

**Urine Segregation.**—I abstract a description of this instrument and its employment from the writings<sup>1</sup> of its inventor, Dr. M. L. Harris, of Chicago.

The chief part of the instrument (Fig. 126) might be described as a twin catheter, the shaft of which is inclosed in a metal sleeve. Each half of the double beak may be rotated outward independently. To the outer extremity of each half glass bottles may be attached to receive the urine, and a rectal lever is held to the shaft of the catheter by means of a fulcrum and spring. The whole instrument may be sterilized by boiling.

Anesthesia is obtained by injecting into the rectum—

R Antipyrin.....	1 gramme
Tr. opii.....	1 c. c.
Water.....	90 c. c.

This solution produces anesthesia of the floor of the bladder after thirty minutes, which time is employed in preparing for the operation.

The anterior and the posterior urethra are successively washed, and the bladder irrigated until the fluid returns clean. Then 60 c. c. of a 5% solution of suprarenal extract is injected into the bladder and allowed to remain there ten minutes. This is then drawn off, the bladder washed once more, and 15 to 20 c. c. of a 2% cocain solution is injected and allowed to remain in the bladder for six minutes.

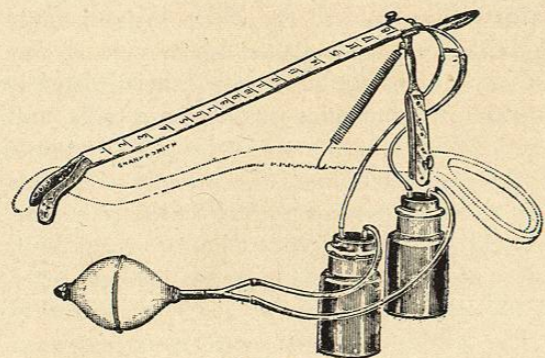


FIG. 126.

This is drained off, the bladder irrigated once again, and the patient is ready.

With the patient lying on his back, his knees drawn up, the lubricated catheter is introduced very gently until its beak is well within the bladder. During this time the outer ends of the catheter are attached to a short circuit of rubber tubing. The fulcrum crutch is attached to the shaft of the catheter some 2 or 3 cm. from its outer

<sup>1</sup> J. of the Am. Med. Ass'n, 1898, xxx, 236. Med. Record, 1899, lv, 457. Annals of Surgery, 1900, xxxii, 149.

extremity. Now the rectal lever is lubricated and introduced into the rectum. It is attached by the fulcrum and spring and carefully held in the median line (it has a tendency, before the catheter is turned down, to slip off sideways). Finally, each half of the catheter is rotated gently downward through an arc of 120°, or thereabouts, until it is felt to rest gently upon the floor of the bladder (too great a pressure might occlude the ureter). The whole instrument is then gently withdrawn until it rests against the neck of the bladder. The shaft of the rectal lever should now be in a line with the patient's body, the catheter inclined obliquely. With the instrument in this position, the end of the rectal lever projecting between the two catheters elevates the floor of the bladder into a ridge on each side of which is a pocket, each pocket drained by a separate catheter. The short-circuit tube is now removed and the fluid in the bladder allowed to drain off. It may be necessary to wait a few minutes until the instrument becomes filled with urine. Each curved tube is then attached to its own bottle; the straight tubes are connected again by the short-circuit tubing after the flow of urine has been started by a few gentle squeezes of the aspirating bulb. Vigorous aspiration is only harmful. It causes hemorrhage by sucking the mucous membrane into the instrument.

The instrument must usually be left in place for thirty minutes in order to obtain enough urine to examine. Harris estimates the normal functional capacity of the kidney at 0.16 c. c. of urine per minute per kilo of body weight. This is an average estimate as the urine descends intermittently. After the desired amount of urine has been obtained, the catheters are folded back, the rectal lever detached, the instrument extracted, and the operation closed by a final washing of the bladder.

**Advantages and Disadvantages.**—In attempting a comparison between the ureteral catheter and the urine segregator it must be remembered that the latter has a much more restricted range of usefulness than the former. The urine segregator has no therapeutic uses while the ureter catheter has many. The instruments can only be compared in the field of diagnosis. Even in this field comparison is not easy, for the surgeon who is accustomed to using the ureteral catheter will obtain better results from it, while he who is familiar with the segregator will find this the more useful. In general it may be said that the segregator is by far the easier instrument to use. Yet this is not said in order to encourage a careless handling of the instrument, for carelessness is more likely to cause the operator to fail than any other one thing. Two errors may be committed. The instrument may be so clumsily arranged that the watershed is not



erected between the two catheters, and consequently the two kidney urines are not segregated: ordinary caution avoids this mistake. The second possible error is the rough introduction of the catheter, whereby the prostate or the bladder is made to bleed. This bleeding is the real bugbear of the operation. Repeated irrigation will cleanse the bladder of pus, but if once a hemorrhage is started irrigation only increases it. It is in order to prevent the small amount of hemorrhage which is almost inevitable that the suprarenal extract is employed in the bladder. There are certain conditions, such as intense cystitis, tumour, stone in the bladder, or prostatic hypertrophy of any size that make segregation impossible, either on account of the hemorrhage, the vesical irritability, or the impossibility of erecting the watershed. It is in these very conditions, however, that catheterization of the ureter is most difficult, and in any one case the choice of instrument will depend on the habit of the operator. Either may fail at one time and succeed the next; indeed, it is a rule that positive evidence derived from either procedure is valuable, while negative evidence—i. e., the absence of urine—is not to be regarded as final. The inconsistencies and imperfections of ureteral catheterization with its 20% to 40% of failures and its danger of infecting the kidneys are graphically set forth in Harris's latest article.<sup>1</sup> Unfortunately segregation gives little better results.

In examining the urine, whether obtained from the segregator or the catheter, the presence of blood and of the albumin due to it must always be discounted, for either instrument is likely to cause hemorrhage, the one in the bladder, the other in the ureter.

The indications for the use of these instruments are best laid down with the description of each particular disease, and no attempt will be made to discriminate between them. The surgeon will use whichever he sees fit. I may confess that I am not particularly enthusiastic about any form of urine segregation. I have employed the procedure in order to determine the presence of both kidneys, I recognise its applicability to the diagnosis of unilateral renal tuberculosis, and I have employed the ureteral catheter to diagnose a suspected ureteral stone. But I am absolutely opposed to the free use of the cystoscope or the ureteral catheter as a familiar means of diagnosis. The clinician should do as well without them; the patient much better. The therapeutic uses of the ureteral catheter are not important, and their description may be brief.

<sup>1</sup> How great this danger of infection may be it is impossible to estimate. The advocates of the segregator make a great to-do about it while expert catheterizers do not take it into account at all. I can only say that I have several times catheterized the healthy ureter through an inflamed bladder and have seen no bad result.

**Therapeutic Uses.**—The ureteral catheter may be employed for three purposes:

1. To wash out the pelvis of the kidney.
2. To cure hydronephrosis or fistula.
3. To dislodge ureteral stone and to dilate stricture.

1. Kelly, Pawlick, Albarran,<sup>1</sup> and Casper<sup>2</sup> have done pioneer work in washing out the pelvis of the kidney through the ureteral catheter for the cure of pyelitis. The solutions employed have usually been boric acid and nitrate of silver, 1:1,000; 10 to 30 c. c. may be injected at a time. Casper once employed 10 c. c. of 2% nitrate-of-silver solution in a case of acute pyelitis. Its effect was as magical as that produced at the neck of the bladder in acute gonorrhoeal cystitis!

It has been my experience that simple pyelitis—and this treatment is avowedly only applicable to the simplest cases—is readily controlled by internal medication; while complicated cases may be held in check by medication and often cured by operation. In view of the further fact that irrigation of the renal pelvis has been followed by chills and death, I shall not perform the operation.

2. Albarran<sup>3</sup> has been particularly successful in curing hydronephrosis and renal fistula by means of the ureteral catheter. He leaves the instrument in place a week or two and in some cases changes from a smaller to a larger catheter every few days, going from a No. 6 or 7 French to a No. 12 or 14 French. He claims to have achieved admirable results, but one cannot help fearing that they may prove only temporary.

3. Stones have been successfully washed from the ureter by injections of olive oil, a procedure which is alleged to alleviate and shorten attacks of renal colic. Kelly and Albarran have dilated ureteral strictures by the use of bougies. Here, again, the permanence of the cure may be doubted. Before using the instrument in these or in any other conditions, the possibility of infecting the kidney must be seriously considered and guarded against.

<sup>1</sup> *Revue de gyn. et de chir. abdom.*, 1897, i, 457.

<sup>2</sup> *Handbuch der Cystoskopie*, 1898, p. 186. *Berl. klin. Wochenschr.*, 1899, xxxvi, 27.

<sup>3</sup> *Guyon's Annales*, 1900, xviii, 790, 799.



## CHAPTER XXXI

### DISEASES OF THE URETER

#### URETERAL ANOMALIES

**Anomalies of Number.**—Variations in the number of the ureters are attributable to anomalies in the kidneys. Thus, when one kidney is absent its ureter is missing as well. A fused kidney, however, commonly has two distinct pelves and ureters. When a kidney has two or more separate pelves the ureters are correspondingly increased in number. These multiple ureters run side by side and usually become fused in the upper part of their courses, or else open into the bladder by two distinct orifices placed close together.<sup>1</sup>

**Anomalous Point of Origin.**—When a ureter rises from any but the most dependent point in the renal pelvis it may so interfere with the outflow of urine as to cause hydronephrosis (p. 545).

**Anomalous Implantation.**—The ureter may empty into the urethra, the rectum, or the seminal passages (or the vagina in the female). Such cases are rare. The subject is discussed by Beuckhiser<sup>2</sup> and Olshausen.<sup>3</sup>

**Dilatation of the Lower End of the Ureter (Intravesical Ureteral Cyst).**—This rare condition is due to constriction of the vesical orifice of the ureter. Stricture at this point causes a back pressure that is chiefly felt in that part of the ureter which underlies the vesical mucous membrane. The ureteral wall gradually stretches at this point until there is a large cyst projecting into the bladder. There is often hydronephrosis as well. The cyst may grow large enough to obstruct the urethra, or even, in the female, to protrude from the meatus (prolapse of the vesical mucous membrane). On the other hand, the pouch may become inverted into the ureter (De-

<sup>1</sup> Cf. Spaletta, Bull. de la soc. anat., 1895, lx, 616.

<sup>2</sup> Zeitschr. f. Geb. u. Gyn., 1899, xli, 413.

<sup>3</sup> *Ibid.*, 1899, xli, 423.

lore<sup>1</sup>). Englisch<sup>2</sup> has collected 23 cases of such cysts, in 7 of which the ureter terminated in an abnormal locality.

*Congenital stricture* occurs at the lower end of the ureter. It causes the condition just described.

*Kinking of the ureter* over a branch of the renal artery or vein probably occurs only as the result of nephroptosis (p. 521).

#### RUPTURE AND WOUNDS

**Rupture.**—Subcutaneous rupture of the ureter is very rare. Morris<sup>3</sup> finds 24 reported cases, of which he rejects 12 and classifies the others as verified (3), probable (4), and possible (5). Macdonald, of Minneapolis, has added an authentic case.<sup>4</sup> The small size, loose attachments, and protected position of the ureter render it peculiarly likely to escape injury except from a penetrating wound.

It is quite impossible to distinguish rupture of the ureter from rupture of the renal pelvis except by operation (p. 637).

**Wounds.**—Accidental wounds of the ureter are even more uncommon. Morris has found only 5 reported cases (2 bullet wounds), and quotes Otis's conjecture that these injuries do not come to the surgeon's notice because the trunk vessels are likely to be punctured.

**Operative Wounds.**—The ureter, in most instances so safe from the onslaught of the surgeon, is frequently wounded during the course of a hysterectomy. "To-day there are few surgeons who have done many major operations upon the pelvic and abdominal organs who have not had the misfortune, once or oftener, to divide, or even excise, a portion of a ureter, either through necessity or by accident" (Morris). So common is this occurrence, indeed, that Howard Kelly advises catheterization of the ureters (that they may be readily recognised) as a preliminary to every hysterectomy. Discussion of these preventive measures we leave to the gynecologist, with the assurance that a maturing experience will serve to reduce the number of accidental wounds of the ureter, which thus far has seemed to wax rather than to wane.

**Symptoms.**—1. If the ureter is tied off or otherwise occluded the kidney, after going through a preliminary period of congestion, atrophies without dilatation (p. 586). In such a case if the patient survives the uremia the accident may never be recognised. On the other hand, unless both ureters are tied off so that there is complete

<sup>1</sup> Gaz. hebdom., 1899, iv, 325.

<sup>2</sup> Centralbl. f. d. Krank. d. Harn. u. Sex. Org., 1898, ix, 373.

<sup>3</sup> Surg. Dis. of the Kidney and Ureter, Lond., 1900, ii, 332.

<sup>4</sup> Med. Record, 1901.



anuria (p. 544), the symptoms, however severe, are merely characteristic of the partial suppression of urine so usual after capital operations, and are indistinguishable from it (except possibly by ureteral catheterization).

2. If the ureter is divided and the accident passes unrecognized, the position of the wound is usually such that the urine discharges into the vagina and a utero-vaginal fistula remains to be dealt with.

3. If the wound is so situated that the urine is extravasated within the peritoneal cavity, it sets up peritonitis, immediate and general if the urine is bacterial, remote and localized if the urine is clean. The source of the infection is suspected only when urine is discovered in the discharge.

**Treatment.**—In the early days of pelvic surgery nephrectomy was the only alternative offered to those women who were left with uretero-vaginal fistulae after hysterectomy. But in 1886 Schopf, Fritsch, and Tauffer (twice) each recognised at the time of operation that he had divided the ureter and proceeded to sew the ends together. Thus began the conservative surgery of the ureter, and thus from the mishaps of gynecology has arisen the most brilliant conservative achievement of urinary surgery, the preservation of the healthy kidney whose duct has been severed.

Yet it was fully seven years later before any general notice was taken of the operation. Since 1893 the rapid development of the technic of uretero-ureteral anastomosis has been almost exclusively American. E. W. Cushing (1893) performed a successful end-to-end anastomosis, supposing the operation to be original. In the same year Van Hook suggested lateral implantation,<sup>1</sup> and Howard Kelly performed it successfully. Bache Emmet then suggested a modification of Van Hook's operation,<sup>2</sup> and Wesley Bovée performed oblique end-to-end anastomosis.<sup>3</sup> The only other notable modification is Poggi's end-to-end invagination.<sup>4</sup> Uretero-cystoneostomy was a later development, and all the while futile attempts have been made at anastomosis with the bowel and implantation in the skin—futile because of the high mortality and the ultimate renal infection.

A review of these various operations and their relative merits and demerits is reserved for a subsequent chapter.

**Ureteral Calculus.**—(See *Renal Calculus*.)

**Ureteritis.**—(See *Pyelo-nephritis*.)

**Ureteral Tuberculosis.**—(See *Renal Tuberculosis*.)

<sup>1</sup> J. of the Am. Med. Ass'n, 1893, xx, 225. <sup>3</sup> Ann. of Surg., 1897, xxv, 25; xxxvi, 314.  
<sup>2</sup> Am. J. of Obstet., 1895, xxxi, 449. <sup>4</sup> Riforma medica, 1887, i, 314.

**Ureteral Stricture** results from one or other of the above conditions, and is not clinically separable from them.

#### URETERAL NEOPLASMS

*Cysts* of the ureter are extremely rare. Mucous cysts may occur, and there are some half-dozen reported cases of multiple small cysts of the ureter and pelvis of parasitic origin (psorosperms) (Morris<sup>1</sup>).

**Epithelial Growths.**—The solid neoplasms of the ureter are almost as rare as the cysts. They are all epithelial formations, papilloma, carcinoma, and epithelioma.<sup>2</sup> These tumours have been studied by Albarran,<sup>3</sup> who has collected 32 cases. Their histogenesis is quite the same as that of vesical tumours. They usually begin as benign growths and become malignant secondarily, arising in the renal pelvis and being propagated downward by direct extension or by implantation. In the kidney they may produce secondary deposits or give rise to hydronephrosis, hematonephrosis, or pyonephrosis. The kidney, bladder, retro-peritoneal glands, and less often the liver or the pleura, may be involved secondarily. The youngest patient was thirty-two years old, the oldest eighty-nine. In 7 cases there was stone in the kidney.

**Symptoms.**—The symptoms are those of renal stone or tumour. Bleeding is usually noted (72%) and is often the first symptom. Tumour was noted in one third of the cases, pain in one fourth. The diagnosis has been made only by the observation (through a cystoscope) of a villous tumour protruding from the ureteral orifice. The tumour has otherwise been either unrecognized or mistaken for a renal growth. Albarran suggests the possibility of diagnosis by the urine obtained from a ureteral catheter. If the urine is bloody, not purulent, and yet contains cylindrical or pavementous epithelium, there must be an epithelial neoplasm. In the presence of pus, however, this sign is of no value, since such cells occur abundantly in chronic pyelitis. As a matter of fact, however, the diagnosis is commonly made only when nephrectomy is undertaken for supposed renal growth.

**Treatment.**—The treatment is wholly operative. Nephrectomy has been performed 13 times, with 3 deaths and 1 known recurrence. One case of papilloma was known to be well fourteen months, and 1 of carcinoma twenty-six months after operation.

Of 2 nephrotomies, with curettage, for a supposedly benign papil-

<sup>1</sup> Surgical Diseases of the Kidney and Ureter, ii, 480.

<sup>2</sup> Morris has, however, collected 3 reported cases of sarcoma.

<sup>3</sup> Guyon's Annales, 1900, xviii, 701, 918.



loma, 1 relapsed and died, the other relapsed and underwent successful nephrectomy.

Complete nephro-ureterectomy is, therefore, the only appropriate treatment. The cystoscope will determine whether or not the disease has reached the ureteral orifice. If not, the kidney and ureter may be removed by the lumbo-inguinal incision (p. 637). If so, the nephrectomy must be combined with complete removal of the ureter and perhaps a portion of the adjoining bladder wall (p. 500). Above all things it is essential not to be misled by gross appearances. The ureter must always be removed well down into the pelvis, for the growth may be propagated by implantation, forming a secondary tumour in the ureter at a distance from the original growth.

#### URETERAL FISTULÆ

Ureteral fistulæ have many causes. Congenital uretero-rectal and uretero-vaginal fistulæ are extremely rare. In these cases it is usually possible to make an opening into the bladder through a suprapubic wound. The termination of the ureter is then obliterated by extirpation or cauterization. Acquired fistulæ, on the contrary, occur in any portion of the ureter: at the upper end after nephrectomy, especially if the ureter is actively tuberculous. In other parts of its course cutaneous fistulæ form after the duct has been inadvertently divided during an abdominal operation or after rupture from stone, stricture, or other disease, such as tuberculosis and neoplasm, or from trauma or pressure of some intra-abdominal growth usually of the uterus or ovary, or from injuries inflicted during labour.

The discharge from the ureteral fistula is usually uro-purulent, sometimes simply purulent, and rarely simply urinary. The presence of urine in the discharge may be taken as presumptive evidence that the fistulous ureter leads up to a functioning kidney. Yet the absence of urine does not necessarily prove that the kidney is past all usefulness, nor does its presence prove a connection with the kidney; for it has been observed by Hartman and Desnos (Morris) that the urine may regurgitate from the bladder through a ureteral fistula.

**Treatment.**—The treatment of cutaneous fistula is ureterectomy if the kidney has ceased to functionate, ureteral anastomosis or some allied procedure if the kidney is worth saving.

The treatment of uretero-vaginal and uretero-uterine fistula is no simple matter. The great variety of operations employed for its cure, the great proportion of failures after most of these, and the total absence of concerted surgical opinion upon the subject, attest

the complexity of the problem. While the number of operations is legion and the choice among them lies rather with the gynecologist than with the genito-urinary surgeon, a few simple principles may here be laid down.

When practicable Tuffier's<sup>1</sup> operation should be employed, as it combines the attributes of simplicity and perfect safety. The steps of the operation are as follows: (1) Introduce a director into the fistulous opening, and, using this as a guide, dissect free the lower 2 or 3 cm. of the duct. (2) Split up the orifice for 1 cm. in order to insure an ample opening. (3) Make a triangular opening in the most accessible point of the bladder wall (pushed down by a sound). (4) Suture the ureteral and vesical mucous membranes with catgut and the muscular layers with silk. Finally, close the wound in the anterior vaginal wall. A ureteral catheter, or at least a permanent vesical catheter, is necessary for the first week after operation.

If this operation fails or is impracticable, abdominal ureterocysto-neostomy should be tried and should succeed. Hysterocleisis and colpocleisis are operations of last resort. The functional result of including the uterus or the vagina in the urinary reservoir is anything but satisfactory. If all attempts at uretero-vesical anastomosis fail and the opposite kidney is healthy, nephrectomy would be preferable to colpocleisis. Let it not be forgotten, however, that at least once the wrong kidney has been removed. This deplorable accident may, for a certainty, be avoided by catheterization of the fistulous ureter at the time of operation and palpation of the catheter within the pelvis of the organ to be removed.

<sup>1</sup> Bull. de la soc. de chir., 1895, xxi, 270.