

OPERATIVE INJURIES OF THE URETER<sup>1</sup>

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**A**LTHOUGH a review of the literature reveals numerous reports of operative injuries of the ureters, it is probable that relatively few cases are recorded. This discussion deals briefly with the treatment of some types of such injuries and is based on the observation and treatment of 5 cases.

In considering the question of operative injury of the ureter either from the standpoint of prevention or treatment, the important thing to be kept in mind is the preservation of renal function. Before entering upon a discussion of the treatment of these injuries means of preventing them should be mentioned. The presence of a catheter in the ureter during difficult operations in the pelvis will make it possible easily to avoid the ureter. For many years we have routinely inserted catheters in the ureters of such patients for the Department of Gynecology at the Wisconsin General Hospital, and as a result only one ureter has been damaged (Case 4 of this series). In this case serious pathology was unexpectedly encountered and catheters had not been introduced.

In treating these injuries the genito-urinary surgeon encounters many difficult problems. The variations depend upon the age of the injury, its distance from the bladder, whether one or both ureters are involved, and the type of injury; that is, whether it is completely severed, completely severed with the removal of a segment, partially severed, ligated, or clamped. Suddenly confronted with the problem of dealing with a severed ureter many surgeons adopt the procedure of ligation as the best way out of the dilemma. Embarrassing circumstances are in this way avoided in many cases, but a kidney is rendered functionless. Further, in some cases this treatment results after a lapse of a few days in urine draining from the ureter into the peritoneal cavity, or possibly finding its way to the outside, or infection in the kidney may necessitate surgical interference. The ligation of a cut ureter under circumstances favorable to repair should receive our most severe condemnation.

The method of repairing the ureter when the injury is discovered at the time of operation is for obvious reasons of the greatest importance. However, since the genito-urinary surgeon is rarely present when the injury occurs he will seldom have to deal with this situation. Simple ligation is justified only when the condition of

the patient is too bad to permit an operation for repair, for which, of course, more time is required.

A large number of operations have been described for the repair of this type of injury, but all are based on the principles of end-to-end, end-in-end, or side-to-side anastomoses. As this operation will always be infrequently performed, a simple method should be adopted and its principles thoroughly understood, so that when called upon to repair a ureter the surgeon will not have to use a technique with which he is not thoroughly familiar. My first opportunity for repairing a severed ureter came suddenly. Fortunately, a satisfactory repair was made and a normally functioning kidney was obtained (Case 1). Afterward in looking up the subject I found that I had adopted the technique described by Dr. Hugh Young. This technique seems to combine the principles of simplicity, splinting of the ureter, maintenance of caliber, and satisfactory drainage. It is, I believe, the technique of choice for the repair of these ureters with certain exceptions which will be mentioned later. The technique is as follows:

A ureteral catheter as large as will freely move through the ureter without interfering with the circulation is introduced into the ureter and passed into the kidney pelvis. Introduction may be made through a cystoscope or the catheter may be passed each way from the point of injury, the lower end being brought out through the urethra later. Over this catheter end-to-end anastomosis is made with fine catgut, the sutures being passed through the serous and muscular layers. With satisfactory drainage the catheter may be left in place for many days to prevent contraction of the lumen during healing.

Exceptions are to be made when (1) the injury is sufficiently low to permit re-implantation into the bladder, which is preferable; or when (2) a segment has been removed of sufficient length to cause tension. If there is tension satisfactory healing will not occur and implantation into the bowel is the operation of choice.

In old injuries every case is a law unto itself. After appropriate examinations to determine the condition of the kidneys and ureters a satisfactory procedure must be selected. This may be a plastic repair, implantation into the bladder or bowel, nephrostomy, or nephrectomy.

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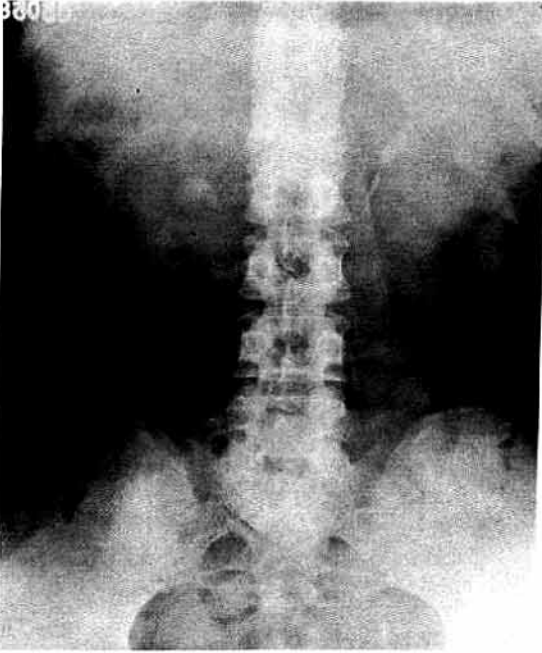


Fig. 1. Intravenous urogram made nearly 5 years after left ureter was completely severed and repaired. The kidney pelvis and ureter appear normal. Case 1.

**CASE 1.** Mrs. J. N., a white female aged 24, was operated upon, April 9, 1929, by a general surgeon for an inflammatory mass of long standing which was located in the left side of the pelvis, having originated in the left fallopian tube. During the course of the operation it was discovered that the left ureter had been severed. Being in the hospital at the time, I was called, and with the wound still open passed a direct cystoscope into the bladder, and introduced a No. 6 catheter into the left ureter. When this catheter reached the point of severance the surgeon introduced it into the proximal end of the ureter and it was passed to the kidney pelvis. The ends of the ureter were then anastomosed—end-to-end—with fine chromic catgut sutures, which were passed through the serous and muscular layers. There was never any leakage of urine at the point of anastomosis. The catheter was removed on the tenth day. Convalescence was smooth and uneventful. The patient was discharged from the hospital on the twentieth postoperative day in good condition. She has been seen at intervals since and has at no time had any symptoms referable to the kidney, and the urine has been normal. She was last seen in February, 1934, when she came for examination at my request. She was free of symptoms, the urine was negative, and intravenous urograms showed normal kidney pelvis and ureters.

**CASE 2.** Mrs. B. was operated upon by a general surgeon, August 11, 1931, for the removal of an ovarian cyst. About 4 centimeters of the ureter which was attached to the wall of the cyst were removed. I was called at the time and inserted a No. 12 catheter through a cystoscope as described in Case 1. The ureter was repaired as in Case 1 but with considerable tension due to the removal of a piece of the ureter. On the seventh day a small amount of urinary drainage was noted on the dressing. There was no further drainage, and recovery seemed uneventful. The



Fig. 2. Retrograde urogram (reversed) showing normal right kidney and extravasation of medium in peri-ureteral tissues on left. This was made more than 2 months after the injury, the ureter having been repaired and the catheter left in the ureter for 15 days after the operation. Case 2.

catheter which had drained freely was removed on the fifteenth day and the patient went home on the nineteenth day with the wound well healed. Ten days later, however, she developed symptoms of frequent and painful urination and the urine was found to contain considerable pus. She was treated for several weeks with bladder lavage and urinary antiseptics, but was returned to the hospital on October 13, 1931, when she had a chill, fever, and pain in the right side of the abdomen. On cystoscopic examination the right kidney was found to be infected with *Bacillus coli*. No urinary spurt was seen on the left side and though the left catheter apparently passed to the left kidney the urogram indicated that it passed into the peri-ureteral tissues at the point of severance where it was coiled. The proximal end of the ureter apparently healed with occlusion as an intravenous urogram showed no evidence of dye in the left kidney pelvis and ureter.

**CASE 3.** Mrs. H. K., a white female, aged 48 years, had a vaginal hysterectomy and repair of cystocele by a general surgeon on March 24, 1931. Following the removal of a vaginal pack urine was noted from the vagina. From cystoscopic and other examinations it was determined that this was due to an injury to the left ureter. On October 7, 1931, through a left rectus incision the left ureter was isolated, freed, and re-implanted into the bladder. Convalescence was uneventful and the patient was discharged from the hospital on the twenty-first day in good condition. The patient has been seen at intervals since and has been free of symptoms referable to the urinary tract. She was last examined on April 15, 1934, when she was free of symptoms and the urine was normal. An intravenous urogram at that time showed good function in both kidneys and very little dilatation in the left pelvis.

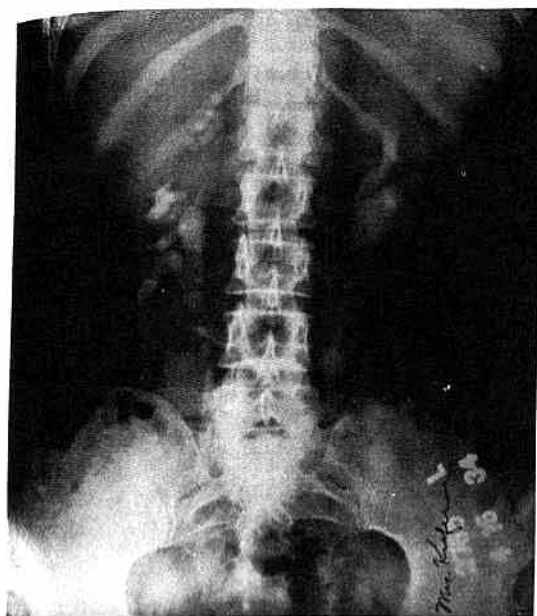


Fig. 3. Intravenous urogram 3 years after reimplantation of injured left ureter into bladder. The pelvis, calyces, and ureter are normal or very slightly dilated. Case 3.

CASE 4. Mrs. C. M., a white female aged 46 years, was operated upon by a gynecological surgeon in November, 1930, for a very large fibroid tumor. When ligating the left uterine vessels a structure thought to be a severed ureter was encountered. It was ligated, the abdominal wound was closed, and vaginal drainage instituted. A few days after operation urine began to drain through the vagina. Four weeks after operation an intravenous urogram revealed a large left hydronephrosis. A left nephrectomy was performed. Convalescence was uneventful. As large aberrant vessels were found going to both poles of this kidney, it is probable that the vessel to the lower pole was at least partly responsible for the hydronephrosis.

CASE 5. A white female, aged 38 years, was first seen on June 24, 1931. She presented a letter from her local physician who stated that he performed an operation in March, 1931, for the removal of cysts from both broad ligaments. The left ureter was cut and repaired by invaginating the proximal end into the distal end. The wound healed, but 10 days after discharge from the hospital severe chills and fever occurred, the wound re-opened and urinary drainage was noted. This continued. When we first saw the patient she was very acutely ill with temperature 103-104 degrees, chills, fever, nausea, and vomiting. There was free urinary drainage through the old abdominal incision. Urine was voided regularly. On cystoscopic examination urine was seen spurting from the left ureter and indigocarmine appeared in 9 minutes. A catheter met an impassable obstruction 3 inches above the bladder. No urine was seen coming from the right ureter and indigocarmine did not appear. A catheter met an impassable obstruction 5 inches above the bladder. A diagnosis was made of complete occlusion of the right ureter, probably the result of ligation, and left uretero-abdominal fistula; part of the urine from the left kidney draining into the bladder and part through the fistula. Operation was

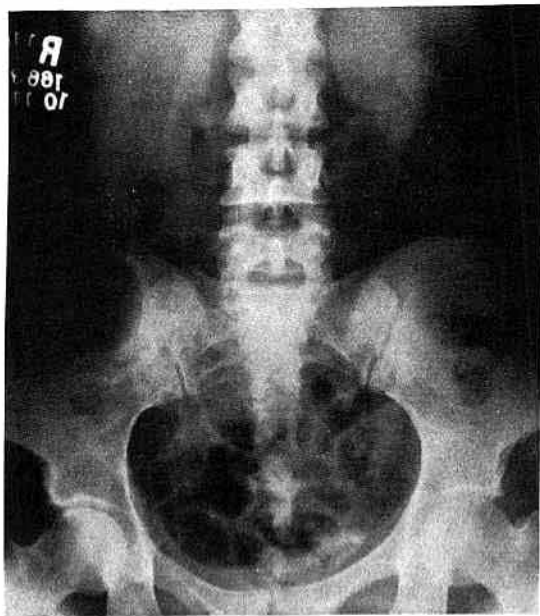


Fig. 4. Intravenous urogram showing the presence of hydronephrosis on the left side which was the side injured. Case 4.

performed on July 14, 1931. The left ureter was located and was found to be firmly adherent to the iliac artery for a distance of  $1\frac{1}{2}$  inches; this was carefully dissected free. The fistulous tract which passed through the abdominal

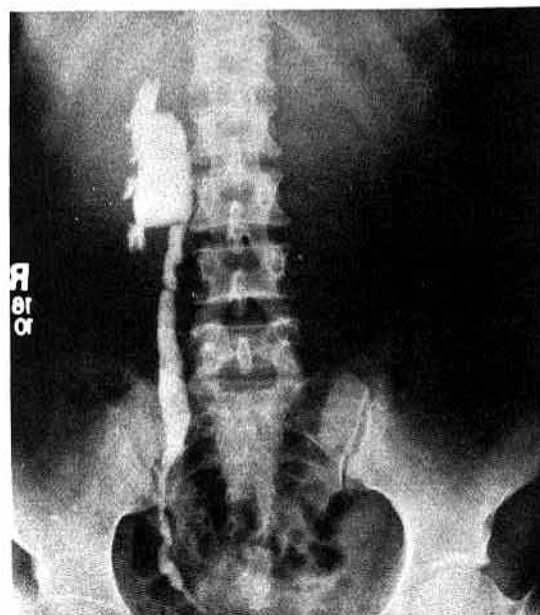


Fig. 5. Retrograde pyelo-ureterogram, right. Case 4.

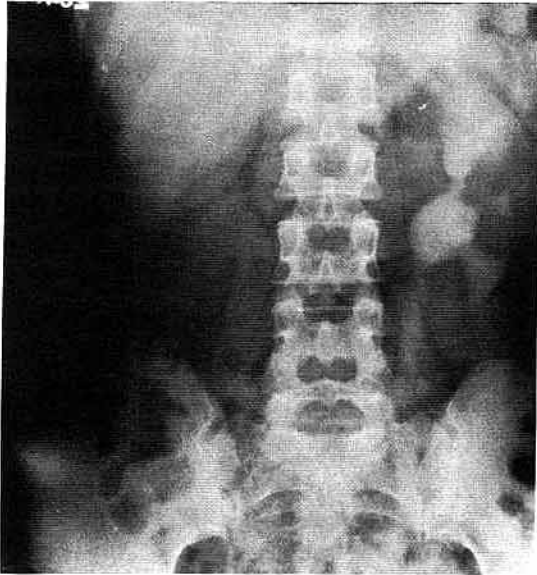


Fig. 6. Intravenous urogram. The left pelvis, calyces, and ureter are moderately dilated. No dye was excreted by the right kidney. Case 5.

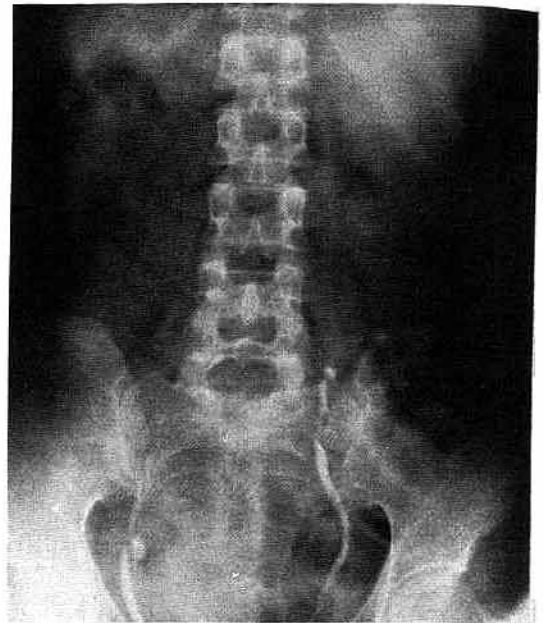


Fig. 7. Bilateral ureterograms (retrograde reversed). Catheters could not be passed to kidneys as one ureter was completely occluded and the other was nearly occluded at the point of injury. Case 5.

cavity was dissected from the ureter and the peritoneum was closed. The ureter was then opened above the strictured area and the stricture was widely dilated. Through the opening in the ureter a No. 12 catheter was passed upward to the kidney pelvis and downward through the bladder to the outside. The ureter was sutured and the wound closed with drainage. As a result of the free drainage the patient's condition in a few hours was better than before the operation. The catheter drained freely and in large quantities and there was no urinary drainage on the dressings. The patient died suddenly on the third post-operative day, apparently from an embolus, though this could not be confirmed as autopsy was refused.

There are in the literature many case reports in which it is assumed that a satisfactory result has followed a ureteral repair, but few in which the question is proved by appropriate follow-up examination. In 1929, Curtis reported a case in which a satisfactory result followed an end-to-end anastomosis and stated, "I believe that this is the only recorded case in which end-to-end anastomosis of the ureter has been followed by clinical proof of normal kidney-ureter function." To the successful proven cases we add Case 1, and as further proof of the well known fact that the absence of symptoms following the repair of a ureter does not prove the result satisfactory, we cite Case 2 in which complete healing with occlusion occurred after the removal of an indwelling

catheter which permitted free drainage from the kidney for 15 days after the operation.

#### CONCLUSIONS

1. Normal kidney-ureter function may be obtained following complete severance of a ureter by end-to-end anastomosis over a ureteral catheter.
2. Simple ligation of a severed ureter is contra-indicated if the condition of the patient will permit a conservative operation.
3. The absence of symptoms following the repair of a severed ureter does not prove the result satisfactory.
4. In old injuries of the ureter a suitable procedure must be adopted to each case. Re-implantation into the bladder is desirable if possible. Implantation into the bowel, nephrostomy, or nephrectomy may be indicated.

#### REFERENCES

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 YOUNG, H. H. *Practice of Urology*, vol. 2.