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THE EXPECTANCY OF LIFE AFTER URETERAL TRANSPLANTATION.*

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SOMETIMES the urinary bladder fails to do its duty as a vessel in which the water is collected and from which it is periodically voided.

It may have been damaged in the making, and the child is born with a moist strawberry-like swelling on the lower belly wall. If this swelling be tilted up by the finger, two ureteral orifices will be observed jetting forth urine. Here early in intra-uterine life a local arrest of growth from some unknown cause has occurred, the cloacal membrane has persisted, and when this is cast off and the membrane separated after birth the anterior wall of the urinary bladder and the anterior abdominal wall in front of it are absent, and the cherry-like swelling is noted to be due to the bulging forward of the unsupported bladder wall.

Sometimes the damage in the making is not so obvious at the time of birth and may not be discovered for many years, as was the case with one of the patients to whom I will refer. She was J. McDonald, who came under my care at the age of 16 in the year 1925, and her story was that she had been troubled with frequency of micturition and a degree of incontinence of urine all her life. At the age of 11 she was two months in hospital and received injections, but no operative treatment. On discharge she believed that she had better bladder control at night, but otherwise was much as before during the day. It was noted when she was first examined, that she could hold her water fairly well when she was in bed, but

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only very imperfectly when she was up and going about (Fig. 1). A few months before admission, as it was believed that her disability was nervous in origin, she received electrical treatment from a nurse, but this produced no improvement. It was thought advisable therefore to refer her again to hospital, and she was admitted to the Royal Infirmary under my care. I found her then to be a healthy, well-developed young girl. When she lay in the dorsal attitude with the limbs extended,

FIG. 1.—To illustrate the "saucer bladder" in a case of subsymphyseal vesical exstrophy in a young woman. Excretion urography photograph at thirty minutes; patient recumbent. J. D., aged 17.

there was no noticeable abnormality at first to be observed. On closer inspection, however, it was noted that the mons veneris was cleft at its lower part and, when the limbs were drawn up and the thighs separated, this cleft was noted to be the forepart of a congenital defect wherein the labia majora, instead of fusing anteriorly, faded away, and the mons pubis was replaced by a vallecum in front of the symphysis. From

this depression a small median ridge ran down to the bladder orifice in the normal position of the clitoris. The apparent representatives of the labia minora and clitoris when traced forward faded away on each side, as the labia majora did. When traced posteriorly, they became continuous with pendulous folds which hung down from either side of the vaginal orifice. The vaginal orifice was narrow and in front of it there was a large aperture which readily admitted two fingers, funnel-shaped and lax, leading into the bladder cavity. From this urine dribbled. The congenital malformation was that known as subsymphyseal vesical exstrophy, or epispadias in the female, a malformation wherein the neck of the bladder anteriorly and the ventral wall of the urethra are absent (Figs. 2 and 3).

This congenital deformity owes its origin to a cause similar to that which produces the condition of complete vesical exstrophy. (See further, p. 78.)

In other cases damage may have been due to a difficult labour, an obstetrical injury resulting in a partial destruction of the bladder wall and vesical sphincter along with a portion of the adjacent vagina, a vesical-vaginal fistula being thus produced.

Or damage may have been wilfully inflicted in the operating theatre, when it had been found necessary to remove the entire organ to eradicate a cancer growing from its wall.

Or damage may have been inflicted in the operating theatre, the effect of which was not apparent at the time, and may not reveal itself until many months later, the mysterious agent producing this result being radium.

Such was the case with Mrs Mary Fleming. She originally came under my care in the autumn of 1933. Three years previously she had had radium applied to the cervix uteri for carcinoma of the cervix. She had three applications of 2640 mgrms. hours, and the result as regards the new growth was most satisfactory in every way and she appeared to be restored to excellent health. Two and a half years later she developed marked dysuria and frequency of micturition, the act of micturition being accompanied by a burning pain in the vulva and lower abdomen. On cystoscopic examination the appearances observed were strongly suggestive of tumour growth lying below the trigone, a patch of necrosis being situated over the base of the bladder which had established a

communication with the vagina. This patch was surrounded by an area of bullous œdema and was recognised to be due to necrosis of the tissues caused by delayed action of radium.

Sometimes the urinary bladder fails to do its duty as a vessel in which the water is collected, and from which it is periodically voided, not because it was broken in the kiln, or by the hand of man, but from its very excessive zeal as is seen in the systolic bladder of chronic tuberculous cystitis.

In the light of our present knowledge, the accepted treatment of tuberculous disease of the kidney, where the disease is unilateral and the health of the patient does not otherwise contra-indicate it, is to remove the diseased organ along with the greater portion of its ureter. When this is done, in most cases tuberculous cystitis is also present. Fortunately, however, the power of resistance to infection and of recovery from infection of the urinary bladder is high and the primary source of infection having been removed by nephrectomy, the bladder recovers completely within two years. Occasionally this does not take place and the highly irritable inflamed bladder remains in a state of constant systole, with the result that the patient has to void urine very frequently. At the same time, this contracted bladder is silently producing most serious damage by the backward pressure it exercises on the ureter and renal pelvis, which become dilated, the renal secreting tissue is pressed on and atrophied, and renal functional activity most seriously impaired, so seriously as to prove fatal in some cases.

For these, and for certain other conditions I have not mentioned, I have found it necessary to perform the operation of vesical exclusion, that is to deviate the urine stream elsewhere. The simplest and safest procedure to adopt is to transplant the ureters on to the loins. Both can be done at one operation ; through a gridiron incision they are exposed extraperitoneally, brought to the skin surface and fixed there so that two fistulous openings are established, through which the urine is voided. The procedure, as has been mentioned, is both simple and safe. It has, however, the very grave disadvantage that so far no apparatus has been devised into which the urine can be collected with comfort and with certainty when the patient is standing upright, sitting, or lying down. This operation, however, is still justified in the case of advanced malignant disease where the situation is desperate.

The other form of vesical exclusion that is practised, and

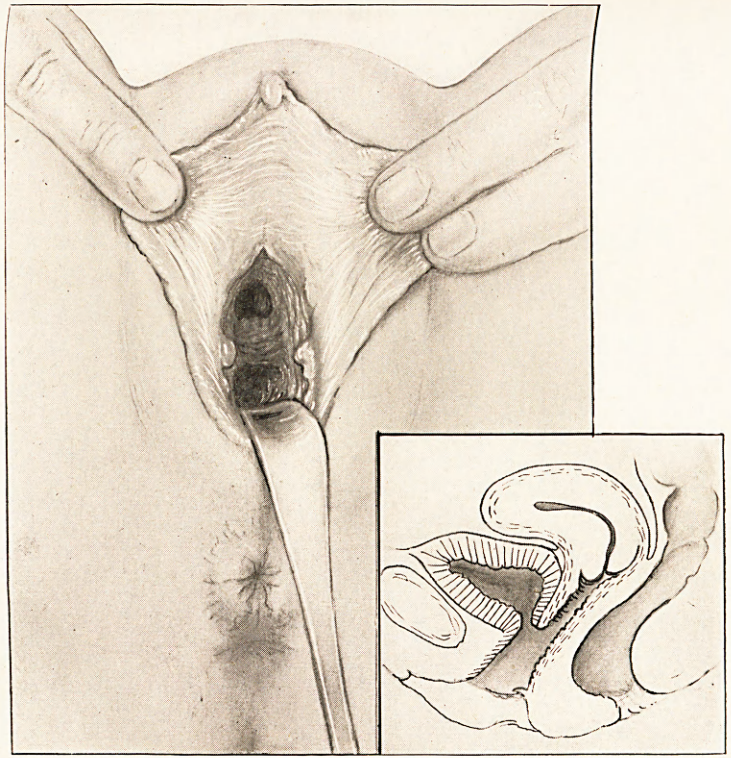

FIG. 2.

FIG. 3.

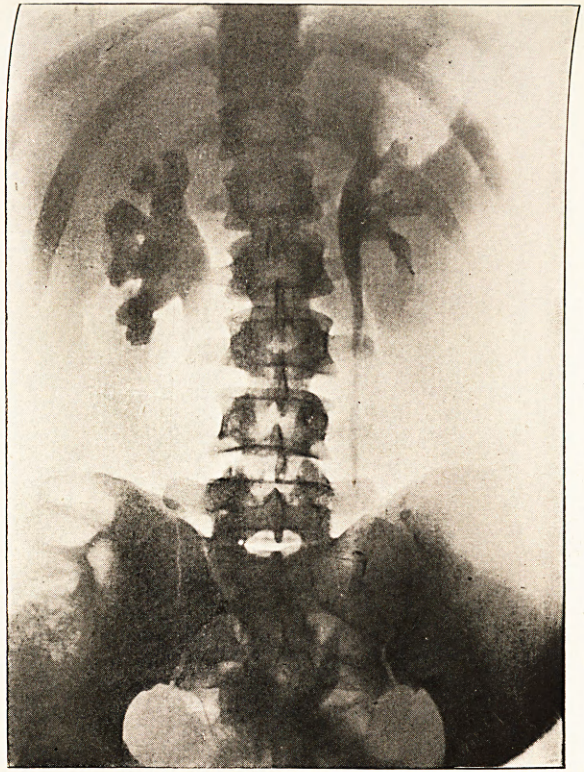

FIG. 5.

FIG. 2.—To illustrate the malformed patulous bladder neck in a case of subsymphyseal vesical exstrophy in a young woman. The labia minora are separated and retractor inserted into the vagina, revealing a deep transverse ridge extending across the cavity; in front of it is the patulous bladder neck and behind it the vaginal cavity. J. D., aged 17.

FIG. 3.—Diagram to illustrate the anatomy in the case of subsymphyseal vesical exstrophy sketched in fig. 2. J. D., aged 17.

FIG. 5.—Photograph delineating by excretion urography the kidneys, calyces, pelves, and ureters fifteen minutes after the injection of uroselectan B, twenty-nine years after bilateral ureteral transplantation into colon. Mrs R., aged 32.

the one with which we are at present concerned, is where the urine stream is deviated into the intestinal tract by transplanting the ureters into the colon and the rectum, thereby establishing a cloaca.

In certain animals a cloaca exists naturally and the urine, intestinal, and genital streams are voided into a common channel, as in the Platypus and the Echidna. If the comparative anatomy of these animals is studied, it will be noted that the entrance of the urinary channel into the cloaca is protected in certain cases by a mucous valve and in others by a projection into the cavity of a nipple-like orifice. Both of these serve as protection against backward pressure and probably also an ascending infection. The protective mechanism against an ascending infection that is most important, in my opinion, is the current of water that flows down from above from the kidneys, and it is for this reason that at all our urological examinations the patients are given a pint of recently made warm tea, prior to going to the diagnostic theatre, and in all cases of ureteral transplantation intravenous infusion is commenced the moment the patients return to bed from the operating theatre.

In the animal with the cloaca, although a common channel exists, it is noted that portions of that channel serve separate functions, one portion being the urodæum, where the urine is collected, another being the proctodæum where the intestinal content gathers. In the human being in whom by operative procedure a cloaca has been established by ureteral transplantation, it is found that comparatively soon they develop a urodæum and proctodæum, as can be demonstrated by excretion urography—the urine is collected in the pelvic colon and is voided from there on several occasions during the day, sometimes of a clear and natural colour, and a formed motion may be voided from the bowel on another occasion (Fig. 4).

In my opinion therefore, the ideal situation into which the ureters should be implanted is the pelvic colon.

The methods of implantation that have been employed are very numerous. The technique I personally always now adopt is a modified Coffey-Mayo method. How this technique came to be evolved is of interest. When a young man, engaged in experimental surgery, Coffey made the anatomical observation that where a duct enters a channel its orifice is protected by a mucous valve, formed by the duct piercing the

muscular coats of the channel obliquely and travelling some distance beneath the mucous membrane before entering. The orifices of the salivary ducts demonstrate this, as also do the entrances of the bile ducts into the duodenum and the ureters into the urinary bladder. From this anatomical observation he made the physiological deduction that these mucous valves protect the ducts against regurgitation of fluid from the channel. This assumption was tested by experimental research on

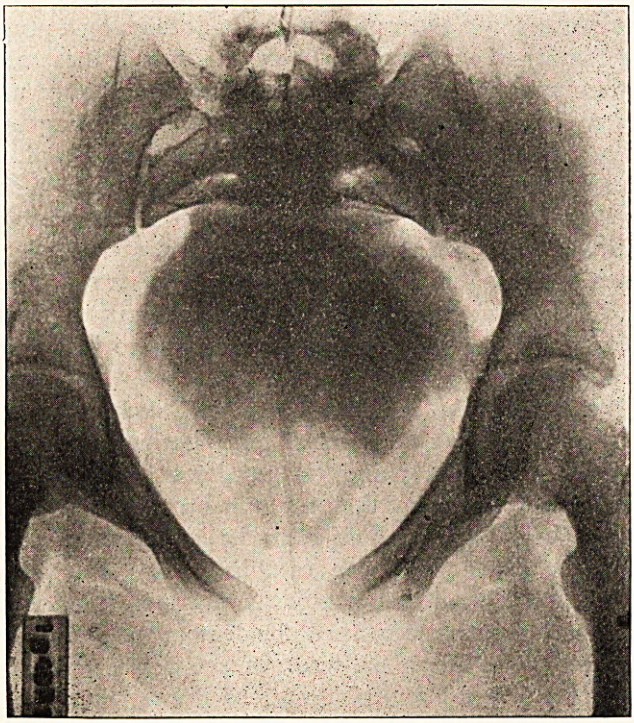

FIG. 4.—To illustrate the "urodæum." A collection of urine in the bowel after bilateral ureteral transplantation performed nine years previously, delineated by excretion urography. J. McD., aged 26.

animals, wherein it was shown that dilatation of the duct from backward pressure took place when it was implanted directly into the channel, but where the implantation was carried out obliquely with a submucous passage no regurgitation occurred and the duct was not dilated. The final stage consisted in the application of this discovery in the operating theatre and thus the Coffey technique was evolved.

To implant the duct obliquely into the wall of the channel with the consequent post-operative œdema must be associated with a risk of blockage of this channel and interference with the descent of urine, and to obviate this Charles Mayo introduced a strand of catgut which passed down the channel into the bowel to act as a wick. He also advocated and practised a procedure where, recognising the probability of a transient anuria, the implantation was carried out in two stages with an interval of approximately a fortnight or three weeks.

As I have already mentioned, in our experience the most important factor in preventing an ascending infection, or the development of anuria, is that an abundant stream should from the first flow down the channel from the kidney above, and working on this subject, my colleague, Mr Lawson Dick, found a suggestive observation casually recorded in some work done by Cushny which led him to investigate the properties of sodium sulphate as a diuretic. By clinical observation and by experiment, Dick showed that the ideal solution for this purpose was an isotonic solution of sodium sulphate :—

> " The sulphate is injected in the form of an isotonic solution of sodium sulphate. The preparation used is ordinary hydrated sodium sulphate, Na_2SO_4, 10 H_2O, or Glauber's salt. This is the most stable of the forms in which sodium sulphate is obtainable. 42·85 grams of Glauber's salt dissolved in one litre of water give an isotonic solution, and this strength has been used throughout."

Operative Technique.—The fundamental essentials of the operation of ureteral transplantation, and these apply to the wide field of abdominal surgery, are briefly as follows :—

First, as regards the anæsthetic : I prefer that the patient should come to the operating theatre unconscious of the surroundings, as previous mental anxiety and strain are undoubtedly factors deleterious to a good and speedy recovery. Twilight sleep is therefore induced. At one time I used nembutal ; in my hands it proved excellent in some cases, uncertain in others. I have therefore come back to the method of scopolamine and morphine—the adult patient receiving $\frac{1}{4}$ gr. of morphine and 1/100th of scopolamine two hours before the operation, followed by 1/6th morphine and 1/200th scopolamine half an hour before going to the theatre.

The anæsthetic used in the theatre must possess one essential characteristic, *i.e.* it must be certain to produce complete muscular relaxation so that the operative technique can be carried through, as all modern surgery should be, on a sound physiological basis. Bacteriology is of importance in the operating theatre, but should not now have the priority we used to afford it. Like the anatomical basis of operative works as carried out by the masters with whom we served our apprenticeship, it now takes a subordinate position. The physiologically minded surgeon realises how abundant are the harmful nerve impulses that radiate from tissues torn by self-retaining retractors, the damage to organs rich in sympathetic innervation that "packing off" produces, and the torn endothelial surfaces which such treatment results in.

The spinal anæsthetic I personally use is spinocaine, preceded by an injection of ephedrine to keep up the blood-pressure. Complete anæsthesia is thus obtained for one hour, which is more than sufficient time to carry through the operation with thoroughness and deliberation.

The question to be next decided is whether it is necessary to do the operation in two stages—first, one ureter being transplanted into the colon, and the other being similarly treated a fortnight or three weeks later. Until a few years ago I would have had no hesitation in answering that, where time permitted, the two-stage operation was always advisable. To-day my answer is different. I now recommend bilateral ureteral transplantation in all cases—a change of opinion brought about essentially by the work on anuria and its treatment by the intravenous injection of sodium sulphate, by my young colleague, Ian Lawson Dick. The sequence of events that led up to our altered decision came about when we were concerned with the treatment of malignant disease of the urinary bladder. I have always felt that the cystoscopic appearances alone were not sufficient to warrant the grave operation of total cystectomy. Before so momentous a decision is reached the bladder must first be opened, and the growth seen, felt, and examined. If the decision is in favour of cystectomy, the bladder must first close naturally, the ureters then be transplanted individually, and finally the operation of total cystectomy be carried out, the procedure consuming much valuable time and requiring four separate operations—a terrible ordeal for even the most robust to go through. To

shorten this technique we instituted bilateral transplantation, with immediate intravenous infusion of sodium sulphate solution and normal saline. So satisfactory did we find this in promoting immediate renal secretion and preventing anuria that we have now adopted this technique as a routine procedure in all cases.

I do not propose to describe the technique of the operation in detail. There are, however, some points I would mention. I would again remind you of the great importance of delicate handling of the tissues. When the patient is fully anæsthetised by twilight sleep and spinal anæsthesia, the abdomen, being completely relaxed, is opened by a midline infra-umbilical incision. The operating table is then further tilted so that the small intestine falls out of the pelvis and the field of operation is freely exposed. The right ureter is first sought for, just below the iliac vessels. Often it is seen contracting beneath the pelvic peritoneum. The peritoneum over the ureter is incised and the ureter, along with the para-ureteral tissue, is isolated down to its lower end. The lower end is now ligatured and above this the ureter is divided by means of the diathermy current, the object of employing this being to seal off the para-ureteral lymphatics as these might be a potential path for the spread of infection. The ureter, having been isolated below from the floor to the pelvic brim, is now lifted into the abdomen and the divided pelvic peritoneum is sutured. I would advise that the left ureter be sought for below, not above, the pelvic colon (Fig. 6). It is much easier to find it here. It is treated similarly, but after it is isolated up to the lower surface of the pelvic colon a pair of strong curved forceps is passed along beside the ureter behind the pelvic colon to the root of its mesentery where the points of the forceps are forced through the peritoneum. Down the channel thus formed, another pair of forceps is passed and the end of the divided ureter is grasped and drawn up so that it now emerges through a small opening at the root of the mesentery above the pelvic colon (Fig. 7). The ureters are then prepared for implantation by the insertion of a wick of catgut up the lumen, as originally suggested by Charles Mayo, and in doing this I employ the neat device of threading the end of the catgut, acting as a wick, on to the eye of a probe, and passing this probe up the lumen of the ureter, so that it unthreads itself and leaves the catgut as a wick in good position.

In choosing a site for implantation the object is ultimately to form a "urodæum," and the best situation for this is in the pelvic colon, not in the rectum. The left ureter is first implanted high up in the pelvic colon, the right lower down. When doing this, remember that in Nature the ureters not infrequently enter the cloaca with a mucous valve protecting the outlet, and that in other cases a nipple valve projects into the lumen

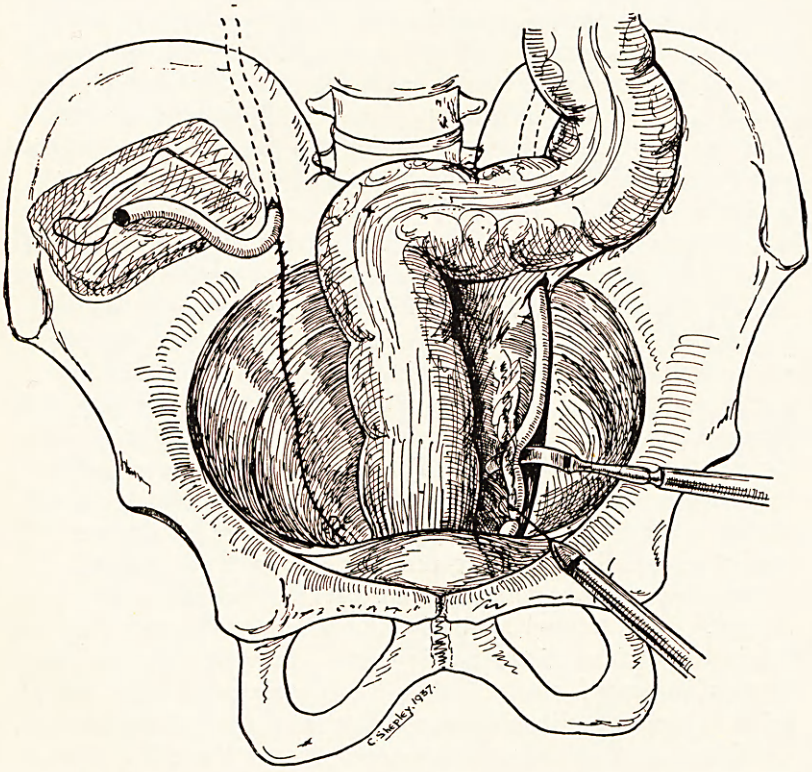

FIG. 6.—Technique of operation. Right ureter isolated, divided at its lower end, and prepared for implantation, and divided peritoneum sutured. Left ureter isolated below pelvic colon, ligatured at lower end, and in process of division by diathermy knife.

—and make your implantation accordingly, with the ureter running beneath the mucous membrane of the bowel and projecting a short distance into the lumen of the channel. At the conclusion of this stage the ureters are seen traversing the peritoneal cavity for a varying distance before they enter the bowel; the shorter this passage the safer for the patient.

At the same time the ureters must not be fixed and liable to tension. We therefore render the course of the ureters almost entirely extraperitoneal by suturing the bowel adjacent to the site of implantation to the parietal peritoneum at the point of the exit of the ureter, a tag of omentum on each side being

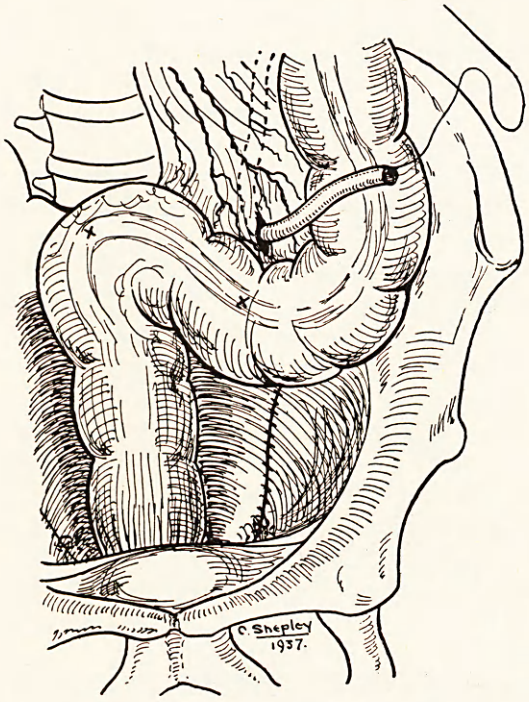

FIG. 7.—Technique of operation. Left ureter isolated below pelvic colon, displaced above colon and brought out through base of mesocolon, and prepared for implantation; peritoneum sutured.

used to fix the gut to the peritoneum (Fig. 8). An important stage of the operation is now reached. It was introduced as the outcome of our first case of bilateral transplantation with continuous intravenous infusion. The immediate result of this treatment in this case appeared disappointing, and on the morning following the operation a tube was passed into the rectum when we were pleased, but frightened, to see a pint of limpid urine escape. Fortunately, no damage was done to the implantation, but in every case now we insert a tube into the rectum before the wound is closed, employing the

method Lane used when doing an ileosigmoid anastomosis or a total colectomy. The hand of the surgeon, low down in the pelvis, guides a stomach-tube, which is inserted into the rectum; to this is attached a Higginson's syringe through which a jet of liquid paraffin is forced. The tube, having entered the rectum for a distance of three inches, is fixed by a suture to the thigh. The abdomen is now closed without drainage, and the patient returned to bed.

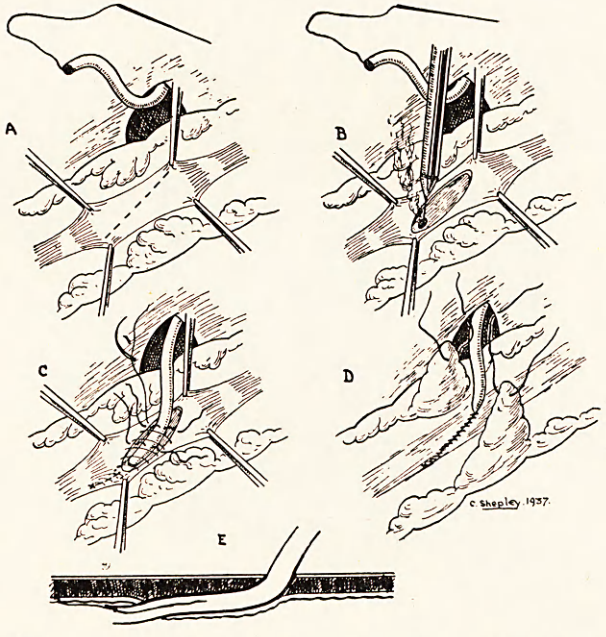

FIG. 8.—Technique of operation: (A) Preparing submucous bed; line of incision through serous and muscular coats. (B) Opening bowel with diathermy knife at distal end of submucous bed. (C) Ureter inserted, fixed and buried beneath serous and muscular coats. (D) Retroperitonealising implanted ureter by uniting appendices epiploicæ to opening in parietal peritoneum at exit of ureter. (E) Scheme of implantation; formation of a mucous and nipple valve within lumen of bowel.

Post-Operative Treatment.—The vitally important post-operative treatment demands an extremely high standard of nursing. Day and night, for the next ten days at least, the patient is constantly under supervision and frequently receiving skilled attention. The intravenous infusion apparatus is fitted up, and into a vein in the arm a slow stream of sodium sulphate solution, followed by normal saline, flows. This is kept up

for three or four days, the amount administered being carefully regulated to prevent the patient becoming waterlogged. Usually by the evening of the day of the operation urine begins to flow through the rectal tube. By the use of a small dose of pituitrin ($\frac{1}{4}$ c.c.) repeated six-hourly if necessary, flatulent over-distension of the bowel is corrected. The rectal tube acts as a flatus tube and relieves distension greatly. It is often five or six days before it is wise to administer an aperient. Many other points require attention by the nursing sister at this stage, and others of importance arise later. Thus, for example, in those cases of intractable cystitis treated by ureteral transplantation, the now silent bladder may require to be washed out frequently. On the other hand, more than one case of this nature has not required any after-treatment to the bladder, which never appeared to give the slightest discomfort or produced the slightest inconvenience—a remarkable change when one remembers how just before the operation the urine was being painfully expelled about every half-hour. After about a fortnight, the patient begins to acquire what I may call " the habit of a functioning cloaca," at first voiding urine two to three times during the night, but soon most patients go the whole night through undisturbed.

The nursing sister, to whom is due much of the credit in dealing with my cases, informs me that some of the women who have suffered much from frequency of micturition at first have a tendency to develop what I may call an irritable bowel, voiding urine unduly frequently from it. To correct this, tactful patient re-education is required before these patients also have undisturbed nights.

We have now reached the stage where the patient is convalescent after the operation of ureteral transplantation. A cloaca has been established and the question that now faces us is whether the possessor of this abnormality is doomed to spend a short and precarious existence trembling on the brink of impending disaster, or, on the other hand, may look forward with reasonable certainty to a long life of happiness and comfort.

I have carried out the operation of vesical exclusion on over sixty people, but certain of these were forlorn hopes undertaken in an attempt to mitigate the utter misery they were enduring. The immediate mortality in these cases was high. The ultimate mortality was influenced by the primary disease

for which the operation was performed, such as carcinoma and tuberculous disease.

In order to determine the expectancy of life after ureteral transplantation and to assess accurately how far, if at all, this has been shortened by the establishment of a cloaca, it is necessary to select patients in sound general health and free of disease, but who by developmental error or accident have had the urinary bladder irreparably damaged. In this category are included certain cases of complete vesical exstrophy, subsymphyseal exstrophy and vesico-vaginal fistulæ with destruction of the vesical sphincter due to obstetrical injuries or similar cause.

Cases are now available where a sufficient period of time has elapsed since the operation of vesical exclusion was performed for ureteral transplantation to enable us to estimate accurately the influence of this operation on the general health of the patient and the expectancy of life. In this connection I would refer to four cases in which the ureters were transplanted into the pelvic colon for the congenital malformation of vesical exstrophy. They form a most interesting and instructive group and, to my mind, demonstrate conclusively that where the operation of ureteral transplantation has been successfully performed the patient is given not only comfort, happiness, and good health, but also the prospect of a natural length of life. In all of them sufficient time has elapsed to warrant this assumption. They were operated on thirty, twenty-eight, twelve and eleven years ago respectively. The surgeons were Sir Harold Stiles, Mr C. H. Allen of Nottingham, the late Mr Farquhar Macrae of Glasgow, and myself. The operative technique, although different in each case, was followed in all with a most satisfactory result.

Case of Mrs Robertson.—At a meeting of the American Surgical Association held in Denver, Colorado, in June 1911, Sir Harold Stiles read a paper on " Epispadias in the Female and its Surgical Treatment, with a Report of Two Cases." The patients were aged three years and seven years respectively, and Sir Harold had operated on one in 1907 and on the other in 1908, for the congenital malformation to which we have previously referred as " subsymphyseal vesical exstrophy," that malformation in which the neck of the bladder is deformed, the urethral channel absent, and the vesical sphincter non-functioning. In these two cases he transplanted the ureters into the pelvic

colon, doing the two-stage operation with an interval of from three to six weeks between the implantation of the right and the left ureters into the pelvic colon. The method he employed consisted of introducing the divided ureter into the lumen of the colon through a small punctured opening, the ureter being held in position by a temporary fixation-stitch of catgut, after which it was buried in the outer coat of the bowel as the rubber tube is buried in the wall of the stomach in a Witzel's gastrostomy. Both cases did well, and in the concluding paragraph of his paper Sir Harold Stiles wrote :—

> " While it would be rash to assert that my two patients will remain free from any kidney infection, it is nevertheless very satisfactory to know that more than three years have elapsed without either of them showing the slightest evidence of such a complication."

It is my good fortune to be able to give you a report on one of these cases, thirty years after the operation. The patient is now a married woman, aged thirty-three, living a happy natural live in the county of Fife. A few years ago she developed acute appendicitis and was operated on for this in hospital, and those who then cared for her were not aware that she was in any way abnormal. Her health to-day is good. By blood examination the renal functional activity is found to be normal, and examination by excretion urography shows the size, situation and contour of both kidneys to be normal (Fig. 5). The renal pelves and ureters are also normal. Even if her case stood alone, it would be sufficient to provide an unanswerable argument in favour of the contention that the creation of a cloaca by the deviation of the urine stream into the lower bowel is compatible with long life, good health, and happiness. But her case does not stand alone. Many now share her good fortune.

William Woolley, aged 38.—This patient, when aged 10 years, was brought to hospital by his mother who stated that he was incontinent of urine and was continually wetting his clothes. The urine was not passed naturally, but leaked from the perineum. This condition had persisted since birth.

On examination he was found to have a subsymphyseal extroversion of the bladder. When aged six, he was operated on in Great Ormonde Street, when an attempt was made to close the bladder. This was unsuccessful. A further operation was performed subsequently, without success. In 1910 he was operated on by Mr C. H. Allen in the General Hospital at Nottingham.

The abdomen was opened by a midline incision and the ureters defined to their entrance into the bladder. They were

removed, leaving an umbrella of bladder wall. Catheters were passed into the ureters and allowed to drain through the rectum. The ureters were implanted low down in the pelvic colon, each through a band. A drain was inserted into the pelvis.

His subsequent progress was satisfactory and both catheters drained well on the day following operation. They were removed on the second day. During the second week, control of the sphincter was obtained. After ten weeks he was discharged, when he passed urine about four times during the day and twice at night.

Patient remained in good health until about the age of 16, when puberty led to certain complications. His general health, however, was normal in every other respect until 1935, when he began to have discomfort in the left loin.

X-ray examination showed a calculus in the lower pole of the left kidney. This was voided naturally and he was discharged from hospital. The blood urea being 45 mgrms. per cent., excretion urography showed both kidneys to be acting satisfactorily and the pelves normal.

In May 1938 he was readmitted with another attack of renal colic producing obstruction. This was associated with fever and elevation of the blood urea, but subsequently he voided the stone naturally and the blood urea dropped to 48 mgrms. per cent. and his normal health was restored. The bowel motions have always been a mixture of fæces and urine and he has never acquired the ability to pass a fæcal motion separate from the urine. He has now three or four motions during the day and never more than one at night, but often he goes throughout the night without having to pass urine.

Once more he has returned to work as a chauffeur.

There are many points of interest in this case. In my opinion it must be one of the earliest cases of bilateral ureteral transplantation successfully carried out in one stage. It also appears to anticipate the tube method that came to be described later as the Coffey No. 2 technique. The patient is now a healthy man, occupying a responsible post and leading a normal active life, twenty-eight years after the original operation.

Mrs Jessie Bolton, aged 32.—This patient was originally seen by me at the Inaugural Meeting of the Scottish Urological Society in Glasgow, in April of this year. She was then presented to the meeting by Mr J. Scouler Buchanan. His letter of the 28th May 1938 to me is as follows: " Here are the details regarding Mrs Bolton. When she was admitted to the Western Infirmary on 19/10/27, she was twenty-four years old and single. There was present a typical Extroversion of the Bladder with

much excoriation of the surrounding skin. The condition had naturally been present since birth and she had had a miserable life trying to keep herself dry by applying any old pieces of cloth, etc.

"The raw surface of the bladder was 3×3 ins. in extent and the ureteral orifices could be seen discharging normally on the surface. There was a pungent ammoniacal odour about her person.

"On 29/10/27 the left ureter was transplanted into the descending colon.

"On 22/11/27 the right ureter was exposed. It was found to be considerably dilated, but the kidney felt normal. In view of this, it was considered unwise to transplant it.

"By this time she had good control of the rectal urine.

"On 8/12/27 a Retrograde Pyelogram of the Rt. Kidney was done showing a mild degree of Hydronephrosis and a marked Hydroureter.

"On 9/12/27 Rt. Nephrectomy was carried out. The raw surface epithelialised over rapidly and soundly and she was discharged on 31/12/27.

"Some time afterwards I heard that she had got married and had adopted a child. I managed to trace her this year and persuaded her to come up for examination. We were surprised to learn that three years ago she had become pregnant and was delivered of a live child by Cæsarean Section in the Edinburgh Maternity Hospital. This was all the more surprising in view of the condition of the vagina which could not have been penetrated.

"Unfortunately I have no note as to her menstrual history.

"She is now happy and contented and has no trouble with the bowel. She can go all night without having to void urine, and this comes away apart from fæces. There was some ulceration at the site of the extroversion, but this was not causing her much trouble.

"I enclose copies of the Excretion Urography Films taken recently, together with a photograph of the pelvic bones. You will see that the left kidney is functioning well, though there is some dilatation of the pelvis and ureter."

Her case also has been fully described by Dr W. I. C. Morris in a paper communicated to a Meeting of the Edinburgh Obstetrical Society, 12th February 1936, and is published in the *Edinburgh Medical Journal* for June 1936.

Dr Morris's paper is on "Three Cases of Congenital Abnormality of the Genital Tract Complicating Labour," and his third case is Mrs Bolton, "A Labour Complicated by Congenital Extroversion of the Bladder and Uterus Unicornis."

He describes how she was delivered of a live child by Cæsarean Section, carried out by Dr Sturrock in the Royal Maternity Hospital on the 24th October 1935. A very full account is given of the case in that paper. Her confinement after the operation was ultimately satisfactory, although it is noted as having been extremely stormy.

My comment on this case was the notable degree of excellent health which Mrs Bolton obviously possessed when she was first seen by me at the meeting at Glasgow and subsequently at the more recent lecture. Even the slight degree of dilatation of the pelvis and ureter in the remaining kidney that is referred to, can be explained by the fact that the technique employed when the photograph was taken was one where compression was exercised over the lower end of the ureter to dam back the secretion and render the delineation of the parts above more distinct.

Janet McDonald, aged 17.—On the 26th December 1925, Janet McDonald, aged 17, was admitted to my Wards in the Infirmary.

The history of her case was as follows :—

Patient has been troubled with frequency of micturition and a degree of incontinence of urine all her life. At the age of 11 she went to Yorkhill Hospital, Glasgow, where she stayed two months and received injections but no operative treatment. On discharge, patient had better bladder control at night, but was much as before during the day. At present patient can hold her water fairly well when she is lying in bed, but only very imperfectly when she is up and going about. On admission, patient had a frequency of about two hours in bed and of half an hour or less when going about.

A few months ago patient went to a nurse in Stirling who gave her some form of electric treatment, but as no improvement resulted, this was abandoned. About two years ago, patient went to the Glasgow Western Infirmary and was examined, but she was told that nothing further could be done. On 26th December 1925, patient was admitted to Ward 5, in the Royal Infirmary of Edinburgh, where, on examination, her condition was found to be one of subsymphyseal vesical exstrophy.

The appearances on physical examination have been described by me earlier in this paper.

On the 26th January 1926 the right ureter was transplanted into the pelvic colon according to the Coffey Mayo Technique.

Progress.—On the night of operation, 26/1/26, patient voided about one ounce of urine per rectum three times, at intervals of three hours.

27/1/26.—Total of 18 ozs. passed at intervals of about 1 hour.

28/1/26.—Total of 29 ozs. passed at intervals of 1½ hours.

30/1/26.—Now coming about every 2½ hours during the day and twice during the night.

Patient complained of slight pain during the first four or five days and she then settled down. Temperature and pulse swung slightly for the first ten days.

Her convalescence ultimately was most satisfactory and she returned to hospital and the second operation, at which the left ureter was transplanted, was carried out on the 21st June 1926. After this operation her convalescence was slightly stormy, but in no way alarming, and ultimately she was discharged in a very satisfactory state.

Since that date, she has reported regularly, and by excretion urography examination the kidneys were found to be functioning normally, actively, and to be healthy, and the renal functional activity is normal.

We have here four patients leading healthy useful lives, the first as a housewife, the second as a chauffeur, the third as a housewife, and the fourth as a domestic servant. They illustrate that with four different techniques equally successful results may be obtained, and at once they raise the question as to the prospect of a like success being obtained in similar cases by transplanting the ureters into the pelvic colon. If, as has been already stated, those cases where forlorn hopes are being treated be excluded, and only those cases where a deformity of congenital origin or the result of an accident are being dealt with, the answer is in the affirmative. Here the operation of ureteral transplantation is a relatively safe procedure and fully warranted as a method of treatment for these distressing disabilities.

Elsewhere * I have given a brief statistical record of sixty patients on whom I have carried out the operation of vesical exclusion during a period of fourteen years. A large number of these patients suffered from malignant disease of the bladder, either of primary or secondary origin. The mortality attending the treatment of these cases was extremely high. From the detailed records of the sixty cases I have treated certain tables have been compiled.

* "Vesical Exclusion," *Proceedings of the Royal Society of Medicine*, January 1938, vol. xxxi., pp. 277-292 (Section of Urology, pp. 1-16).

TABLE I.

Transplanted to loin	5
Transplanted to fistulæ	1
Transplanted to bowel—	
Two-stage operation	14
Single-stage operation	30
Single kidney	10

Since April 1934 in every case the operation has been performed in a single stage.

The five cases in which the ureters were transplanted on to the loins were operated on twelve and eleven years ago. Total cystectomy was subsequently carried out.

In fifty-four cases the ureters were transplanted into the colon.

TABLE II.

Results of Whole Series.

	Cases.	Recoveries.	Deaths.	
Non-malignant conditions	27	20	7	(25·5%)
Carcinoma	33	16	17	(51·6%)
Total	60	36	24	

Results since January 1936.

	Cases.	Recoveries.	Deaths.	
Non-malignant conditions	11	10	1*	(9%)
Carcinoma	14	8	6	(43%)
Total	25	18	7	

* Cervical carcinoma treated by radium with formation of fistulæ from vagina into bladder and rectum.

In Table II. the results since January 1936 are especially interesting. They illustrate the low mortality of the non-malignant conditions. This is especially noteworthy, particularly when it is borne in mind that the one case that was lost was a case of cervical carcinoma treated by radium, with subsequent formation of fistulæ extending from the vagina into the bladder and rectum. If the patient had recovered from the vesical exclusion, it was purposed to close the fistula in the rectum by obliterating the vagina and bladder.

In Table III. (p. 82) the high ultimate mortality of cases of vesical carcinoma is brought out. This is due to there being included those cases of carcinoma in which the patients died some many months or years after the operation, from the natural progress of the disease.

Name.	Condition done for.	Date.	Unilateral or Bilateral.	Single or Double Kidney.	Surgeon.
Mrs E. Robertson (Absent)	Subsymphyseal Vesical Exstrophy	1908	Bilateral	Double	Sir Harold Stiles
William Woolley (Absent) .	Vesical Extroversion	1910	Bilateral	,,	Mr C. H. Allen
Janet McDonald . .	Subsymphyseal Vesical Exstrophy	26.1.26	Rt. Ureter Trans.	,,	Mr Wade
		21.6.26	Lt. Ureter Trans.		
Mrs J. Bolton . . .	Extroversion of Bladder	29.10.27	Lt. Ureter Trans.	Single	Mr Farquhar Macrae
		9.12.27	Rt. Kidney Excsd.		
Mrs C. Dryburgh . .	Vesico-Vaginal Fistula	30.12.32	Rt. Ureter Trans.	Double	Mr Wade
		31.3.33	Lt. Ureter Trans.		
Mrs M. Fleming . .	Vesico-Vaginal Fistula	14.11.33	Bilateral	,,	Mr Wade
Mrs Olive Gray . .	Vesico-Vaginal Fistula	24.11.33	Attempt repair of fistula	,,	Mr Wade
		16.1.34	Lt. Ureter Trans.		
		10.4.34	Rt. Ureter Trans.		
Mrs Kennedy . . .	Intractable Cystitis	11.2.33	Pre-Sacral Neurectomy	,,	Mr Wade
		6.3.34	Rt. Ureter Trans.		
		30.3.34	Lt. Ureter Trans.		
Mrs Bain . . .	Intractable Cystitis	25.6.35	Nephrectomy Lt.		Mr Wade
		30.1.36	Rt. Ureter Trans.	Single	
Mrs Morgan . . .	Vesico-Vaginal Fistula	17.11.36	Bilateral Trans.	Double	Mr Stewart
William Morrison . .	Extroversion of Bladder	2.3.37	Bilateral Trans.	,,	Mr Wade
Mrs Davids . . .	Intractable Cystitis	5.3.37	Bilateral Trans.	,,	Mr Wade
Mrs Peters . . .	Vesico-Vaginal Fistula	9.7.37	Bilateral Trans.	,,	Mr Wade
Jean Dryburgh . .	Subsymphyseal Vesical Exstrophy	3.8.37	Bilateral	,,	Mr Wade
Mrs A. Kerr . . .	Vesico-Vaginal Fistula	6.7.37	Bilateral	,,	Mr Wade
Mrs Margaret Thomson .	Carcinoma of Bladder	2.7.36	Bilateral	,,	Mr Wade

TABLE III.

Analytical Results.

	Cases.	Post-operative Mortality.	Ultimate Mortality.	Alive To-day.
Vesical carcinoma	27	13	23	4
Vesico-vaginal fistulæ (obstetric injury)	9	0	0	9
Vesico-vaginal fistula (radium burn) .	3	2	2	1
Persistent vesical systole (T.B.) . .	6	2	4	2
Congenital abnormalities . . .	6	2	2	4
Urethral carcinoma	4	2	3	1
Intractable cystitis	3	0	0	3
Urethral stricture	2	2	2	0
Urethral fistula	1	1	1	0

Perhaps the most convincing demonstration of the value of the operation of ureteral transplantation and the best guide to the expectancy of life thereafter was demonstrated in the fourteen patients who attended and were introduced to the Meeting. (See Table, p. 81.)

The ultimate conclusion of our consideration of this question is, that where the urinary bladder has been so seriously damaged as to be incapable of repair, the creation of a cloaca by transplantation of the ureters into the pelvic colon is indicated. The risk to life thereafter is not undue and the expectancy of life is good.