Proceedings of the Royal Society of Medicine Vol. XXXI 277

Section of Urology

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[*October* 28, 1937]

Vesical Exclusion

PRESIDENT'S ADDRESS

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ABSTRACT.—In the operation of vesical exclusion the urine stream is deviated from the urinary bladder into the colon, thereby forming a cloaca, or on to the surface of the skin, where a fistula discharging urine is created.

The operation is indicated in all cases of complete or partial vesical exstrophy. It is successfully employed in treating severe cases of vesico-vaginal fistula, whether the result of obstetric injury or the delayed action of radium.

In carcinoma of the urinary bladder, whether primary or secondary, it is practised, frequently preliminary to the operation of total cystectomy.

In cases of persistent vesical systole and in intractable cystitis, it has also been occasionally done.

The immediate operative mortality following transplantation of the ureters into the pelvic colon is largely dependent on the condition for which the operation is performed. In cases of malignant disease it is high : whereas in conditions that are non-malignant it is a relatively safe procedure.

The establishment of a cloaca, particularly in the female, of itself produces no appreciable disability. If the operation has been performed for a congenital or an acquired deformity, and this has been skilfully and successfully carried out and the patient has become stabilized, the expectancy of life should not be appreciably diminished.

The case of a patient, upon whom the operation had been performed twenty-nine years previously, is reviewed and particulars of others in which it was performed fourteen years ago, or later, are referred to.

In the pre-operative preparation, in addition to the usual thorough clinical investigation, an examination by excretion urography is indicated, especially to determine the possible presence of a third ureter or a single functioning kidney. At this period it is also important, particularly in cases of obstetric injury, to be sure that the rectal sphincter is fully competent and that no hæmorrhoids are present.

The operative technique was carried out under twilight sleep and spinal anæsthesia. The vital importance of careful post-operative treatment is emphasized. By the immediate post-operative administration of sodium sulphate, by intravenous injection and attention to other details, bilateral ureteral transplantation carried out in one stage could be safely embarked upon without the fear of anuria developing.

A detailed record of 60 cases, in which the operation of vesical exclusion has been carried out by the author is given.

RÉSUMÉ.—Dans l'exclusion opératoire de la vessie, l'urine est conduite dans le colon, avec formation d'une cloaque, ou à la surface, où elle s'échappe par une fistule urinaire.

L'opération est indiquée dans tous les cas d'extrophie totale ou partielle de la vessie. On l'emploie avec succès dans les cas graves de fistule vésico-vaginale, qu'elle soit le résultat d'un traumatisme obstétrical ou d'un effet tardif d'un traitement au radium.

Elle s'emploie dans le traitement des cancers primitifs ou secondaires de la vessie, souvent comme préliminaire à la cystectomie totale.

Elle a aussi été employée de temps en temps dans les cystites obstinées et dans la systole vésicale persistante.

La mortalité immédiate suivant la transplantation des uretères dans le colon pelvien dépend en grande partie de l'affection pour laquelle l'opération est employée, étant élevée dans les cas de tumeur maligne et relativement basse dans les cas bénins.

La formation d'une cloaque, surtout chez la femme, ne cause pas d'inconvénient appréciable. Si l'opération est habilement et soigneusement exécutée dans un cas de malformation congénitale ou acquise, et si le malade s'est habitué à son nouvel état, sa vie moyenne n'est pas appréciablement raccourcie.

L'auteur rapporte un cas opéré il y a 29 ans, et fait allusion à d'autres cas opérés il y a 14 ans ou moins.

Une pyélographie excrétoire est indiquée avant l'opération en plus de l'examen clinique complet habituel, surtout pour exclure la possibilité de la présence d'un troisième uretère ou d'un seul rein fonctionnant. Il est aussi important, surtout dans les cas de traumatisme obstétrical, de s'assurer en même temps que le sphincter rectal fonctionne bien, et qu'il n'y aie pas d'hémorroïdes.

L'opération se fait sous le sommeil crépusculaire associé à l'anesthésie spinale. L'auteur appuie sur la grande importance du traitement post-opératoire. Si le danger d'une anurie est évité par l'administration intravéneuse de sulphate de soude immédiatement après l'opération et par l'attention à quelques autres détails, la transplantation des deux uretères en un temps pourra être entreprise avec sureté.

L'auteur rapporte en détail 60 cas personnels d'exclusion opératoire de la vessie.

ZUSAMMENFASSUNG.—Bei der operativen Blasenausschaltung wird der Harn von der Harnblase unter Bildung einer Kloake in das Kolon oder zur Hautoberfläche geleitet, wo er sich durch eine Fistel entleert.

Die Operation ist in allen Fällen von totaler oder partieller Blasenexstrophie indiziert; ferner wird sie mit Erfolg in der Behandlung schwerer Fälle von Blasen-Scheiden-Fistel angewandt, gleichgültig ob sie durch Geburtstrauma oder als Spätwirkung einer Radiumtherapie aufgetreten ist.

Sowohl bei primärem als auch bei sekundärem Blasenkarzinom wird diese Operation vorgenommen u.zw. häufig als Vorläufer einer totalen Cystektomie.

Gelegentlich wurde sie auch in Fällen von hartnäckiger Blasensystole oder schwer behandelbarer Cystitis vorgenommen.

Die unmittelbare Sterblichkeit durch die operative Verpflanzung der Harnleiter in den Beckenteil des Kolons ist weitgehend von dem zugrundeliegenden Zustand abhängig, wegen dessen die Operation vorgenommen wird. In Fällen von bösartigen Tumoren ist sie gross während in nicht bösartigen Fällen die Operation ein verhältnissmässig gefahrloser Eingriff ist.

Die Schaffung einer Kloake an sich verursacht besonders bei der Frau keine besonderen Beschwerden. Wenn die Operation wegen einer angeborenen oder erworbenen Deformität vorgenommen und geschickt und erfolgreich ausgeführt wurde und der Patient sich an die neuen Verhältnisse gewöhnt hat sollte die Lebensdauer nicht merkbar beeinflusst werden.

Der Fall eines Patienten, bei dem die Operation vor 29 Jahren vorgenommen wurde, wird geschildert und Einzelheiten anderer Fälle, die vor 14 Jahren und später operiert worden waren, werden besprochen.

Bei der Vorbereitung zur Operation ist abgesehen von der üblichen gründlichen klinischen Untersuchung eine Untersuchung mittels Ausscheidungspyelographie indiziert, besonders auch um das eventuelle Vorhandensein eines dritten Harnleiters oder einer einzigen funktionierenden Niere festzustellen. In diesem Stadium ist es ferner besonders in Fällen von Geburtstrauma wichtig sicher zu sein, dass der Mastdarmschliessmuskel voll funktionsfähig ist und dass keine Haemorrhoiden vorhanden sind.

Die Operation wird unter Dämmerschlaf und Lumbalanaesthesie ausgeführt. Grösster Nachdruck wird auf sorgfältige Nachbehandlung gelegt. Die unmittelbar nach der Operation vorzunehmende intravenöse Anwendung von Natriumsulfat und die Beachtung anderer Einzelheiten ermöglicht es die doppelseitige Ureterenverpflanzung in einzeitiger Operation ohne Risiko und insbesondere ohne Gefahr der Anurie vorzunehmen.

Verf. gibt einen ausführlichen Bericht über 60 eigene Fälle von Blasenausschaltung.

INDICATIONS

EVERY now and then a case is met with in which the urinary bladder has ceased to do its duty and will no longer hold water. A number of causes may produce this sad state of affairs.

Congenital malformations.—(1) Complete vesical exstrophy: An error in development during intra-uterine life may result in the child being born with a strawberry-like swelling on its lower belly wall, and when this swelling is examined it is found to be the posterior wall of the bladder bulging forwards unsupported, the anterior wall of the bladder being absent, as is also the anterior abdominal wall in this region. Water weeps in a constant steady stream from the under-surface of this swelling and when it is tilted up by the finger the two ureteral orifices are seen jutting forth urine. The bladder here fails to function, as there is no bladder cavity.

(2) Subsymphyseal vesical exstrophy: Another less obvious error in development is that in which the anterior wall of the bladder and the anterior abdominal wall are

formed naturally, but the bladder neck is wanting in front, the condition being known as subsymphyseal vesical exstrophy, or epispadias in the female.

Instead of being obvious at birth, the possessor of this deformity may grow up to adolescence without the true nature of her disability being recognized. As an infant and young girl, the patient is considered as suffering from lack of control of micturition from a nervous or similar cause.

The explanation of this oversight is due to the fact that Nature has here formed a urinary bladder which is a saucer capable of holding some water when the patient is in the recumbent posture (fig. 1), but which spills its contents when she assumes the erect posture. Thus she may reach the age of 17 or 18 years before it is recognized.

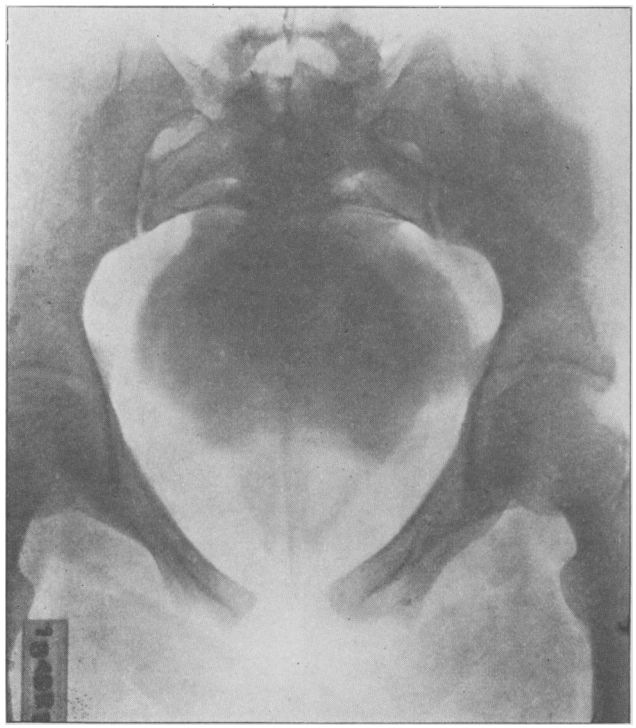

FIG. 1.—To illustrate the "saucer bladder" in a case of subsymphyseal vesical exstrophy in a young woman. Excretion urography photograph at thirty minutes; patient recumbent. J. D., aged 17.

When she is then examined, as she lies in the dorsal position with the thighs together, at first nothing abnormal is noticed except that the lower margin of the mons veneris is notched. When the thighs are separated the nature of the deformity is apparent. The notch previously seen is observed to deepen into the cleft which splits the clitoris and passes down to the neck of the bladder, the anterior wall of the urethra being absent, as is also the vesical neck in front, so that the examining finger passes readily through a wide patulous orifice into the bladder cavity. The vesical neck in front and the anterior wall of the urethra may alone be absent in the simplest variety of this deformity, as illustrated in figs. 2 and 3.

In the majority of these cases an X-ray examination shows that the symphysis pubis has failed to unite.

Obstetric injury.—Vesico-vaginal fistula: Sometimes during parturition the urinary bladder is so severely damaged that a large opening into the vagina results; a vesico-vaginal fistula is formed. Fortunately the great majority of these cases can

be repaired by plastic operation. Sometimes this treatment fails and a large fistula remains through which every drop of urine escapes to foul the vulva and excoriate the thighs of the unfortunate patient.

In still another variety of vesico-vaginal fistula the vesical sphincter may also be damaged so that even a successful attempt to close by plastic operation the fistula fails to cure the patient as incontinence from another cause still remains.

Vesical carcinoma.—In the light of our present knowledge we have to acknowledge that there are still cases of primary carcinoma of the urinary bladder, the only cure for which is by removing the entire organ, doing the operation of total cystectomy, and

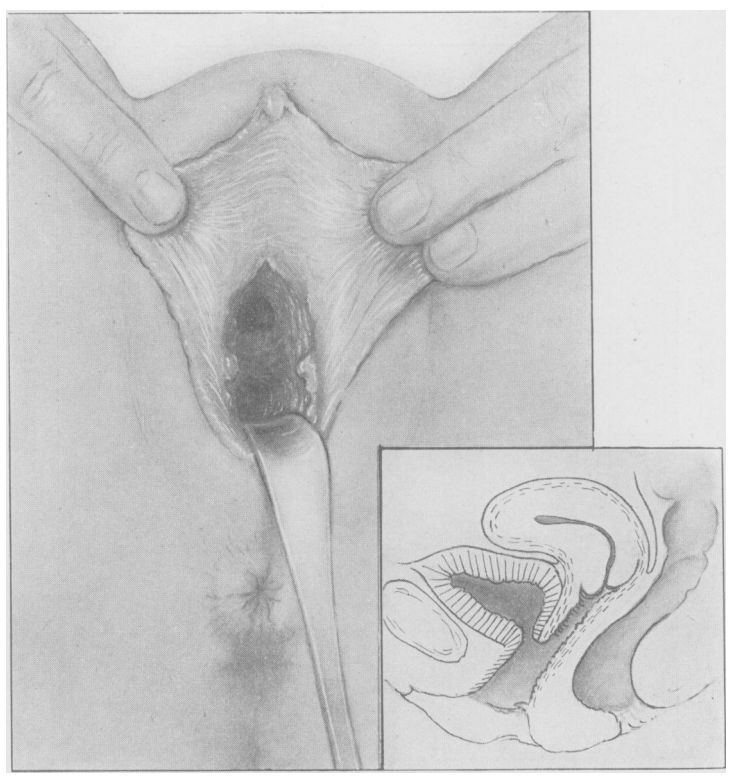

FIG. 2. FIG. 3.

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.

this of course necessitates the previous deviation of the urine stream by vesical exclusion.

Carcinoma of cervix uteri treated by radium, followed by vesico-vaginal fistula from delayed action of radium.—Carcinoma of the cervix uteri is most successfully dealt with by the application of radium. In many cases a permanent cure is effected, leaving the patient without any apparent disability. Unfortunately, this is not so in every case. In more than one I have seen this treatment followed by destruction of the bladder floor and the creation of a vesico-vaginal fistula owing to a delayed action of the radium. These cases are unsuitable for cure by a plastic operation and are best treated by vesical exclusion.

Recurrent carcinoma of cervix uteri.—The fate of the urinary bladder is also raised in carcinoma of the cervix uteri which has been overlooked or has recurred after treatment.

This disease spreads upwards behind the bladder along the cellular tissue planes of the pelvis so that it comes to surround and involve the lower ends of the ureters and subsequently the wall of the bladder. To attempt to destroy this growth by radiation would necessitate a partial destruction of the bladder floor and the production of a vesico-vaginal fistula.

If untreated, the expectancy of life in these cases is stated to be from seven to nine months, death being frequently due to anuria.

In treating them the first problem is therefore that of performing the operation of vesical exclusion by deviating the urine stream. Thereafter treatment by radiation can be actively carried out regardless of the extent to which the now functionless bladder is damaged. Or, if so desired, the growth may be excised by combined hysterectomy and cystectomy.

Tuberculous cystitis.—Persistent vesical systole : Vesical exclusion may be called for in the treatment of tuberculous disease of the urinary tract. The accepted treatment of unilateral renal tuberculosis is to remove the diseased kidney and ureter by operation. When this is done, in the majority of cases the bladder is found to be the site of tuberculous cystitis. A natural cure of this usually follows within two years after the operation of nephrectomy. When this cure is not achieved the inflamed bladder remains in a state of persistent systolic contraction, with the result that backward pressure is exercised on the solitary kidney, and hydronephrosis and hydroureter develop, with progressive impairment of renal function, culminating ultimately in uræmia and death. Having witnessed this tragedy on several occasions, I have tried to relieve the deadly backward pressure by various means—by drainage of the renal pelvis, by drainage of the ureter, and by sympathetic denervation of the lower end of the ureter. These have afforded only temporary relief, so that ultimately it was recognized that vesical exclusion was indicated and in certain of these cases the single ureter was transplanted into the pelvic colon.

Intractable cystitis.—I have carried out the operation of vesical exclusion, transplanting the ureters into the pelvic colon, in the treatment of cases of intractable cystitis—a procedure which at first sight some might consider unjustifiable. In each of the cases ureteral transplantation was only finally decided upon after the patient had received prolonged treatment by a physician widely experienced in the treatment of such cases. It was only when he also finally confessed failure that the treatment was decided on. In all these cases the patients had a normal and uneventful convalescence and are in excellent health to-day, happy, and deeply grateful for the treatment they have received.

Urethral stricture with urethral and vesical fistulæ.—In three cases classified under this category I have been driven to perform the operation of vesical exclusion, transplanting the ureters into the colon as a forlorn hope. Two were cases of fracture of the pelvis in young lads, with rupture of the urethra followed by extravasation of urine and pelvic cellulitis. After many operations and years of suffering, they were broken-down in health, with several vesical and perineal fistulæ. It seemed to me that the only hope of improving their lot was by deviation of the urine stream into the bowel.

Another case of urethral stricture had been followed by destruction of the urethra and development of numerous fistulæ with intractable cystitis above.

Spina bifida with vesical incontinence.—I have had one case of this nature. It illustrates the desperate problems that are laid before you when you are known to be interested in the subject of vesical exclusion. The case sent to me was that of a child who suffered from spina bifida and vesical incontinence, for the relief of which the ureters had been transplanted on to the abdominal wall a year and a half before. The child was leading a life of indescribable misery. The entire urinary secretion

flowed on to the abdominal wall; the infant came to me in foul-smelling rubber clothing, and when this was removed the skin beneath was seen to be the site of an encrusting urinary dermatitis—a desperate situation. The skin was improved by baths and similar treatment, but the only hope of relief appeared to be by deviating the urine stream into the pelvic colon.

Immediate Operative Mortality

The cases I have mentioned, and particularly the last group, raise the question as to the immediate operative mortality of such an operation, the disability, if any, the patient subsequently labours under, and, finally, the expectancy of life thereafter.

As regards the immediate operative mortality, I will later give an accurate statistical record of the patients I have treated. But I would here say that my personal experience is that the most important factor in this connexion is the presence or absence of malignant disease. If malignant disease is present the mortality is high, and if your experience of this operation is to be confined to such cases you are fated to have many disappointments for, undoubtedly, your greatest triumph will be in those other cases that I have mentioned. The manner in which patients in these cases behave is such as to convince me that in all cases of malignant disease a deadly secret subtle poison is present which conspires to bring about a fatal issue. It is not in the first few hours or the first few days that disaster arises. It is later, when your other cases would have been considered safely out of the wood, that the malignant case slips back and slowly sinks. And you may lose your patient possibly, even as I did in one of my cases, by what amounted to the manifestation of the instinct of death. She ceased to talk to her relatives who sat by her bedside; she ultimately refused food, and finally death supervened. At the subsequent post-mortem examination there was no demonstrable complication present. If I may use a hackneyed and much misunderstood expression, from the surgical standpoint the operation had been most successful. All that was apparent was the malignant disease in the pelvis, for which the original operation had been performed, and this has held good in a number of other cases of malignant disease that I have dealt with. A fatal issue has ultimately supervened, usually about the third week, the post-mortem appearances, from the surgical standpoint, being satisfactory.

On the other hand, where the operation is performed for any of the other non-malignant disabilities, the immediate mortality is low.

Future Disability

The disability, if any, under which these patients subsequently labour from the establishment of a cloaca, falls now to be considered. As you are aware, many animals possess this, and in the mammalian kingdom the echidna and the duck-billed platypus are so constructed. This common channel, into which the intestinal, urinary, and genital secretions are discharged, is so regulated that segmental function is established. A "urodæum" is formed where the urine is collected (fig. 4), and a proctodæum where the intestinal content is gathered. Very soon a similar state of affairs is established in your patients. In female patients it is most noticeable. They tell you that they sleep the whole night through undisturbed and void urine three or four times during the day. They will probably mention that on many occasions it is a clear urinary secretion which is passed and that a separate act of defæcation takes place where a formed motion is evacuated. To them their existence is a natural and happy one and compatible now for the first time with full social enjoyment.

In the case of male patients, as you can understand, the nature of the act of micturition is most materially altered, but otherwise the cloaca functions as already described. Most of the women who will come under your care will be in the full vigour of their sexual life, and it is important to remember that the operation of ureteral transplantation in no way stands in the way of pregnancy, and a successful confinement. I cannot quote a case in support of this statement, but in this respect our luck has been unfortunate. In one case, that of a married woman on whom the

operation of vesical exclusion by ureteral transplantation was performed, for a vesico-vaginal fistula, pregnancy subsequently occurred ; an accident unfortunately here induced abortion. Another who had successfully and uneventfully reached her fifth month had gestation terminated by her medical adviser who, remembering her terrible experience when she had had the difficult labour which led to the vesico-vaginal fistula, thought it in the interests of her health to carry out this treatment. Personally, I was keenly disappointed as I did not share his opinion on this question. Nevertheless, I look forward confidently to tangible proof of my contention at an early date.

Expectancy of Life

To some the creation of a cloaca may seem so unnatural a process as to be incompatible with a reasonably long expectancy of life. The uninformed pessimist is apt

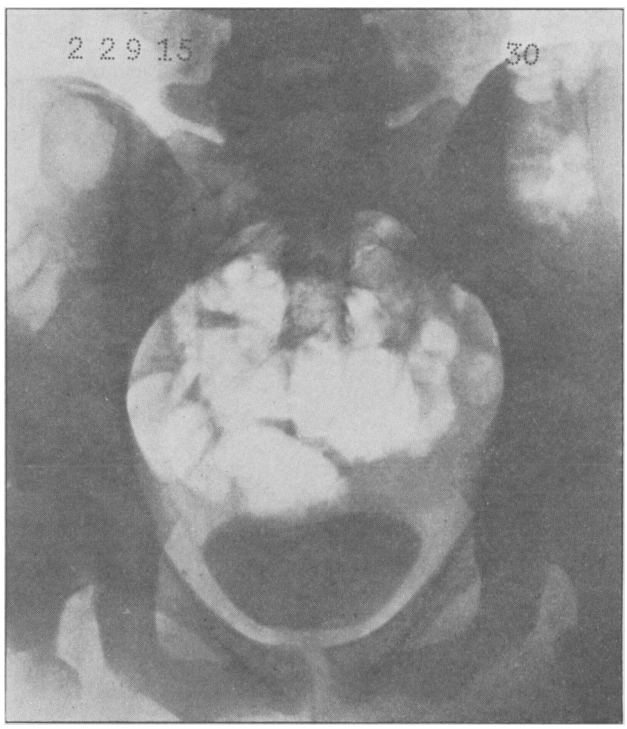

Fig. 4.—To illustrate the " urodæum ". A collection of urine in the bowel after bilateral ureteral transplantation performed nine years previously, delineated by excretion urography. J. McD., aged 26.

to bemoan the likelihood of the early development of an ascending renal infection, suppurative pyelonephritis, and death. My personal experience is to the contrary. Sufficient years have now elapsed to enable me to give it as my opinion that if bilateral ureteral transplantation has been skilfully performed for a congenital or acquired deformity and the patient, having come successfully through the operation, has become stabilized thereafter—I mean by this that a normal functioning " urodæum " has become established—the expectancy of life has become little if at all reduced and a normal, useful, and contented life has been made possible, despite the profound physio. logical alteration brought about by the surgical intervention. The best illustration I know of this is the following :—

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 ".[1] The patients were aged 3 years and 7 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, twenty-nine years after the operation. The patient is now a married woman, aged 32, living a happy natural life 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.

My earliest case was twelve years ago in a young woman aged 17 who also suffered from subsymphyseal vesical exstrophy, which had been overlooked until that date. Bilateral ureteral transplantation was carried out in two stages. Her health to-day is normal. Her kidneys are undamaged, uninfected, and functioning naturally. Many other cases now provide similar testimony.

Pre-operative Preparation

If it be granted that the operation is indicated, certain points in the pre-operative preparation should be attended to. In addition to the customary thorough medical examination, the functional activity of the kidneys should be carefully determined. The collection of a sample of urine is usually difficult and a satisfactory cystoscopic examination, with ureteral catheterization, is frequently impossible. I have found that a blood examination, with an estimation of the blood urea and creatinine, has been a satisfactory means of determining the health of the kidneys.

Examination by excretion urography.—An examination by excretion urography should be made in every case. It provides another excellent test of renal function. It will also demonstrate the possible presence of the not unusual deformity of double ureter on one or both sides. It is very important to make this observation before the operation commences, as it is very easy to overlook, in the operating theatre, the presence of a third ureter, as in a case referred to me by a colleague, in which, after the apparently successful transplantation of both ureters into the colon, urine still continued to escape through the vesico-vaginal fistula. In this case a third operation was performed by myself, and revealed a second ureter on the left side which had previously not been suspected ; on the transplantation of this into the colon, no

[1] *Surg., Gyn. and Obst.*, 1911, **13**, 127.

further escape of urine through the vesico-vaginal fistula took place, and the patient was finally cured.

The excretion urography examination will also provide a guide as to the possible presence of a single functioning kidney, a congenital malformation which, I consider, occurs in one out of every hundred normal persons. The presence of this abnormality is revealed by the excretion urography examination outlining a healthy kidney and pelvis on one side and an entire absence of shadow on the other. But in this connexion a fallacious interpretation may easily be made.

The operation of ureteral transplantation, as has been mentioned, is sometimes done in cases of carcinoma of the urinary bladder. In certain of these cases the

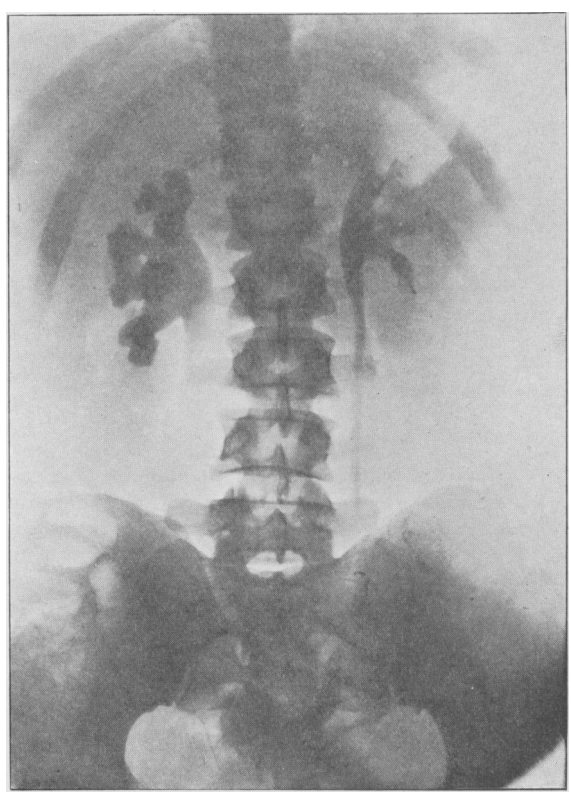

FIG. 5.—Photograph delineating by excretion urography the kidneys, calyces, pelves and ureters fifteen minutes after the injection of uroselectan B, twenty-nine years after bilateral ureteral transplantation into colon. Mrs. R., aged 32.

growth not infrequently involves the lower end of one or other ureter and thereby produces backward pressure on the kidney above. In such cases backward pressure, moderate in amount and even of short duration, may result in a kidney appearing to be functionless on excretion urography examination, no shadow being thrown on that side, an appearance similar to that already met with in the single functioning kidney. In such a case it is only when the abdomen is opened that it is possible to determine the cause of the absence of shadow. Where this is due to backward pressure, it is usually noted that the ureter on this side is markedly dilated and the renal pelvis tensely distended. In such a case, although even a definite degree of hydronephrosis and hydro-ureter may be present and the kidney be apparently functionless, when the pressure is relieved, functional activity returns, and even a

mild degree of hydronephrosis may be recovered from after ureteral transplantation. Another point that is here brought out is that ureteral transplantation is still possible when the ureter appears to be very grossly distended, for when it is opened and the pressure within released, it is noteworthy and satisfactory to observe how its thin walls collapse to a calibre that renders transplantation not difficult. At the same time, of course, there are cases in which the excretion urography examination reveals a degree of dilatation of renal pelves and of ureters which is bilateral and so gross that ureteral transplantation into the pelvic colon is obviously contra-indicated. I would go to the length of saying, however, in the doubtful case, when the single dilated ureter is demonstrated by excretion urography, of recommending operation and, granted that when it is exposed its walls although tense are thin, I would transplant it into the colon with every confidence.

The pre-operative preparation of the bowel is naturally of very great importance and should be carried out by the nursing staff with the thoroughness customary in all cases of abdominal surgery. Personally, I have always obtained in the operating theatre an empty, quiet, normal colon, usually contracting as a spinal anæsthetic has been employed, and one to which it has never been necessary to apply a clamp for fear of contamination of the wound. Personally I would never approve of any technique wherein an attempt is made to cleanse the bowel by lotion or by gauze swabs in the operating theatre.

It is important to remember that in cases of severe vesico-vaginal fistula produced by difficult labour, there may also be damage to the rectal sphincters and a tendency to rectal incontinence. Before the operation of ureteral transplantation is undertaken in these cases, this point should be carefully looked into and if necessary corrected. Similarly hæmorrhoids, if severe, may cause irritation, and frequently after the establishment of a cloaca. These also should be treated.

Operative Technique

In the choice of operative technique a wide field exists. Personally, I have now come to adopt, with certain minor modifications, the Coffey-Mayo operation—the Coffey No. 1 technique, as it is sometimes called. It appears to me to be the best, the No. 2 and No. 3 Coffey operations being, in my opinion, unsound in principle and inferior in many ways. The fundamental essentials of such an operation—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 $\frac{1}{6}$th 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 work as carried out by the masters with whom we served our apprenticeship, it now takes a subordinate position. The physiologically minded surgeon realizes 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 anæsthetized by twilight sleep and spinal anæsthesia, the abdomen, being completely relaxed, is opened by a mid-line 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—and make your implantation accordingly, with the ureter running

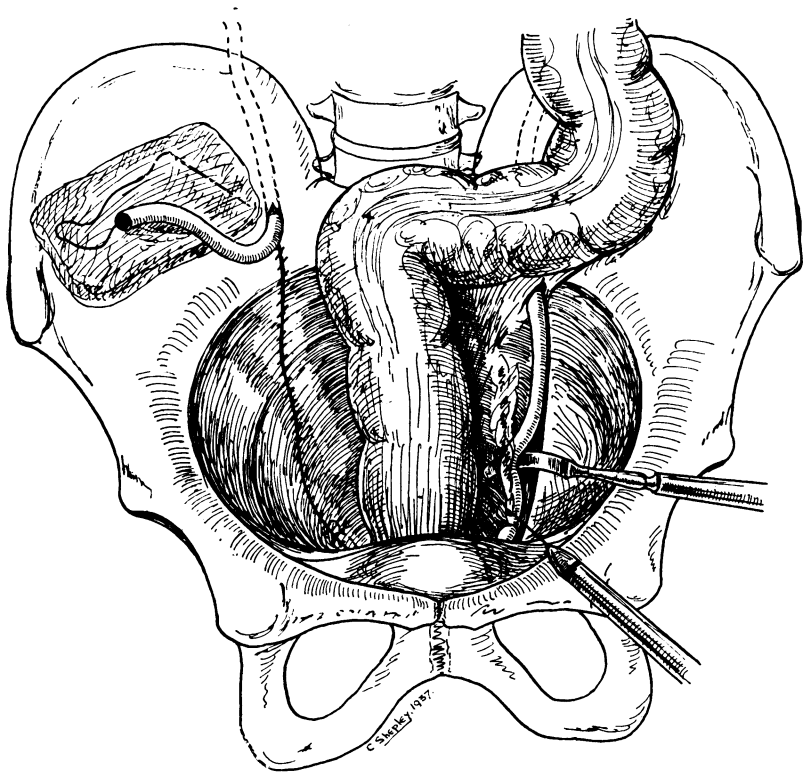

FIG. 6.—Technique of operation. Right ureter isolated, divided at its lower end, and prepared for implantation, and divided peritoneum sutured. Left ureter isolated below pelvic colon, ligatured at lower end, and in process of division by diathermy knife.

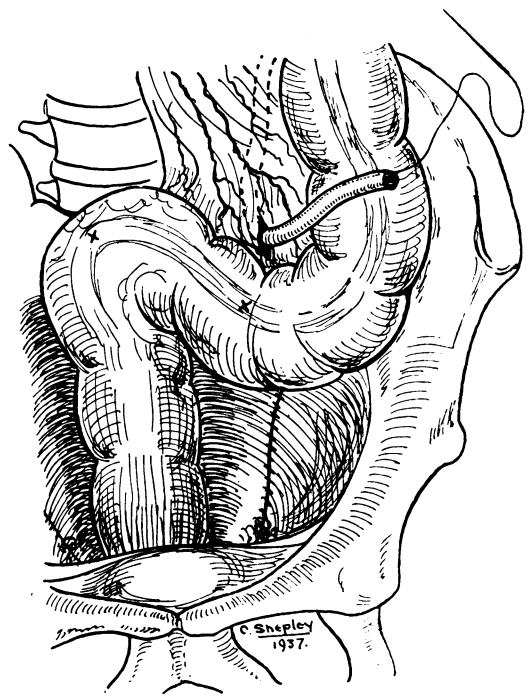

FIG. 7.—Technique of operation. Left ureter isolated below pelvic colon, displaced above colon and brought out through base of mesocolon, and prepared for implantation, peritoneum sutured.

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 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

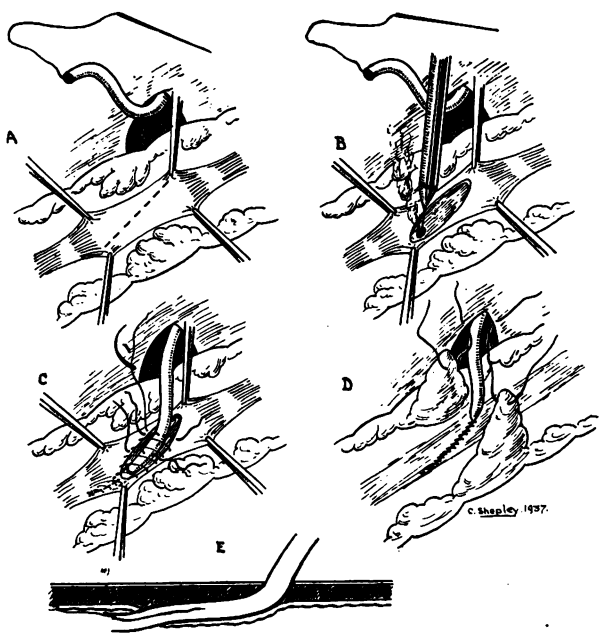

FIG. 8.—Technique of operation: (A) Preparing submucous bed; line of incision through serous and muscular coats. (B) Opening bowel with diathermy knife at distal end of submucous bed. (C) Ureter inserted, fixed and buried beneath serous and muscular coats. (D) Retroperitonealizing implanted ureter by 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.

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 iliosigmoid 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.

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.

As I have mentioned, it was work done by my young colleague, Ian Lawson Dick, which led us to use sodium sulphate for intravenous injection as a post-operative diuretic in cases of ureteral transplantation. We consider that by its use we have eliminated the risk of post-operative anuria in these cases. We have referred elsewhere (*Edinburgh Medical Journal*, vol. 40, 1934) to the experimental and clinical observations made, dealing with its use as a diuretic and the grounds on which its value as promoting renal secretion were based. All our subsequent experience since that article was written has gone to substantiate further the claims there made.

Ureteral transplantation on to the loins.—In the cases of vesical exclusion so far dealt with I have referred only to those in which the transplantation of the ureters into the colon, and the establishment of a cloaca thereby, was carried out.

Two other methods have been employed by me and are worthy of consideration, the first being that of transplanting the ureters on to the loins and creating there two fistulous openings through which urine is discharged. Such an operation is easy to do, safe and speedy, but has the great disadvantage that the collection of urine and the keeping of the patient dry are very difficult. So far we have not been able to devise any apparatus which worked with a reasonably constant efficiency when the patient was standing, sitting, or lying down. The operation cannot therefore be recommended merely on the grounds of enhancing the patient's comfort, and is only to be thought of as part of the treatment of malignant disease of the urinary bladder.

I have used it successfully as a preliminary to total cystectomy, but would now only adopt it if driven to this course by circumstances such as impaired renal function combined with gross dilatation of both ureters, rendering transplantation of the ureters into the colon inadvisable.

The possibility of the performance of this operation as a purely palliative procedure naturally occurs to one, when it is remembered how successful deviation of the intestinal flow is in the treatment of carcinoma of the rectum by a palliative colostomy. Unfortunately, such hopes are doomed to disappointment, which is particularly keen in the light of the terrible end of sufferers from vesical carcinoma. As the cancerous growth invades the bladder wall, there is painfully expelled a small quantity of foul-smelling, blood-stained urine, and this goes on day and night at intervals of a few minutes, and the patient, haggard with pain and want of sleep, clings precariously and almost unwillingly to a life of misery. After transplanting the ureters on to the loins in such a case, these spasmodic painful vesical contractions, unfortunately, still

persist, for it is not the urine that the bladder is endeavouring to expel, but the growth invading its wall. Thus the operation affords little relief as a palliative procedure. It is permissible, however, to do it as a palliative measure in a case of advanced carcinoma unsuitable for total cystectomy, and when combined with pre-sacral neurectomy, it produces appreciable relief.

Ureteral transplantation to natural fistulæ.—Another form of vesical exclusion that I have performed was in a man aged 53, who had had complete vesical exstrophy from birth and had more recently developed a carcinoma on the extruded bladder wall, which had remained untreated until it was very extensive. It had been in existence for two years and formed a foul-smelling large fungating growth ; in fact, to be candid, it was apparently more in the interests of the relatives than of the patient that the patient was transferred to my care.

Excretion urography examination showed a very extreme degree of dilatation of the ureters and renal pelves, obviously precluding the possibility of transplanting the ureters into the colon. Under ordinary circumstances this would have been scarcely possible. It was less so here, where it was first necessary to excise widely a large cancerous growth, a procedure necessitating the removal of a large portion of the entire wall of the lower abdomen. A method of vesical exclusion therefore was employed here similar in principle to that used by me in treating the ureter in a hemicystectomy for carcinoma of the urinary bladder. The ureters were divided and left undisturbed and allowed to form natural fistulæ where they lay. These fistulæ came, ultimately, after the bladder had been removed, to discharge on to the abdominal surface. The repair of the defect of the abdominal wall was successfully accomplished and to-day, twelve months after the operation, the patient is in good health, and the urine is voided into a depression on to the lower part of the abdomen, into which both ureters open.

In the cases of vesical exstrophy in the adult male that I have met with both testicles have been of full adult size and hanging over the pelvic brim below the spines of the pubis in separate large sacs.

Clinical examination and the patients' own statements have suggested that virility and potency existed. This has suggested to me the possibility of restoring the genital tract by a plastic operation after vesical exclusion has been performed, and the urine stream deviated into the bowel. I have one case that appears suitable for this treatment, and the patient is willing to submit to it, if I approve.

Statistics

I will now lay before you a brief statistical record of the 60 patients on whom I have operated during a period of fourteen years. You will note from the record, however, that the great majority of the operations have been done in recent years. You will also note that a large number of these patients have been sufferers from malignant disease of the bladder, either of primary or secondary origin. The mortality attending their treatment has been extremely high, and the reason for this is in part to be found in the critical state of the patients when they were operated on, for it is my belief—and will always be my practice to consider—that in the light of our present knowledge of the terrible distress that lies ahead for the patient suffering from malignant disease of the urinary bladder, we are fully justified in attempting any form of treatment, however heroic, that offers relief, or a possible cure. Earlier in this paper I have mentioned a fact which I would again dwell upon. It is that even where, clinically, the patients, although suffering from malignant disease, appear to be in sound general health, by test of renal function and other means of renal investigation, and the urinary tract is sound and free from infection, still in many of these cases they do not do well and are carried off, not by any unusual complication, not by any acute emergency arising, but by the slow sinking and absence of response that they show. As I said before, they would appear almost doomed to a fatal issue from the very onset. In dealing with them I have learned nothing that would make me incline to

modify the technique that we find so successful in certain of these cases and so constantly safe and sure in the non-malignant case.

From the detailed record of the 60 cases that I have treated and carried out the operation of vesical exclusion, four tables have been compiled.

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.

The single case described as transplanted to fistulæ has been referred to previously and was one of carcinoma developing in the extruded wall of vesical exstrophy.

In 54 cases the ureters were transplanted into the colon.

TABLE II.—POST-OPERATIVE MORTALITY.

	Cases	Deaths	Percentage
Transplantation of first ureter	12	5	45·5
Transplantation of second ureter	13	3	25
Transplantation of both ureters at same operation	36	15	40·5

In Table II the calculation of the post-operative mortality, according to the type of operation performed, is given. Under the category of transplantation of the first ureter are, of course, included all cases of single kidney.

TABLE III.—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 III 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.

The high mortality of cases of carcinoma has been already referred to.

TABLE IV.—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

In Table IV 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.