to inflammatory changes in the kidney and pelvis of the kidney, to cystitis, or to inflammation of the ovaries or Fallopian tubes, or of the connective tissue included in the fold of the ligamentum latum. In the latter case the infection is carried to the ureters through the lymphatics; in the two former cases the propagation of the infection may take place either through the urine or through a continuous growth of the micro-organisms along the mucous membrane. On the whole, the ureters are not very favorable to inflammatory changes. Cystitis may exist for many years without the affection extending to the mucous membrane of the ureters. Inflammation may be found after a primary cystitis only in the pelvis of the kidney, the ureters remaining unaffected. These facts seem to indicate that the propagation of the infection from the bladder upward takes place principally through urine carrying micro-organisms and regurgitating into the ureters. Such a regurgitation can easily take place if, through an obstacle to the outflow of urine in the urethra for instance, first a dilatation of the ureters takes place. In this case the openings of the ureters into the bladder soon become enlarged as well. Experiments have shown, however, that even without a previous dilatation of the ureters, if the bladder is slowly distended through injection of a solution of methylene blue, the injected fluid in a certain number of cases may pass upward into the ureters.

Propagation of the inflammation of the kidney to the ureters may take place in cases in which the pelvis of the kidney is infected, as, for instance, in cases of stone in the pelvis or of pyelonephritis following abscesses in the kidney.

Anatomically, the mucous membrane is red (hyperemia), oedematous, infiltrated by leucocytes, while its epithelial cells are thrown off in increased numbers. The infiltration with leucocytes may go so far that a purulent inflammation is produced. In severe cases in which decomposition of the stagnating urine takes place, we may find a diphtheritic inflammation of the mucosa. Dark membranes are formed, consisting of a fibrinous exudate and the necrotic superficial parts of the mucous membrane.

In severe chronic inflammations the mucous membrane may hypertrophy and form villous projections; in other cases a simple thickening takes place through proliferation of the connective tissue. The inflammation sometimes proceeds from the ureter to the connective tissue surrounding it, the latter becoming greatly thickened in consequence.

In certain cases of chronic inflammation (*ureteritis granulosa, nodularis, follicularis*) we find small gray milky nodules in variable number disseminated in the mucous membrane of the ureters. They consist of collections of small round cells similar to or identical with the lymphocytes. It has been maintained that lymphoid tissue is normally present in the ureter and other mucous membranes. This is, however, not the case. In newborn children, and also in healthy adults, it may be entirely absent, although it may be found in cases in which no other sign of a past inflammation can be determined. If these nodules, however, are present in large numbers they probably point to a chronic inflammation. The mucous membrane around these grayish nodules is usually red and oedematous. These nodules have also been observed in typhoid fever and in diseases of the kidneys and of the heart. A similar anatomical sign of inflammation has been observed in the conjunctivæ.

Ureteritis Membranacea.—An inflammation has been described in which membranes, several centimetres long, are said to have been expelled from the ureters. So far a confirmation through post-mortem examination does not seem to have been recorded, this contention being based only on clinical evidence.

A condition without much clinical significance, yet of pathological interest, is the *ureteritis cystica*. In this condition the ureter is covered with superficial cysts. They

are especially frequent in the upper half of the ureter, near the pelvis of the kidney; they are usually of the size of a pinhead and sometimes they are twice as large; they contain a material like mucus. Not rarely they are distributed in small groups in the mucous membrane, which may occasionally form polypoid processes containing these cysts. They are often found combined with inflammatory conditions of the ureters. They take their origin from the "Brunnschen Epithelnester," formed by an ingrowth of the ureteral epithelium into the connective tissue. These epithelial nests may branch and form secondary processes; at the surface they may become occluded by connective tissue, and the cells in their centre may become dissolved. In this way cysts are formed. The degenerating epithelial cells, together with certain products of the blood, may give rise to structures which probably incorrectly have been believed to be micro-organisms and the cause of the cyst formation. The structures, described by different authors as micro-organisms, are not identical, and they have also been interpreted in a different way by different investigators (myxosporidia, coccidia). Similar structures seem to be present in the colloidal cysts of the thyroid.

TUBERCULOSIS OF THE URETERS.—A primary tuberculosis of the ureters is not known. Tuberculosis of the ureters is either descending, following tuberculosis of the kidney and of the pelvis of the kidney, or ascending, following tuberculosis of the bladder. How far the urine containing shreds of tuberculous material and bacilli is responsible for this propagation, and how far the bacilli spread by way of the lymphatics, has not been determined. That the urine is an actual source of infection is shown by the fact that in descending tuberculosis it is not uncommon for the narrowest part of the ureter near its entrance into the bladder to be affected, the upper parts remaining free. Involvement of the ureter in chronic tuberculosis of the kidney is frequent. The first tuberculous lesions of the ureters consist of small disseminated gray nodules of tuberculous tissue in the mucous membrane. They caseate and then form small ulcers. In the beginning the epithelium covering these nodules may have markedly proliferated, becoming horny, and forming cholesteatomatous plaques. In the mean time new nodules are formed near the first one, which also caseate and unite with the first. The outer part of the ureter and the surrounding tissue become thickened through proliferation of the connective tissue. The process progressing in this way, the ureter becomes often transformed into a tortuous tube, thicker than a finger, with cheesy masses inside and a thick fibrous wall. These cheesy masses may become incrustated with lime salts. The ureter frequently remains open, but it may become occluded by the cheesy masses or shreds of tuberculous tissue from the kidney. In ascending tuberculosis the same changes are first to be found in the lower half of the ureter.

SYPHILIS.—Lesions of the ureter, undoubtedly due to syphilis, have not been described. In certain cases of syphilis an inflammatory thickening of the wall of the ureter has been found. The syphilitic nature of this inflammatory change, however, is doubtful.

FOREIGN BODIES IN THE URETERS.—Stone in the ureter, in cases known so far, has been secondary to stone in the kidney or stone in the pelvis of the kidney. If small, such a stone may easily pass the ureter. If somewhat larger, it will be held back at the entrance of the ureter into the bladder. A large stone may obstruct the lumen of the ureter at any place, either permanently or for some time, until the force of the stream of urine presses it down into the bladder. In passing, a stone may injure the mucous membrane of the ureter and cause hemorrhage. If kept back at a certain place, hydronephrosis may follow. The outer wall of the ureter may become thickened through an inflammatory reaction, or the pressure of the stone may cause atrophy of the wall of the ureter, which can be followed by an actual rupture. In this way a stone may penetrate into the surrounding connective tissue, into the peritoneal cav-

ity, or into the intestines; or if the retention of the stone occurs at the lower end of the ureter, the stone may produce an artificial passage into the bladder.

The injury caused by a stone may be complicated by the settling of micro-organisms at such places; then pyelonephritis and pyonephrosis may follow, or near its wall at the place of injury an abscess, lodging the stone, may arise at the side of the ureter. If the ureter is entirely occluded by a stone, its lumen below the obstruction may become considerably shrunken.

In tropical and subtropical countries distomum hæmatobium and its eggs may live in the wall of the ureters, and may cause papillary outgrowths of the mucous membrane. Another parasite to be found, though rarely, in the ureters, is *eustrongylus gigas*. In cases of hemorrhages from the ureter or kidney, or of chyluria, coagula of blood or lymph may fill its lumen.

OBSTRUCTION OF THE URETERS.—The causes of obstruction to the flow of urine in the ureters may be the following: Calculus in the ureter, stricture in the ureter through inflammation of its mucous membrane, or through inflammation of the surrounding connective tissues. Compression of the ureter through exudates in the para- or perimetrium, or through enlarged lymph glands or a tumor. Obstruction caused by a projecting tumor, by tuberculous products, or by a coagulum of blood or lymph, by parasites, or by compression of the ureter through an abnormally situated branch of the renal artery. The formation of abnormal folds, or of a valve caused by the obliquity of the ureter's insertion into the renal pelvis, or a twist of the ureter on its long axis, may also obstruct the flow.

Inflammatory changes in the mucous membrane leading to a stricture may be caused by the injury of a calculus, or by an inflammation with formation of diphtheritic membranes. Stricture may follow an ascending inflammation, originally caused by the gonococcus; whether, however, the changes in the ureters are also caused by the gonococcus or are produced by a secondary infection with other organisms, is not certain.

Obstruction to the flow of the urine in the ureters may be caused by changes in the bladder or in the urethra. If the bladder cannot contract sufficiently, obstruction in the ureters may follow. The urine collecting behind the obstacle causes a dilatation of the ureters. The ureter may not only become dilated, but also tortuous. If the condition is a chronic one, the wall of the ureters becomes thickened; this thickening is produced by hypertrophy of the muscular coat. Inflammatory changes also are frequently present in the ureteral wall, contributing to the thickening. The result of a chronic obstruction is hydronephrosis and destruction of the kidney. If, as is often the case, micro-organisms are present at the point of lesion, or are added secondarily, a pyonephrosis follows. If an artificial stenosis of the ureter is produced in animals, hydronephrosis does not necessarily follow. Atrophy of the kidney may be the only result, and if a hydronephrosis does follow, the fluid may contain urine (uronephrosis).

In the case of a congenital obstruction to the flow of urine, hydronephrosis does not necessarily follow; simple atrophy of the kidney of the affected side may be the only result.

TUMORS OF THE URETERS.—Primary tumors of the uterus, rectum, bladder, and kidney may secondarily affect the ureters. Carcinoma of the uterus frequently penetrates the wall of the ureters, causing hydronephrosis. In several cases one ureter was in its whole circumference included in a fibroma of the uterus, probably to be explained by secondary concrescence of originally separated fibromatous nodules.

Primary tumors of the ureters and the pelvis of the kidney are rare. Benign papillary tumors and carcinoma have been found most frequently; myoma striocellulare, sarcoma, and endothelioma are very rare. The ordinary papilloma consist of a fibrous centre covered by one or two rows of epithelial cells. Tumors showing a transition from typical benign papillomata to carcinomata of a

papillomatous structure have been found. Typical papillomatous carcinomata also have been described; these are rarer than the benign papillomata.

The fact is of importance that in several well-authenticated cases the epithelium of a papilloma which had existed for some time as a benign tumor, later on began to infiltrate the deeper tissues, thus becoming a carcinoma. Besides the papillomatous variety of carcinoma, the ordinary non-papillomatous carcinoma has been found in the ureters and in the pelvis of the kidney. It may have the character of an alveolar carcinoma with cuboidal cells, or it may be of the cylindrical-celled or of the squamous-celled variety. Transformations of the epithelium of the ureter into the stratified squamous type have also been observed without the presence of a tumor (leucoplasia).

It is of interest to note that quite a number of benign papillomata, or indeed of carcinomata, may be present at the same time, and that tumor nodules may even extend the entire length of the ureter, reaching the bladder. The favorite sites for the isolated as well as for the multiple tumors are the pelvis of the kidney and the vesicular end of the ureters. This suggests a certain analogy to the favorite seat of oesophageal neoplasms.

The multiplicity of malignant tumors may be caused by implantation of cells carried away by the urine and kept back at places where a greater resistance to their passage is offered, or to metastatic growth along the lymph channels. Whether the multiple occurrence of the benign papillomata is to be explained in a similar way, is still doubtful. In several instances the origin of the neoplasms has been connected with the presence of a stone in the ureter. No convincing case, however, has been reported so far. A problem is thus presented similar to that in connection with the gall bladder.

The tumors of the ureters may cause hydro-, hæmato-, and pyonephrosis. Carcinoma of the ureters may spread to the kidney, bladder, seminal vesicles, lymph glands, and peritoneum, and may cause metastases in the liver pleural cavity, and lung. *Leo Loeb.*

URETERS, SURGERY OF THE.—The ureter is a flattened, whitish tube which connects the pelvis of the kidney with the bladder. It begins at the level of the twelfth rib, about 4 cm. (1.6 in.) from the median line. It crosses the pelvic brim one-third of the distance, that is, about 3 cm. (1.2 in.) from the median line, to the anterior superior iliac spine. It can be palpated just above the brim of the pelvis. In the pelvis it lies just in front of the common iliac artery and then curves sharply forward to pierce the base of the bladder (Fig. 4839). In the abdomen it lies upon the psoas magnus muscle. Either the right or the left ureter can be exposed without opening the peritoneum, through an oblique incision parallel with and a little above Poupart's ligament. The ascending or descending colon is freed and pushed toward the median line, exposing the ureter.

The length of the ureter is from 25 to 30 cm. (10 to 12 in.). The function of the ureter is simply to transmit urine which collects in the pelvis of the kidney. This is done by a slow peristaltic action. The portion of the ureter close to the bladder can be palpated in man through the rectum, while in woman the lower end of the ureter can be palpated to a distance of 5-8 cm. (2-3 in.) through the vagina. If there is a stone in any portion of the ureter the lower end is said to be extremely sensitive.

Traumatism.—Injury to the ureter is not common. It may be opened by stab or gunshot wounds, or torn by the passage of a wheel across the abdomen. If it is torn clear across, little or no blood will enter the bladder, so that the urine passed from the bladder may be entirely clear. If it is partially torn, some urine from the injured side may reach the bladder. In either case there will be a retroperitoneal extravasation of urine, with more or less obstruction in the corresponding kidney. Such a condition was formerly treated by repeated aspirations. At the present time the proper procedure is to expose the

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

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

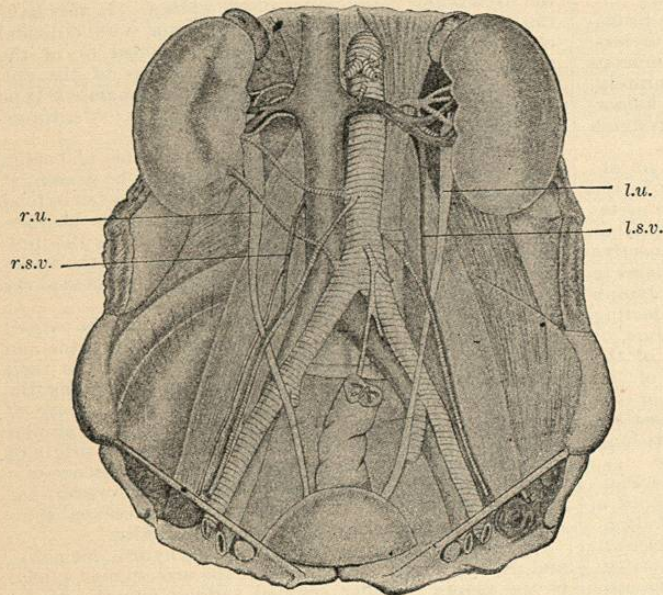


FIG. 4830.—Relations of Ureters. r.u., Right ureter; l.u., left ureter; r.s.v., right spermatic vein; l.s.v., left spermatic vein.

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

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

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

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

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

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

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

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

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

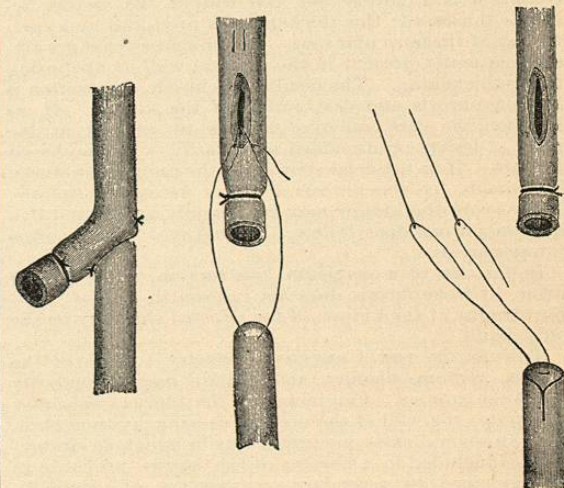


FIG. 4840 Illustrates Different Methods of Reuniting the Cut Ends of the Ureter after a Portion of the Tube has been Resected. (Van Hook's lateral uretero-ureteral anastomosis.)

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

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

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

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

Edward Milton Foote.

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

Edward Curtis.

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

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

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

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

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

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

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

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

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

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

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

INJURIES OF THE URETHRA.

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

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

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

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