Proceedings of the Royal Society of Medicine

Vol. 52
101

Section of Urology

President—ALEC W. BADENOCH, M.A., M.D., Ch.M., F.R.C.S.

Meeting
October 23, 1958

Injuries of the Ureter

PRESIDENT'S ADDRESS

By ALEC W. BADENOCH, M.A., M.D., Ch.M., F.R.C.S.
London

I HAVE chosen the subject of injuries to the ureter as I have been interested in it for many years and not very much time has been spent in discussing it in this Section: indeed, much less than it takes me to repair one injury. Terence Millin, in his Presidential Address in 1949, did of course digress on it when dealing more comprehensively with the ureter in gynæcology, but the only other occasion when the subject has been of surgical concern of recent years was at the meeting of the American College of Surgeons in London in 1954, at which I had the privilege of opening a discussion on these injuries.

Gunshot wounds.—Despite its rather delicate structure and tenuous length, the ureter is vulnerable in only very special circumstances. It is rarely injured by gunshot wound. Everidge and Barnes (1946) reported only 4 cases seen at a Base Hospital during the last war. In rather more than 10,000 casualties who were evacuated by air from Normandy and Belgium in 1944–45, and who passed through a Royal Air Force Hospital at which I was stationed, only one case of division of the ureter was observed.

A guardsman was first seen five days after being wounded. Through-and-through wounds of the stomach and small bowel had been treated by primary excision and suture at a forward hospital. On admission he was thought to have a residual abscess in the right iliac fossa. This was incised and drained and next day the diagnosis of a ureteric injury was obvious, as there was a profuse leak of urine from the wound. Intravenous and retrograde pyelograms confirmed this. Attempts at repair were unsuccessful and eventually a nephrectomy was performed.

I saw another intentional injury to the ureter last year.

A bank manager in Cape Town was shot in the abdomen whilst successfully intervening in an attempted robbery at his bank. The perforated bowel was repaired, extravasation from the injured ureter followed and this was drained locally and by nephrostomy. Despite this, the kidney had to be removed. I came into the case when, some months later, whilst convalescing in this country, the patient had an attack of right renal colic and was found to have two stones obstructing and causing dilatation of the remaining ureter. The calculi were removed, allowing the patient to continue his tour of Europe.

Closed injuries of the ureter are equally rare and I have encountered but two.

In 1933, a man of 36 was admitted to hospital following an attack of severe right-sided abdominal pain. A diagnosis of acute appendicitis was made, the abdomen was opened and the appendix was found to be a little swollen but not acutely inflamed. The peritoneum seemed a little œdematous, however, and after appendicectomy a drain was left down to the peritoneum. Next morning, there was an obvious discharge of urine from the wound. A plain X-ray showed a small opacity in the line of the ureter, and I was asked to do a retrograde pyelogram. I passed the catheter up to the opacity but no farther. Next day, he had another attack of colic and passed a small irregular calcium oxalate stone, and the fistula healed spontaneously.

Ten years ago, I was asked to see a case on behalf of an insurance company.

A young man had been involved in a road traffic accident, and the left side of his chest wall was stove in. Every rib on that side was fractured, he had a laceration of the left lung with a hæmothorax and very nearly died. By efficient resuscitation and aspiration of the hæmothorax he eventually made a very good recovery. Some three weeks later, there was brisk hæmaturia. An intravenous pyelogram showed no function on the left side and an attempt at a retrograde pyelogram failed, as the catheter was obstructed in its upper third. It was thought that the renal lesion was almost certainly associated with the injury but a neoplasm could not be excluded. His condition by now being reasonably satisfactory, a laparotomy was performed and the kidney was found to have been avulsed at the pedicle, the ureter being torn across just below the pelvi-ureteric junction. The atrophied remains of the kidney were removed without too much disturbance to the patient.

Scarring by fibrosis.—The ureter may be seriously obstructed as the result of fibrosis of the peri-ureteric tissue and pelvic fascia especially by irradiation, but a somewhat similar effect may occur after the extensive dissection necessitated by a radical hysterectomy.

A woman of 29 years, who had the uterus removed for a carcinoma of the body, was admitted to hospital some months later in a uræmic state with the blood urea raised to 250 mg. per 100 c.c. On retrograde pyelogram both ureters were seen to be dilated to the brim of the pelvis. The right ureter was transplanted into the sigmoid colon. The left kidney then completely suppressed but the transplanted right side, after several anxious days, took on the burden of renal excretion, sufficient for her needs until the carcinoma recurred.

I dealt with this case before ileal loop surgery became fashionable, but I am sure a conduit, perhaps with a later ileo-cystostomy, would be safer and more certainly effective than was the ureterocolic anastomosis. Occasionally, a ureter becomes partially obstructed by adhesions to an appendicectomy stump or to a calcified gland and may give rise to sufficient symptoms to require adhesiolysis, or some other form of intervention.

These injuries are all comparatively rare and whilst of interest do not constitute the main premises of my Address. This is concerned with injuries to the ureter which occur accidentally in the course of a surgical operation. I have excluded those divisions which we make deliberately in the operation of partial and total cystectomy, and also those which we may make intentionally or occasionally accidentally as when a ureter is intimately adherent to a diverticulum.

Surgical injuries.—The large majority of unintentional injuries to the ureter with which I have been concerned have followed operations in the pelvis.

On the other hand, I have seen one case (*see* p. 103) where a piece of ureter 4 cm. in length was removed in mistake for the lumbar sympathetic chain.

A woman suffered from stress incontinence for five years and the late Wilfrid Shaw performed his rather intricate hammock operation with complete success for the stress incontinence. However, she now began to have intermittent attacks of pain followed by discharge of pus from the vagina and sometimes incontinence. After repeated investigations over many weeks she was found to have the upper ureter of a right double kidney opening into the vagina. She had not had any similar trouble or true incontinence prior to the sling operation and we decided this ureter had in some way been divided. A heminephrectomy was followed by relief of symptoms.

A patient had worn a vaginal ring pessary continuously for a number of years. With some difficulty it was removed and this procedure was followed by incontinence which was at first thought to be due to a vesico-vaginal fistula but the latter communicated with the left ureter. This was mobilized, divided at the site of the fistula, and re-implanted in the bladder with a satisfactory result.

Including the cases I have already mentioned, I have had dealings with 48 cases of injured ureter (Table I). 4 cases followed abdomino-perineal excision of the rectum. Injury occurs only rarely in this operation. Cooling (1958) in analysing a series of 369 cases of excision of the rectum found only 4 cases of injury. In 2 the ureter had been ligated accidentally, and in 2 deliberately. 39 injuries occurred during gynæcological operations and I may say that these operations were performed at sixteen different hospitals. In the large majority of cases hysterectomy, either total or radical, was the operative procedure (Table II). The incidence of these injuries has been worked out at a number of centres. Ureteric fistula is of comparatively common occurrence in the radical operation. Liu and Meigs (1955), in analysing a series of 473 radical operations from a group of Boston hospitals, found 45 fistulæ, i.e. 9%. On the other hand, Newell (1939) found the incidence to be only 0·4% in 3,144 cases of hysterectomy of various types. In the years 1952–1954 inclusive, in a careful analysis by Ostry (1955) of 857 hysterectomies performed at the Samaritan Hospital, six ureters were injured, giving an incidence of 0·7%. At the same hospital, during a consecutive period of six years, 3,172 operations were performed in which the ureter was liable to injury. In only 11 cases (0·34%) was an injury known to occur. In fairness to my colleagues, I should mention that in some of those cases the operation was performed by a surgeon under training. Nevertheless, the complication does occur even when the operator is a highly skilled and experienced surgeon. As John Howkins (1954) has said: "the gynæcologist who boasts that he has never damaged the ureter is either guilty of under-statement or has a small and timid practice." It is incumbent on all of us, therefore, who work in the pelvis to take every possible care to avoid such an injury. It has been suggested that a patient should have each ureter catheterized before undergoing hysterectomy. I cannot feel that this is necessary. Indeed, the procedure may give rise to a false sense of security as the ureter has been divided, and also

TABLE I.—INJURIES TO THE URETER

Gynæcological operations	39
Abdomino-perineal excisions	4
Gunshot wounds	2
Lumbar sympathectomy	1
Avulsion	1
Rupture from stone colic	1
Total	48

TABLE II.—OPERATIVE PROCEDURES CAUSING FISTULA

Total hysterectomy	22
Wertheim radical hysterectomy	10
Pelvic floor repair	3
Rupture of full-term uterus	1
Amputation of cervix	1
Sling for stress incontinence	1
Removal of vaginal pessary	1
Total	39

ligatured, with a catheter *in situ*. A preliminary excretion urography will help in ascertaining the anatomy in the particular patient, but meticulous attention to the steps of the operation is the most important preventive factor. The ureter can be nicked with a needle, clamped, or divided and, apart from these hazards of direct assault, the blood supply can be interfered with and ischæmia produced in the lower end. This is especially so in the extensive dissection required in the radical operation. Howkins (1954) emphasizes the danger points in the course of the ureter, the most important of which are:

(1) When it enters the pelvis and is crossed by the ovario-pelvic fold of peritoneum.

(2) When it passes downwards, forwards and medially in the base of the broad ligament and passes beneath the uterine vessels.

At any part of its course, however, it may be injured by tearing the peritoneum to which it is closely attached and more especially it can be occluded, in part or in whole, by over-enthusiastic clamping or suturing in an attempt to stop troublesome bleeding. In the large majority of my cases the injury has been at the lower end. In more than half I have removed catgut or silk from the region of the injury, therefore ligature or suture is the commonest cause in this series. Ischæmia may occur when there has been extensive dissection of the ureters, and division of the many blood vessels which supply it, as in the radical operation.

Hanafee *et al.* (1958) have recently done an excellent radiological survey after the radical operation. In the immediate post-operative period X-rays may not be of much value because there is always some degree of ileus leading to an accumulation of gas and, furthermore, the kidneys do not seem to be able to concentrate the dye very well. Bilateral hydronephrosis and atonic bladder are commonly found in the early stage. Cystograms show what they call the "Christmas tree" or pyramidal shaped bladder, and there is a large amount of residual urine. The distal 4–5 cm. of ureter may be of normal calibre or even narrowed but the upper part is usually dilated. These changes can be caused by interference with the blood supply. In the radical operation, the internal iliac arteries are often ligatured as are the superior vesical, uterine, inferior vesical and middle hæmorrhoidal arteries. It is indeed fortunate, as Daniel and Shackman (1952) have demonstrated, that the ureteric blood supply is so generous. All these vessels supply branches to the distal end of the ureter and to the posterior, inferior and lateral portions of the bladder. It is an axiom that the more extensive the removal of potential cancer-bearing tissue, the greater is the likelihood of injury to a normal organ. Hanafee *et al.* (1958) have found that many of these injuries recover after a period of weeks, but in some, necrosis occurs with resultant fistula formation. In my own series, 4 fistulæ were almost certainly ischæmic in origin.

Clinical Course

(*a*) *Observed at operation.*—The clinical course of a ureteric injury depends on whether or not it is seen at operation. Cases are on record of a clamped ureter having been observed at operation. I have not had such a case but it is then advised that the clamp should be released and a ureteric catheter passed up to the kidney and left in for some days. I think the observation of this injury must be extremely rare. If the ureter is seen to be divided near the bladder, it should then and there be re-implanted in that organ. I have been told of several successful cases of this manœuvre but have not included any in my series. Two unsuccessful immediate implants are, however, included. If the ureter is seen to be divided near the brim of the pelvis, unless the patient is in desperate straits, an attempt should always be made to restore its continuity by suture over a catheter. I have not performed this personally, but 4 such cases are included in this series: 3 were successful, 1 subsequently required nephrectomy.

Many methods of anastomosis have been employed—end-to-end, side-to-side, and end-to-side, and Charles Higgins (1935) has reported success after the cut end has been joined to the side of the normal ureter. Experimentally, however, Hamm and Weinberg (1957) found that the most satisfactory method was by directly joining the ends after they had been cut obliquely in a somewhat spatulate fashion. The consensus of opinion is in favour of leaving a catheter or polythene tube in the ureter, drawing this out through the bladder and attaching it to a Foley catheter, which is then left to drain the bladder. Ligation of the observed divided ureter is rarely indicated but may be the most reasonable solution if a large segment of the tube has been removed. I know of some cases when this has happened in association with carcinoma of the sigmoid colon. One unusual case I have already referred to.

A lumbar sympathectomy was being attempted in a fat young woman, and some 4 cm. of ureter was removed from the upper segment. The surgeon in this case, although quite senior, was still in training. His chief, in the adjoining theatre, was informed and attempted to restore the continuity but owing to insufficient length was unable to do so and ligatured the upper end. I saw the patient next morning, her general condition was satisfactory, she had passed 15 oz. of urine and an intravenous pyelogram which had been suggested, showed that the remaining kidney was quite normal. It was decided to do no more.

(*b*) *Not observed at operation.*—If the ureter has been injured and this is not observed, the post-operative course will be variable and will depend on several factors. If both ureters are occluded, there will be anuria, no urine will be passed and the bladder will remain empty, certainly after the first post-operative catheterization. One or both ureters may form a fistula. There are three bilateral injuries in my series. One had both ureters obstructed following a pelvic floor repair. One had anuria following bilateral ligature at the brim and the third had the left ureter occluded by ligature and the right one divided. I will refer to these again later.

Unilateral injuries vary tremendously in their manifestations. If the ureter is tied off, the kidney may remain completely obstructed. In some cases, especially if infection is present, there is pain in the loin and raised temperature, but in some, symptoms are minimal and patient and surgeon remain ignorant of any injury, maybe for a long time.

A woman who had had a hysterectomy nine years previously returned to her surgeon's out-patients, complaining of a swelling in the right side of the abdomen. He found the right kidney easily palpable and enlarged. An intravenous pyelogram showed a normal left side, but no function on the right. She was referred to me and I confirmed the clinical findings. An attempt at retrograde catheterization failed as the catheter was obstructed 4 cm. from the ureteric orifice. I explored the right kidney and ureter and finding the kidney but a shell and the ureter dilated the whole way down to the obstruction, I did a nephro-ureterectomy. Everything went well until she became mobile and walking about in the ward. She then said "you may have removed my kidney but the swelling is still there". My chief assistant found that what she had really complained of was a small intramuscular lipoma and when this was excised she was quite happy.

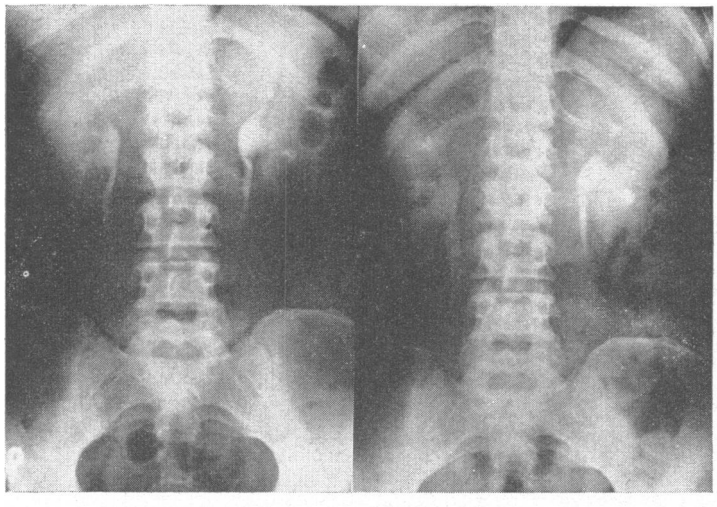
In one of this series there was extravasation into the left iliac fossa following a left salpingo-oophorectomy.

The patient had previously had a hysterectomy and other pelvic operations. She had had some loin pain and pyrexia and on the seventeenth post-operative day a swelling was found in the left iliac fossa which proved at operation to be a collection of urine. After a very lengthy exploration the proximal end of the ureter was found just below the bifurcation of the iliac artery and was tied off as the lower end was never identified. I saw her the following day and we decided to leave it. She made an uninterrupted recovery.

Another patient had aching pain in the loin following total hysterectomy which continued for three months. An intravenous pyelogram showed no function on that side. The ureter was blocked 3 cm. from the orifice. The kidney was explored and a nephrectomy performed. There was no evidence of hydronephrosis, the pelvic capacity being only some 10 ml., but the capsule was very adherent to the perinephric fat and there were widespread pyelonephritic changes throughout the kidney.

Fistula formation.—In my series 32 of the 39 gynæcological injuries formed a fistula. In many the immediate post-operative period was rather stormy, some degree of ileus was common, pyrexia was usually present as also was lower abdominal pain. Loin pain was not a marked feature but when it did occur it was often intense and indeed resembled ureteric colic. In each of the cases which experienced severe pain, the injury was incomplete and the pain may well have been caused by the ureter being caught by a suture, part of which was in the lumen, and spasm occurring in an attempt to extrude the foreign body. The pain cleared up dramatically when the fistula developed. As one resident put it to me "she is very much better to-day, but can't hold her water". In this series 20% of the fistulæ appeared in the first week, 60% in the second and 20% in the third week or later. The longest interval from the time of operation until establishment of a fistula was twenty-four days. The early fistula is from division or partial inclusion in a suture, the in-between fistula, from ligation, with actual division or subsequent sloughing, and the late one is from ischæmia.

Determination of cause and side of fistula.—The diagnosis of fistula is of course easy but it may be extremely difficult to decide whether the leak is from the bladder or from a ureter, and if from a ureter, from which side. An intravenous pyelogram should always be done and very often gives an important pointer. One side will be normal, and the other may show a little dilatation of the renal pelvis and upper ureter (Fig. 1 A, B). There may be obvious extravasation at the lower end of the ureter in the perivesical space (Fig. 2). Cystoscopy can be very helpful and should always be carried out; an irrigating cystoscope is essential. In the immediate post-operative phase, in both intraperitoneal and vaginal operations, there is much œdema at the base of the bladder. The heaped-up, reddened mucous membrane makes the identification of the ureteric orifice difficult and sometimes impossible, and in at least one case led to the diagnosis of papillomatosis of the bladder. If at all possible, an attempt should be made to catheterize each ureter. If vesico-vaginal fistula is suspected, the vagina should be lightly packed with gauze and 1 ml. of 0·4% indigo carmine in 200 ml. of water should be injected into the bladder. If the bladder and vagina communicate, the gauze will show a blue stain. If it becomes damp without staining, the fistula is undoubtedly ureteric.



A B

FIG. 1.—A, Normal pyelogram before operation. B, Hydronephrosis on right side indicative of injury to this side with post-operative fistula.

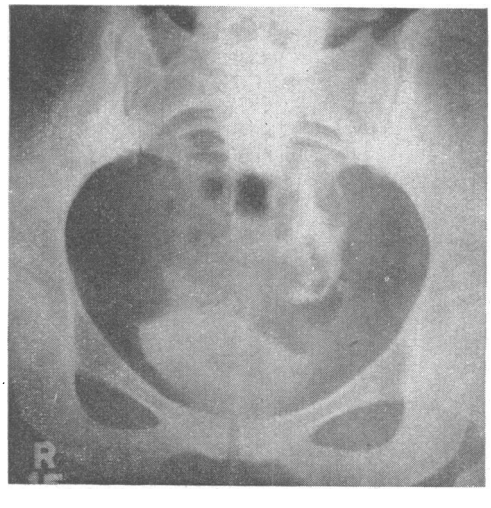


FIG. 2.—Dilated left ureter connecting with extravasation.

TREATMENT

In bilateral injuries this may be imperative as it was in 2 of my cases.

The first followed a pelvic floor repair. I saw her forty-eight hours after operation when there was complete anuria. Cystoscopy showed an œdematous bladder base, and neither orifice could be seen. All the sutures in the vagina were removed, and she made an uninterrupted recovery. Happily, despite the removal of all the sutures, I believe the operation proved effective and she no longer had a prolapse.

It must be emphasized that all the sutures have to be removed.

The second case had anuria following a total hysterectomy and bilateral nephrostomy was performed. As a rule unless the patient is in dire straits I would rather remove the ligatures and would expose first one ureter extraperitoneally at the bifurcation of the vessels, work down to the obstruction and release and repeat the procedure on the other side. In this case, however, the nephrostomy turned out to be the better approach, since it was found that both ureters had been ligatured at the brim of the pelvis. A repair was effected on each side and the left became almost normal. A uretero-vaginal fistula developed on the right side. A catheter could be passed easily up this side without obstruction at the site of repair. This fistula leaked for weeks at a time, although it also sometimes remained closed for weeks. I saw her some eighteen months after the original operation and advised exploration of the lower ureter. At operation, a partial injury of the ureter was found and the ureter was divided and re-implanted. She became dry and two months later had a good functioning kidney still with some hydronephrosis. Subsequently, an intravenous pyelogram showed both kidneys had almost returned to normal. This patient must, therefore, have had two injuries to the right ureter as well as one to the left.

My third case of bilateral injury followed a Wertheim for carcinoma in a woman of 33 years. She passed no urine from the bladder but leaked from the vagina from the third day. I first saw her fourteen days after the injury and an intravenous pyelogram then showed function with hydronephrosis on the right side, but no evidence of function on the left. The bladder contained pus but no urine. A catheter was obstructed low down in each ureter. The patient was ill, cachectic with an infected, discharging wound. It was decided to wait until the sepsis had abated before attempting restorative surgery. It was eleven weeks and four days before this took place. At operation, I found the right ureter had formed a uretero-vaginal fistula and the left was completely occluded by a ligature. I re-implanted both ureters into the bladder. The convalescence was stormy, but she was a good patient and the nursing staff were determined that she should live and that she should be dry. They succeeded. A pyelogram taken eight weeks later showed both kidneys were functioning and one taken three years later showed two normal kidneys. She was free from symptoms and, as far as one could tell, free from carcinoma.

How long can a kidney survive after the ureter has been completely occluded? We really do

not know a great deal more about it since Hinman's masterful study of 1934. He then found experimentally that a rabbit's kidney did not atrophy if the ureter was tied off, unless infection was present. It developed a hydronephrosis which gradually increased in size until the kidney tissue became thinned out like a shell. This may well have been what happened in the kidney of the woman whose symptoms were due to a lipoma but I agree with O'Connor (1956) who says that complete sudden ligation is usually followed by symptomless atrophy. I feel that the result in the patient whose kidney became normal after eighty-one days' occlusion of the ureter, rather refutes Hinman's postulation. In the pyelogram taken eight weeks after the double implant the kidney showed no evidence of hydronephrosis and the calyces, indeed, were quite normal. Furthermore, the kidney function was excellent and eventually completely recovered. I have felt for a long time that the view that twenty-one days' occlusion will lead to permanent suppression is not correct, and certainly in this case it was not so, although perhaps this result was influenced by the fact that the other kidney was not functioning normally. I can find very little reference to clinical cases but Reisman *et al.* (1957) reported one case of unilateral injury which recovered normal function when the ureter had been ligatured for thirty-three days.

In my series there were 30 cases of unilateral injury producing fistula; 2 of these had in addition a vesico-vaginal fistula, and 1 a fistula of the sigmoid colon. In 6 cases, a ureteric catheter could be passed up to the kidney. In 2, the catheter was left in for twenty-four hours, in the other 4 it was removed. All these cases healed spontaneously within a fortnight. One case healed spontaneously without catheterization. I had always felt that if I failed to get a catheter up the ureter, operation was necessary and in such cases of fistula it has been my practice to explore the ureter. My colleague, Mr. J. Burke of St. James' Hospital, however, has had 2 cases with good, though not perfect, results, which he has treated conservatively after having failed to get the catheter up the ureter.

The first case had had a synchronous combined abdomino-perineal excision of the rectum. She had a stormy convalescence and twenty-three days after operation developed a fistula. An intravenous pyelogram taken before the operation was normal. One taken five weeks after operation, after the development of the fistula, showed no function on the right side. A catheter passed easily up the left side, but on the right it was obstructed at 10 cm. A picture taken after injection of dye showed extravasation, displacement of the ureter but also filling of the proximal ureter. In view of this, it was decided to wait. The fistula closed, leaving some dilatation of the renal pelvis on the right side, but nine months later she was free from symptoms and there was no increase in the dilatation.

The second patient had a fistula following a pelvic floor repair. There was a bilateral hydronephrosis, and neither side could be catheterized, thirty-three days after operation. Following the attempt at catheterization, she remained dry; nine months later she was free from symptoms and both kidneys functioned well although there was some dilatation at the lower end of the left ureter.

When a fistula which has healed spontaneously has taken many weeks to do so, and especially if associated with bouts of pyrexia and loin pain on the affected side, the kidney is usually infected and may indeed have ceased to function as in one of the Boari repairs in this series. Usually little is gained by waiting if the ureter is occluded and it is thought that operation will eventually be necessary.

In one unilateral case, interference became imperative. On the fifth day after a total hysterectomy, the patient leaked urine *per vaginam* and continued to do so for some thirty-six hours. She then became dry but began to complain of abdominal pain. When I saw her a few hours later, she was tender in the left iliac fossa. There was much guarding and some rigidity on the left side and at operation it was found that a divided ureter was leaking into the peritoneal cavity. The result in her case was very good. After three months the kidney on the injured side was quite normal whilst the other side showed some hydronephrosis. A picture taken nine years later showed that the injured side had remained satisfactory but on the other side the hydronephrosis had progressed.

The approach I most often employ is through an Abernethy extraperitoneal exposure, although not infrequently I inadvertently open into the peritoneal cavity. Dissection is always difficult and a plane of cleavage almost impossible to find. A hæmatoma is not uncommonly encountered. The operation is long and tedious and the ureter can be extremely difficult to find. It is wise to identify the bifurcation of the iliac artery as soon as possible; the ureter can then be identified and followed downwards. It is usually dilated. In the early days, after division or ligature, there is marked œdema of the peri-ureteric tissues and a swelling as thick as a little finger may be found with a ureter of normal calibre forming its core. Sometimes, and especially in the later stage, the ureter is dilated and it has then a rather bluish appearance and may be mistaken for a vein. An ischæmic ureter is usually dilated, flabby-looking and grey, and vermiculation is absent. A tied-off ovarian vein may bear some resemblance to an ischæmic ureter. There is certainty of the identity of the structure when urine is seen to spurt out of the tube. It should be followed as far down to the vagina as possible, in order to

conserve length and if this is done, in the large majority of cases, it can be re-implanted in the bladder. I have no doubt that it is the safest and surest procedure to conserve the kidney, if this can be effected. In this series of 23 fistulæ treated by operation, 19 were re-implanted directly into the bladder wall, with 17 permanently successful results (Figs. 3 and 4). In 2, the fistula persisted or remained; a second nephrectomy was performed in one, and in the other a uretero-ileal cystostomy was made. The cut end of the ureter should be implanted into the nearest part of the bladder wall. I used to split the lower end, forming two flaps which were sutured back into the bladder mucosa, and this can give very good results as in a case treated by my colleague Mr. H. K. Vernon.

A woman of 45 had a total hysterectomy and bilateral salpingo-oophorectomy. After the operation, she passed no water from the bladder but leaked from the vagina. At cystoscopy, the ureteric orifices could not be identified on account of œdema. An intravenous pyelogram showed considerable hydronephrosis on each side. Twelve weeks later Mr. Vernon re-implanted both ureters by the flap technique with a perfect result.

For some years, when the calibre of the ureter is normal, I have used a direct implant and when the ureter is dilated, a mucous membrane to mucous membrane anastomosis. I stitch the bladder muscle to the peri-ureteric tissue with several interrupted sutures, rather like a Witzel gastrostomy. This is usually easily done because of the thickness of the tissues surrounding the ureter. As in all plastic procedures, tension and constriction must be avoided. I do not use a catheter in the ureter implanted in the bladder. I have not used the method described by Patton (1952) of St. Louis, when the cut upper end is brought through the lower end to present at the ureteric orifice. It must be very uncommon for sufficient length of ureter to remain for this to be done without tension.

When I have found it impossible to approximate the ureter and bladder, I have raised a flap after the manner described by Casati and Boari (1894). This method has been employed three times in this series; only one case was satisfactory. The second case required a secondary nephrectomy twelve months later for chronic pyelonephritis producing persistent pain and infection. In the third case the fistula recurred twice and closed

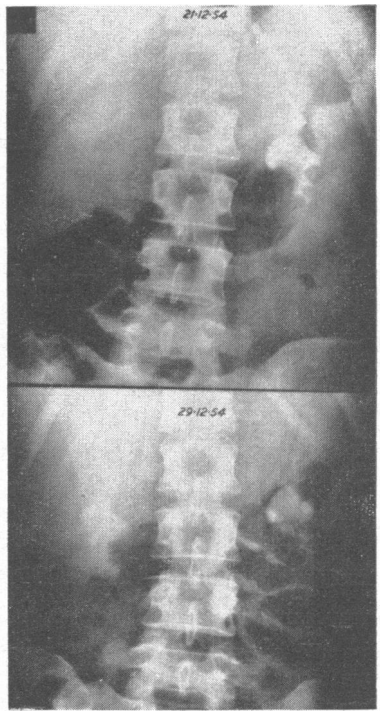


FIG. 3.—A, Intravenous pyelogram five days after hysterectomy with no excretion on right side. B, Intravenous pyelogram eight days after development of fistula, showing hydronephrosis.

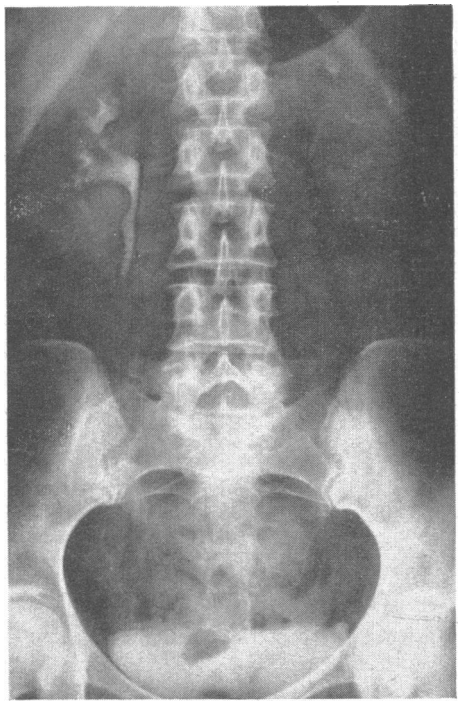


FIG. 4.—Two months after implant of right ureter.

gradually over a period of three months. Now, twelve months after the Boari operation, she is free from symptoms but there is no evidence of function on this side. I therefore cannot say I am enamoured of this operation. I have employed an ileal loop in one failed anastomosis, with an ischæmic ureter. Convalescence was most satisfactory and three months after, she was well and free from symptoms. However, an intravenous pyelogram showed very poor function on this side.

Results.—The results of treatment of this serious injury are not nearly as pessimistic as some published reports would indicate. In this series of 48 cases of injury to the ureter, there have been no deaths. Over 80% of the cases of fistula have healed with good renal function (Table III).

TABLE III

Healed spontaneously ..	7	22%
Healed after operation ..	19	59·25%
Primary nephrectomy ..	2	6·25%
Secondary nephrectomy ..	4	12·5%

Nevertheless about a fifth of these cases have lost a kidney either by nephrectomy or by suppression of function. In one of these at least, it was the combination of an impatient patient and an impetuous surgeon and I have no doubt that when a ureteric injury does not early show signs of spontaneous closure, there is more chance of the kidney being conserved if the surgeon who did the original operation passes the patient to a urological colleague.

We all realize that even when the most careful technique is employed by a skilled surgeon, injury to the ureter can occur. Especially is this so in the extensive and formidable operations performed to extirpate cancer, from what Sir Gordon Gordon-Taylor has called the Fairyland of Surgery. The injury usually becomes obvious and the persistent fistula remains distressing to the patient and to her attendants until it has closed. With careful investigation and cautious treatment, in most cases it should and can be closed and the patient left with a normal upper and lower urinary tract.

REFERENCES

BURKE, J. (1958) Personal communication.
CASATI, E., and BOARI, A. (1894) *Atti Accad. Sci. med. nat. Ferrara*, **68**, 149.
COOLING, C. I. (1958) *Proc. R. Soc. Med.*, **51**, 874.
DANIEL, O., and SHACKMAN, R. (1952) *Brit. J. Urol.*, **24**, 334.
EVERIDGE, J., and BARNES, D. R. (1946) *Brit. J. Urol.*, **18**, 166.
HAMM, F. C., and WEINBERG, S. R. (1957) *J. Urol.*, **77**, 407.
HANAFEE, W., OTTOMAN, R. E., and WILK, S. P. (1958) *Radiology*, **70**, 46.
HIGGINS, C. (1935) *J. Urol.*, **55**, 25.
HINMAN, F. (1934) *Surg. Gynec. Obstet.*, **58**, 356.
HOWKINS, J. (1954) *Ann. R. Coll. Surg. Engl.*, **15**, 326.
LIU, W., and MEIGS, J. V. (1955) *Amer. J. Obstet. Gynec.*, **69**, 1.
MILLIN, T. J. (1949) *Proc. R. Soc. Med.*, **42**, 37.
NEWELL, Q. V. (1939) *Ann. Surg.*, **109**, 981.
O'CONNOR, V. J. (1956) *J. Amer. med. Ass.*, **162**, 1201.
OSTRY, E. I. (1955) Clinical Report from Samaritan Hospital for Women, London. Privately printed.
PATTON, J. (1952) *J. Urol.*, **67**, 852.
REISMAN, D. D., KAMHOLZ, J. H., and KANTOR, H. I. (1957) *J. Urol.*, **78**, 363.
VERNON, H. K. (1958) Personal communication.

Meeting
November 27, 1958

THE following specimens were shown:

Twin Diverticula of the Female Urethra.—Mr. J. C. ANDERSON.

Renal Adenoma.—Dr. J. H. EARLE.

(1) Tuberous Sclerosis with Bilateral Renal Tumour. (2) An Unusual Large Hernia of the Bladder (a Scrotal Cystocele).—Mr. R. A. MOGG.

Intravesical Foreign Body (Gordian Knot in Plastic Tube).—Mr. C. I. MURPHIE (for Mr. J. E. SEMPLE).

Scrotal Emphysema.—Mr. C. I. MURPHIE.

Transient Ring-constriction of the Bladder.—Mr. JOHN HOPEWELL.

Malakoplakia of the Bladder.—Mr. KENNETH OWEN.

Partial Cystectomy for Localized Leukoplakia of Bladder.—Mr. F. P. RAPER.

Carcinosarcoma of the Bladder.—Mr. D. INNES WILLIAMS and Dr. R. C. B. PUGH.

Radium Necrosis of Bladder Following Radium for Artificial Menopause.—Mr. D. M. WALLACE.

Ureteric Ectopia.—Mr. J. C. ANGELL.

Bilateral Mega-ureter in a Child of 4.—Mr. R. O. LEE.

Calculi in the Seminal Vesicle, Associated with a Hypoplastic Kidney.—Mr. W. G. Q. MILLS.

Sarcoidosis of Epididymis.—Mr. B. H. PAGE.

Rhabdomyosarcoma of the Bladder in a Boy of 4 Years.—Mr. R. F. POWER (for Mr. F. R. KILPATRICK).

Rhabdomyosarcoma of the Epididymis.—Mr. R. F. POWER (for Mr. HARLAND REES).

Lipoma of the Spermatic Cord.—Mr. ALEX E. ROCHE.