

Section of Urology

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Total Cystectomy with Transplantation of the Ureters into the Pelvic Colon for Malignant Growth of the Urinary Bladder

(Based on an Experience of Seven Successful Cases)

PRESIDENT'S ADDRESS

By BERNARD WARD, F.R.C.S.

DESPITE the triumphs of modern surgery, complete removal of the urinary bladder still remains a comparatively rare operation, although the first record of such an operation was that performed by Bardenheuer in 1887.

The chief cause of this unusual reluctance on the part of the surgical profession to remove a diseased viscus is not the technical difficulty of removing the bladder, or any abnormal risk in doing so, but the far greater difficulty and danger of disposing of the ureters and of finding a suitable reservoir for the urine. This is the problem that still confronts us, but I believe it is within reasonable measure of solution and that we may to-day undertake cystectomy in the reasonable hope of offering our patient some years of comfortable and happy life.

In spite of recent advances in the treatment of bladder growths, the greatest of which was the introduction of diathermy by Edwin Beer, there are still epithelial growths which resist all our efforts to counteract or destroy them, and which constantly recur until they finally get the better of us. Radium has not proved the success we all hoped it might do. Except in the papillary type of growth (which can equally well be treated by diathermy) it has given little success in my hands.

The most dangerous growth is the primary infiltrating type, which either starts as a solid growth, or as an ulcer, and rapidly infiltrates the bladder wall. If such a growth is situated at the apex of the bladder, or on either of the upper lateral walls and is of moderate size, it may be removed successfully by a free local excision wide of the growth; but I have been very disappointed with many of my results, even in cases in which I have been able to remove the growth with a wide margin. When these infiltrating growths arise in the base of the bladder around the ureters or the vesical outlet, free removal becomes impossible, or the necessity for transplantation of one or both ureters to another part of the bladder arises. These anatomical difficulties have led to many incomplete and insufficiently radical operations with consequently a high recurrence rate. Infiltrating growths of the bladder base and neck are therefore often a very definite indication for something more radical than local excision, and as radium and diathermy have both failed, this must mean total cystectomy.

Other indications would be as follows:—

(1) Extensive infiltrating growths of the lateral and posterior walls, which it is impossible to excise locally with sufficient healthy tissue around to prevent recurrence.

(2) Extensive multiple sessile papillomata, which rapidly spread and recur despite treatment.

(3) Large multiple papillary carcinomata, the bases of which infiltrate the bladder wall. Although some of these are surprisingly amenable to massive diathermy there are some, which once they have started, infiltrate rapidly.

(4) Rapidly spreading carcinoma of the mucous membrane and submucous coat. A rare type, which seems to ulcerate superficially and spread widely beneath the mucous membrane.

(5) Some cases of extensive leukoplakia and malakoplakia, which are undergoing malignant degeneration, often in several places at one time. Local excision is useless because fresh areas constantly undergo malignant change.

(6) Malignant growths of the prostate, confined to the superior surface and the neck of the bladder, without enlargement or infiltration of the lateral lobes.

In all such growths we ought to consider the advisability of the major operation of complete removal of the urinary bladder, otherwise the patient drifts into a state of constant pain, dysuria, and hæmorrhage.

Short of cystectomy what have we to offer these patients with malignant infiltrating growths of the bladder? Suprapubic cystotomy gives little or no relief and tenesmus and hæmorrhage continue; large clots block the tube from time to time, the urine decomposes, and the patient drags out a painful existence until death comes as a welcome relief. Diathermy and radium, either together or separately, have been tried exhaustively with little or no alteration in the clinical picture; in fact radium often makes it worse. Far better the risk of an operation which, if successful, will give relief rather than to drag out such a miserable existence.

Many other factors, quite apart from the nature of the growth, must be taken into consideration before operation is decided on—such factors as age and general build of the patient; the heart and lungs must be healthy enough to carry him through what is a severe surgical procedure. Another factor, which I believe to be of supreme importance, is the presence of adiposity. A fat patient is always a poor surgical risk; the size of his abdomen, the fat-loaded omentum and mesenteries, make the operation exceedingly difficult, but above all, a fat-loaded bowel will often increase the risk of ureteral implantation to such an extent, I think, as to make it unjustifiable. In one case (reported later) I was obliged to transplant the ureters to the skin, because the bowel wall was so loaded with fat that I could not find a free spot into which to transplant them, and I felt certain that to have attempted to implant the ureters into fat was asking for certain failure.

Unfortunately these factors rule out many patients who would be excellent subjects so far as the growth itself is concerned. So many happen to occur in patients of advanced years with physical disabilities of various sorts that our choice becomes very limited.

The next factor for serious consideration is the state of the kidneys. It is rare to find a patient with a growth of the bladder so far advanced and so situated as to call for total cystectomy, yet in whom both kidneys are healthy. The growth commonly invades or obstructs one ureter and if it obstructs the outlet of the bladder then both ureters and kidneys are liable to be distended by back-pressure, and commonly infection is super-added as well. The most careful estimation of renal function, therefore, becomes imperative and this should include intravenous pyelography. The importance of the latter is that it gives a naked-eye demonstration of any back-pressure dilatation and a rough guide as to renal function and is invaluable after operation to compare with subsequent pyelograms, in order to estimate the after-effects of transplantation of the ureters; it should, therefore, never be omitted. One must, however, be prepared to transplant ureters, many of which are considerably dilated and some of which are dilated and thickened—and there are some cases in which both ureters are dilated and usually one kidney at least infected as well. These can be successfully dealt with as the résumé of my cases will prove. If Quinby's

axiom that "at least one ureter and kidney must be healthy" were to be followed, the cases in which the operation could be carried out would be still further restricted. In one of my successful cases both kidneys were so badly affected by back-pressure and infection that the patient's blood-urea was 141 mgm. % when he was first admitted to hospital.

Undoubtedly the ideal method for the successful disposal of the urine is the formation somewhere in the body of a reservoir over which the patient has voluntary control. There is only one practical method which will comply with this condition and that is transplantation of the ureters into the large bowel, the urine being controlled by the anal sphincter. The crux of the matter is this: Can the ureters be successfully implanted into the bowel, with a low mortality rate and with a reasonable expectation that the kidneys will not become dilated or infected? I believe, from my own personal experience, that they can and that Coffey's technique, with modifications, has made it a reasonable proposition.

Statistics previous to the introduction of this method make such sad reading that H. H. Young declared that "a study of the literature shows in my opinion that the high mortality and rarity of success make the operation of total cystectomy thoroughly unjustifiable." Zukerkandle (quoted by Beer) collected 64 cases of total cystectomy from the literature with a mortality rate of 50%, and in 42 cases quoted by Scheele the mortality for the one-stage operation (transplantation of the ureters and cystectomy) was 53.5%. There were 17 cases in which the two-stage operation was done with a mortality rate of 30%. M. Papin (also quoted by Beer) analysed the mortality in 181 cases of total cystectomy, and found that of 81 cases in which the ureters were implanted into the intestines there were 40 deaths, that is 59.2%, whereas the risk of implantation into the skin was only 28.7%. No wonder surgeons have been reluctant to do cystectomy in face of statistics such as these.

There is, however, a brighter side to the picture. Waltman Walters, using Coffey's method of oblique submucous transplantation into the sigmoid colon, has operated on 76 cases of ectopia vesicæ, transplanting one ureter at a time, and followed later by resection of the ectopic bladder. In the 76 cases there were three deaths, 3.9%; 59 of these cases were traced, and in 50% of them there was no evidence of renal infection for periods varying from one to ten years (more than five years had elapsed in 27 cases, and ten years or more in 13 cases). In 21% of these cases there was evidence of mild renal infection, as evidenced by attacks of fever, with or without pain in the loin, lasting a few days, with weeks or months of normality in between attacks, but with little impairment of renal function. Transplantation is probably carried out with less risk in cases of exstrophy than in carcinoma of the bladder, because in the former the ureters are generally of normal size and infection is slight or absent, whereas in the latter dilatation and affection of at least one ureter is the rule. Moreover, the growing organism lends itself more readily to alterations of anatomy and physiology than the adult, and particularly the old adult, which is the rule in cystectomy. Nevertheless, we can look upon these results as encouraging, and holding out much hope for the future.

Coffey reports 11 cases of cystectomy with three deaths—a mortality of 27.27%. In seven of his cases, all men, the operation was done in one stage; one of these patients died (14.28%). Of four women in whom the operation was done in two stages, two died.

W. C. Quinby has performed total cystectomy with transplantation of the ureters into the sigmoid in 10 patients, with two deaths, and states: "From my experience with these patients, especially when comparing their post-operative careers with those of patients whose carcinoma has been treated by radium, or various applications of radium and partial excision, I cannot but feel that total cystectomy should be employed more often in vesical carcinoma." Quinby transplants one ureter first and at the second operation transplants the other ureter

and removes the bladder. In this way he averts the danger of simultaneous transplantation of the ureters, but necessarily increases the severity of the second operation. It is an ingenious proposition and has proved successful in his hands. I have not tried it because I feel that if adhesions occur as a result of the first implantation, it would make the second one more difficult and there must be the danger of damaging the first successful transplantation during the manipulations necessary in making the second.

Transplantation of the ureters into the large bowel is admitted by all workers to be the best method of disposing of the urine, provided it can be done with such a margin of safety as to make it a practical proposition. The direct method of implantation was invariably followed by rapid dilatation and infection of the ureters and pyelonephritis, and the mortality, immediate and remote, was so appalling that the operation was abandoned until Coffey introduced his oblique submucous method of transplantation, based upon his observations of the anatomical fact that ducts which open into a hollow viscus with a variable pressure run for a certain distance beneath the mucous membrane. This is true both of the bile-duct, as it opens into the duodenum, and of the ureter, as it opens into the bladder. Coffey's successful experiments in dogs, and later his success in transplantation of the ureters in man, stimulated me to give his method a trial; since that time I have been carefully feeling my way, and although my series of cases is only a small one, it is the fruits of that experience which I shall put before you this evening.

Sir Harold Stiles also introduced an oblique method of transplantation, which has been very successful in the hands of Grey Turner who published a series of cases of ectopia vesicæ and malformations treated by this method with good results.

The only alternative method of disposing of the ureters which has any advocates to-day is transplantation on to the skin in the iliac region or the loin. The formation of a urinary fistula on the skin necessitates the wearing of a complicated apparatus, despite the inconvenience and discomfort of which the patient is frequently wet, and is constantly surrounded by the odour of decomposing urine; his life is a constant misery. It is an operation which has never appealed to me. However, there can be no question that in the past it has been followed by a much lower mortality than implantation of the ureters into the bowel and on this account it has been practised by Edwin Beer. He has recently published 18 cases of cystectomy with transplantation of ureters, in 17 of which the ureters were transplanted to the skin without any operative mortality, the only fatal case being the eighteenth, in which he transplanted the ureters into the bowel. Although the operative mortality is less than that of implantation into the bowel, the subsequent risk of dilatation and infection of the kidneys seems to be just as great, and the patient's life is probably no longer than after successful cases of intestinal implantation. It has the added advantage that the removal of the bladder and transplantation of the ureters can be done in one stage without any increased risk, and is, therefore, applicable to a far larger number of patients; but there can be no doubt that the patient lives a miserable existence than which death were often far preferable.

Henry Wade, in a paper read before this Section in 1927, advocated this operation, but I am sure, from what he told me on a recent visit to Edinburgh, that, in view of his recent successes with transplantation of the ureters into the bowel, he would to-day employ this in preference to an opening on the skin.

STAGE I.—TRANSPLANTATION OF THE URETERS INTO THE PELVIC COLON

Having decided, after careful weighing up of the various factors, that an operation can be undertaken with a minimum of risk and with a reasonable chance of curing our patient, the next point is to decide in how many stages the operation shall be done. I am quite sure, from my own experience, that it is unwise to

undertake such a serious operation as cystectomy on the results of the cystoscopic examination of the bladder alone. One is so very liable to get a wrong estimate of the extent and character of the growth that operation should always start as an exploratory one, a final decision being left until the peritoneum has been freely opened, a search made for enlarged glands along the iliac arteries and the aorta, and the extent of the growth carefully defined. It is commonly necessary to open the bladder before a decision can be made. I would stress this point especially, because I have been so often misled by a cystoscopic examination into thinking a growth more extensive and more malignant than it really was. It is generally possible for a surgeon experienced in bladder surgery to decide by touch and the appearance of a growth whether an extensive operation, such as cystectomy, is necessary—or whether a local excision or massive diathermy will suffice—without waiting for a microscopic section and pathological report, and, having made his decision, to proceed at once with the first stage of the operation—transplantation of the ureters. If he is unable to decide without a microscopical report it means closing the bladder and subjecting the patient to three operations instead of two, but in some cases in which the diagnosis is doubtful it may be necessary to do so. If so, the section should be taken from the base of the growth and should include a part of the muscular coat. In all my cases, with one exception, the bladder has been opened as a preliminary. This search adds something to the risk, especially of local implantation of malignant cells into the wound, but if one exercises the usual care in technique to make sure that no fragments from the growth get into the wound and that the cut edges of the bladder are lightly cauterized before closure, I am satisfied that the risk is negligible. If after this thorough examination of the local condition it is decided that cystectomy is necessary, the bladder wound is closed and transplantation of the ureters proceeded with.

There are such obvious advantages to the patient if the ureters can be safely transplanted simultaneously in one operation that this must be the operation of choice, provided it can be done without increased risk. Coffey's experiences proved conclusively that simultaneous bilateral transplantation could not be safely done in dogs unless tubes were tied into the ureters through which the urine could drain for eight to ten days, until the swelling, oedema, and infection, around the end of the transplanted ureter had subsided and a free passage for the urine had been established, and he applied the tube technique successfully to man: the tubes were brought out of the anus and drained into a bottle. If the tube technique was not followed then it was only safe to transplant one ureter at a time. Charles Mayo confirmed this in sixty patients with exstrophy of the bladder; all being operated on in two stages, with the introduction of his catgut guide into the ureter, along which the urine finds its way rather earlier than if no such aid is used. Mayo always held, as does Waltman Walters, that the two-stage operation is much safer than bilateral simultaneous implantation, but most of their work has been done in children with congenital deformities. At the outset I very naturally followed these authorities, and my first cases were operated on by simultaneous bilateral implantation by Coffey's tube technique. I soon found, however, that when a ureter was dilated the addition of a tube was quite unnecessary. In fact it was a disadvantage, in that it took up so much extra room in the bowel wall and I, therefore, left the tubes out in all cases in which the ureter was markedly dilated, and found the results satisfactory. In the cases in which I used them I found the tubes such a nuisance, however, what with the constant danger of their getting blocked and the discomfort to the patients of tubes passing through the anus, and the difficulty of nursing, that I eventually discarded them. I am satisfied that if a ureter is dilated at the time of operation, there is little risk of compressing it, and under the circumstances I have no hesitation in grafting it into the bowel wall without any artificial aid. On the other hand, if the ureter is of normal size, or only slightly dilated, risk of compression by swelling

is always present and some aid to preserve the channel during the few days succeeding the operation is advisable. I have used Mayo's catgut guide several times with success, but even Mayo does not advise it for simultaneous transplantation, and I always have the suspicion that it acts as a guide not only for the urine to come down, but also for infection to go up and for this reason would rather do without it.

To obviate this difficulty I have devised a plan which I believe to be original, and which has proved most successful in my hands. It is designed to prevent compression of the ureter during the actual transplantation and to leave enough room to allow for subsequent swelling, without the danger of compressing the ureter as it passes obliquely through the bowel wall. It is as follows:—

After the ureter has been freed and detached from the bladder its lower end is split up on one side for $\frac{1}{4}$ in., a catgut stitch is passed through its extreme tip and one end cut short; the other is left attached to a curved intestinal

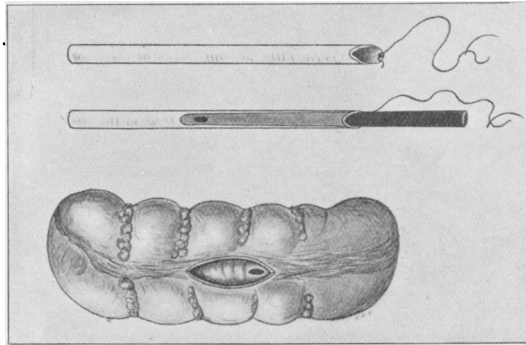


FIG. 1.

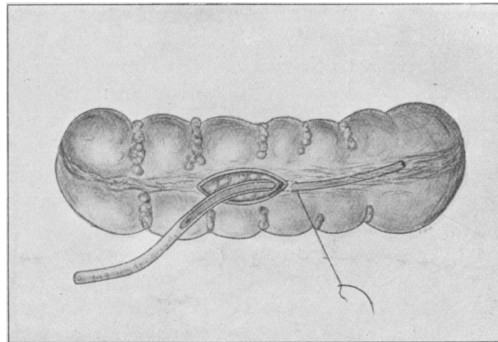


FIG. 2.

needle. A 6 in. length of rubber catheter, which just fits the lumen of the ureter snugly, is then passed up this lumen for 3 in., and 3 in. is left hanging out; it is not fixed in the ureter in any way (fig. 1). The bed in the bowel wall having been prepared according to Coffey's method, by exposing the mucous membrane by an incision $1\frac{1}{2}$ in. in length through the peritoneal and muscular coats, an opening is made in the mucous membrane at its lower end just large enough to take the ureter. Through this hole the needle and catgut attached to the ureter are passed and brought out through the bowel wall about

one-third of an inch below the end of the incision. The catgut is then pulled on, and by this means, and a little manipulation, the ureter, with its contained catheter, is passed through the hole in the mucous membrane into the lumen of the bowel (fig. 2). The catgut is then kept taut by an assistant whilst the ureter is buried in contact with the mucous membrane by two rows of continuous catgut sutures (fig. 3). The catgut in the lower end of the ureter is stitched to the bowel wall and divided; this keeps the ureter in place and obviates the necessity for passing any stitches through its wall during the anastomosis, which I am satisfied is fraught with severe danger. This stitch is buried in the second row of catgut stitches which infolds the ureter. The catheter is then carefully worked out of the ureter by manipulation through the bowel wall

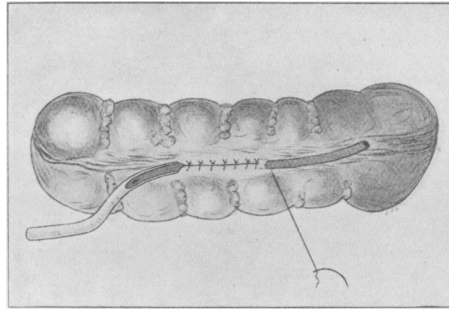


FIG. 3.

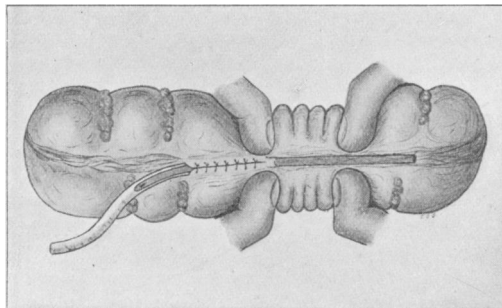


FIG. 4.

until it lies free in the lumen, where it is left, and is usually passed naturally on the second day. This is easily done, as the catheter lies quite loosely in the ureter and is not fixed in any way (fig. 4).

This modification adds no appreciable time to the operation and, I am satisfied, fulfils the requirements for which it was designed, i.e. the preservation of the lumen of the ureter unobstructed by pressure, either during or after operation. In the cases in which I have used this method the patients have all passed urine through the rectal tube within a few hours after operation.

The careful pre-operative preparation of the bowel is most important, our aim being to have it empty at the time of operation. We have usually prepared the patient for a week beforehand, the bowel being first thoroughly cleared by castor

oil, followed by a daily simple enema, the patient, all this time, being kept on a residue-free diet. The bowel is washed out the night before operation, the patient given a $\frac{1}{4}$ gr. of morphia to quieten peristalsis and to give him a good night's rest. The bowel is again washed out on the morning of operation. If the colon is prepared in this way it will be found empty, and there is no necessity even to clamp it during the operation.

The important points to bear in mind when transplanting the ureters are as follows:—

(1) To preserve the blood supply of the ureter as far as possible by not exposing more of the ureter than is necessary for the transplantation and by making sure that the sectioned end of the ureter bleeds before implanting it: if it does not bleed the section should be made higher up until it does.

(2) Not to sew the bowel wall over the ureter tighter than is necessary to make a successful junction. I believe that in their anxiety to make sure of a water-tight union many surgeons have over-sewn the ureter so tightly as to cause interference with its blood supply and this is followed by necrosis. This is especially likely to happen in the hands of surgeons inexperienced in intestinal surgery.

(3) Transplant the right ureter first. It is the more difficult of the two because it is further away from the bowel and unless it can be implanted without tension the risk of necrosis is very great. The left ureter is nearer to the bowel and one has a considerable choice as to the part of the bowel into which to implant it; with the sigmoid flexure always available, and after the right ureter has been implanted at the site of election, the left ureter may be implanted either above or below it without difficulty. I believe this to be an important practical point making for success.

(4) Coffey used an oblique incision extending from the mesenteric attachment to the mid-line of the bowel. I have tried it and find that it cuts across the vessels and free bleeding follows, which is sometimes difficult to control, and necessitates ligatures in the wound, which I believe to be undesirable. I have given up this incision for a straight one along the anterior longitudinal muscular band. It has the advantage of being much easier to make the incision through the peritoneal and muscular coats of the bowel and freely expose the mucous membrane, because one is cutting through a uniformly thick layer. It is followed by practically no bleeding and there is far less danger of buttonholing the mucous membrane whilst making the incision, an accident likely to jeopardize the success of the operation. After the junction is completed the bowel is stitched to the peritoneum of the lateral pelvic wall, so that the ureter is covered over and lies behind the intestines. The abdomen is closed without drainage.

(5) If bilateral simultaneous implantation is performed then some method to prevent occlusion of the ureter during the first few days after operation must be used. I recommend to your notice my method of the rubber catheter as a splint during the operation, as outlined above.

(6) A rubber rectal tube is passed into the rectum and pelvic colon before the operation is begun; and after the ureters have been dealt with it is manipulated so that its upper end lies close to the anastomosis, and is left in situ for three or four days to prevent distension of the bowel and to drain away urine as it is secreted.

(7) Continuous intravenous saline by the drip method is commenced as soon as the patient returns to the ward. This promotes free renal secretion and helps to keep the ureters clear. In my last two cases I have used 4·2% sodium sulphate solution alternatively with normal saline and 6% glucose, as recommended by Henry Wade, to whom I am much indebted for supplying me with the exact particulars of the after-treatment he has been using with much success after transplantation of the ureters and also in severe cases of anuria.

STAGE II.—TOTAL CYSTECTOMY

The whole bladder with its surrounding fat and the whole or part of the prostate and the seminal vesicles must usually be removed when the operation is for infiltrating malignant growth, especially when this invades the base. If the growth is away from the base, and especially if it is of the papillary type, it may at times be safe to make the section through the prostate, above the verumontanum, in which

case, if the seminal vesicles are also saved, the genital tract may be left intact, but the cases in which it is safe to do this are few and far between. I have done it once with a satisfactory result.

The bladder should be removed as soon as possible after the ureters have been dealt with: three weeks is usually long enough for the patient to recover his strength sufficiently to allow of this being safely done.

Technique of the Operation

If the bladder has been opened for exploration at the first operation the scar is excised by an elliptical incision, carefully separated from the abdominal wall and left attached to the bladder, with which it is removed in one piece. In this way any outside contamination of the growth is removed. If a suprapubic sinus is present this is similarly treated and closed. The operation may now be continued either extraperitoneally or transperitoneally, as desired.

The extraperitoneal operation.—This may be done through either a vertical or a transverse incision, or a combination of the two. I have tried both, and am unhesitatingly of the opinion that the transverse incision, with partial division of both recti, gives a much easier and freer access to the bladder. If this is decided on, the peritoneum is dissected off the apex and posterior wall of the bladder after the urachus has been divided; this is much easier if the bladder has been previously distended. The bladder is then separated from the rectum posteriorly by finger dissection. The lateral ligaments containing the vesical arteries are divided first on one side and then on the other. The bladder should now be emptied and pulled well forwards from the rectum and further separated, until the seminal vesicles, and finally the upper part of the prostate, are exposed. This is the most difficult part of the operation, fear of tearing a hole in the rectal wall being constantly present, and a considerable amount of blind dissection being necessary. The vas is exposed and divided. The operation is then completed from below upwards; the pubo-prostatic ligaments are divided, and the anterior surface of the prostate is exposed and dissected from the pubic arch until its apex is exposed. A catheter is passed at this stage to define the membranous urethra, which is then cut across; the apex of the prostate is seized in strong forceps and pulled upwards and forwards, the separation being finally completed from below upwards, several vessels having to be tied. The urethra is then transfixed by catgut and tied off, the cut surface having previously been thoroughly coagulated by diathermy current.

The transperitoneal operation.—The suprapubic scar having been dissected off and left attached to the bladder, the remainder of the old scar is incised to its full extent and the peritoneum freely opened. Any adhesions resulting from the transplantation of the ureters are separated and divided, but it is surprising how few they are if the abdomen has been previously closed without drainage. The peritoneum over the posterior wall of the bladder is surrounded by an incision on either side, and transversely by an incision in front of the rectum at the point of its reflection from the bladder, and this portion of the peritoneum is left attached to the bladder. The incision in front of the rectum is then opened up by finger dissection, the rectum is separated from the bladder base, and the seminal vesicles and the ampulla of the vas exposed. The prostate is defined and separated from the rectum. If the condition of the growth permits of the removal of the upper part of the prostate only, the genital tract may be preserved intact by following the vas down to the ampulla, dissecting it and the seminal vesicles off the base of the bladder and making the section through the prostate, well above the verumontanum. This I did in one case with a most satisfactory result and the preservation of normal ejaculation. In most cases the removal of the whole prostate will be desirable, in which case the vas is divided. The vesical vessels are now easily defined and

ligatured. The bladder is depressed and the pubo-prostatic ligaments are divided, and the operation is completed, as before, by dividing the membranous urethra, seizing the apex of the prostate, pulling it upwards and forwards and completing the separation of the rectum from below. Very little bleeding is encountered and is quite easily controlled.

I am strongly of the opinion that the transperitoneal method is the operation of choice, and for these reasons: It gives a freer exposure and is much easier to perform. It allows of more radical removal of the bladder together with its surrounding fat, and also the free removal of the peritoneum over the back of the bladder, and when one bears in mind that in part this membrane is quite closely attached to that viscus, and that the lymphatics probably communicate, it seems advisable to remove it in all cases of infiltrating growth. No skilled surgeon would remove the rectum for cancer without also taking a wide portion of the peritoneum, and I feel that this ought also to apply to cancer of the bladder. This method of approach demands much less manipulation and pulling on the bladder, and this must lessen the risk of dissemination of the growth, and it allows of easier exposure and more deliberate ligation of the vesical vessels. It is also quite unnecessary and, in fact, inadvisable, to distend the bladder either before or during operation. Its greatest asset, however, is the ease and facility with which the seminal vesicles, base of the bladder, and ampulla of the vas, are freely exposed, and the prostate is separated from the rectum. This eliminates the most anxious part of the extra-peritoneal operation, which is the constant fear of damage to the rectum. It also gives the surgeon an opportunity, in a favourable case, of preserving the genital tract intact. There is no increase of danger in opening the peritoneum; the days when we were afraid of this are long past, and nowadays we look upon the peritoneum as a friend rather than an enemy.

After the bladder has been removed there is a large gap in the peritoneum, which can only be closed by freely separating it from the lateral walls of the pelvis and the abdominal wall, in much the same way as after excision of the rectum. If any enlarged glands are present along the internal iliac artery, and the case is still operable, they should be removed at the time the ureters are transplanted.

I have experienced no difficulty in performing cystectomy, except in one patient—the only woman on whom I have done the operation; this was carried out extra-peritoneally. In view of the larger pelvis and the interposition of the uterus in front of the rectum I expected it to be much easier than in the male, but actually encountered considerable difficulty with a plexus of veins between the cervix uteri and the bladder. In the female the urethra may have to be removed; if so, the opening thus left is utilized for drainage, otherwise a drain is placed through the urethra. In the male free drainage by a gauze tampon brought out through the lower end of the wound is advisable.

THE RESULTS OF TOTAL CYSTECTOMY

I have now done the complete operation in seven cases without a death. These operations have been spread over a period of eleven years and have only been done in those cases in which complete removal of the bladder, and the whole or part of the prostate gland, seemed to be the only operative procedure likely to cure my patients. Many other conditions have influenced me in the choice of case, which have excluded a whole number of others in whom the removal of the bladder was indicated if removal of the growth had been the primary consideration. My first object, however, was to satisfy myself that the operation was a justifiable one and my work so far, therefore, has to a great extent been experimental, the first consideration being to choose those patients whose age and general physical condition made them suitable subjects for a severe two-stage operation. Further, I have

refused to tackle cases in which it seemed, from the local extent of the growth and secondary involvement of the lymphatic glands, that ultimate freedom from recurrence was extremely doubtful.

Despite these imposed limitations nearly all the patients have been poor surgical risks, as a direct result of repeated hæmorrhages, many months of extreme suffering and, especially, dilatation of ureters and renal pelvis, and infection. In only two of these cases were both ureters almost normal.

Case 1.—In my first case only the right kidney was present, the left kidney having been removed by another surgeon nine years previously for “papilloma” (?). The patient lived five years and seven months and then died of carcinoma originating in the remains of the left ureter which broke off during cystectomy. Coffey’s tube technique was used. At the post-mortem examination the kidney was perfectly

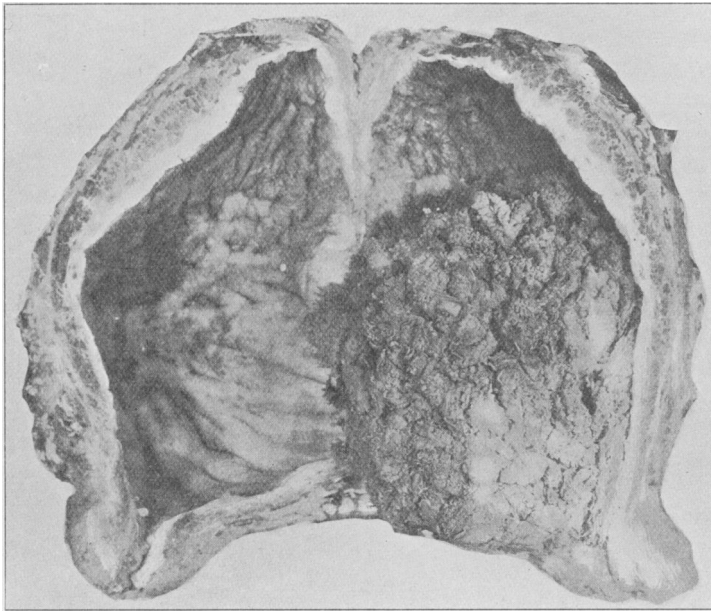


FIG. 5 (*Case 1*).—Papillary carcinoma.

healthy; there was no dilatation of ureter or pelvis and no infection. Microscopically there were a few small nodules of secondary growth in the cortex, otherwise it was healthy. The patient returned to his ordinary occupation and remained in it until just before his death. A most encouraging result.

Case 2.—Both ureters were slightly dilated and were transplanted by the tube technique. The patient lived in perfect health for two years and ten months and then died of acute cellulitis of the neck and axilla, secondary to a tooth abscess. The post-mortem showed that the kidneys were healthy to the naked eye and there was no dilatation of the ureters. Microscopic examination of the kidneys revealed scattered areas of round-cell infiltration, almost certainly secondary to the septicæmia which caused his death. There was no evidence of recurrence of the growth and but for this unfortunate accident he would probably be alive to-day.

Both these men were able to retain urine for four to six hours by day and usually passed the night undisturbed. One patient could always tell whether he wished to

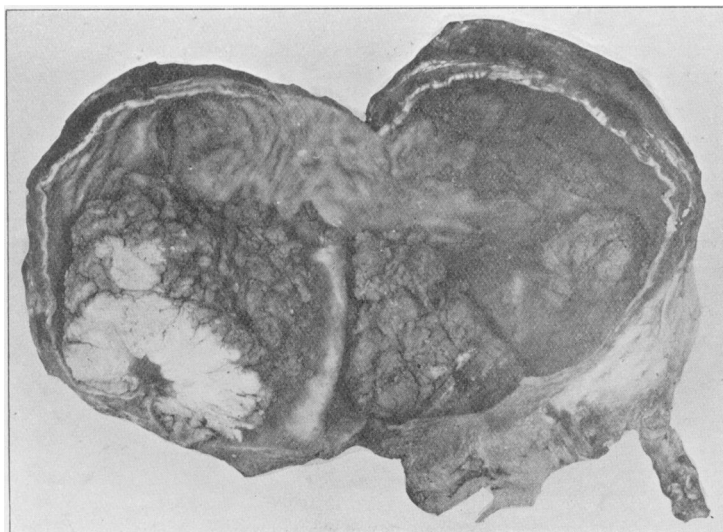


FIG. 6 (Case 2).—Carcinoma.

pass urine or fæces. Both returned to normal occupations and carried on after operation just as well as they had done previously.

Case 3 was severely uræmic on admission to hospital with a blood-urea of 141%. After six weeks' drainage of the bladder, the blood-urea dropped to 51%, but he was such a very poor risk that the ureters were implanted, with an interval of six weeks between the operations. The right ureter was dilated to three times the normal size and infected. Coffey's tube technique was used. The left ureter was the most remarkable one that I have transplanted. It was the size of my index finger and absolutely rigid, and it was only after considerable hesitation that I finally decided to transplant it. It was divided 4 in. below the kidney and implanted into the descending colon without a tube. After it had been embedded in the wall of the bowel it seemed almost to block the lumen of the intestine, but despite what seemed to be courting almost certain failure the patient never turned a hair and I removed the bladder twenty days later. The real reason why I operated on this patient was that he was only 35 years old, and the drainage of his bladder had given no relief. I thought that, under the circumstances, we might give him a last chance. He lived for six and a half months in comfort and then died of uræmia.

Case 4.—The only woman in this series. Her right ureter was the size of my little finger and slightly thickened, the left ureter the size of my thumb and also slightly thickened. The left kidney was severely hydronephrotic, the right moderately so: both ureters were implanted simultaneously without tubes or any artificial aid. I had for some time previously felt that dilated ureters could be satisfactorily transplanted without tubes, but this was the first time that I dared to transplant both ureters simultaneously without tubes, and it was highly successful. Urine was secreted into the rectum within six hours after operation and freely thereafter. Pyelograms taken four months after operation showed an extraordinary improvement in the kidneys. The left hydronephrotic kidney appeared to be absolutely normal in outline and the right showed only slight dilatation. Later this patient developed stones in her right kidney and ureter and the kidney became dilated again, but without symptoms. The left kidney remained normal. She died of recurrence of growth in the spine two years and seven months after removal of the bladder.

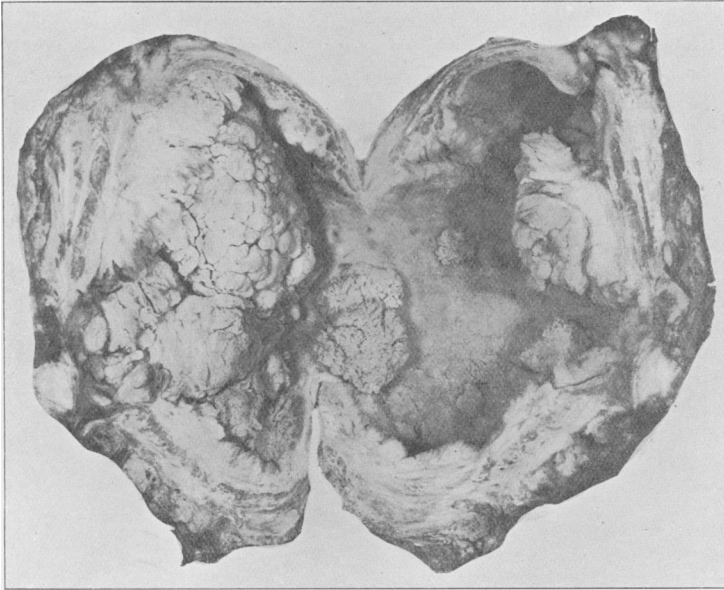


FIG. 7 (*Case 3*).—Multiple massive malignant papillomata.

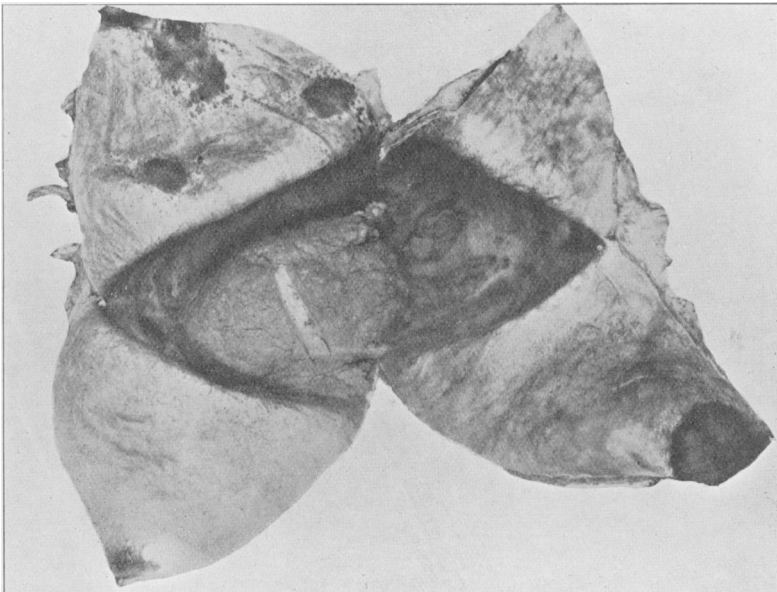


FIG. 8 (*Case 4*).—Papillary carcinoma.

Case 5 was the least satisfactory of the series. The patient was exsanguinated by loss of blood and several transfusions were necessary before operation could be safely undertaken. Both ureters were transplanted simultaneously by the tube method: the left ureter was twice the normal size and the right larger than normal.

Pyelograms taken six weeks after cystectomy showed practically normal kidneys. He never made the progress I expected. He seemed worn out by his previous sufferings and loss of blood and unable to find sufficient reserve to fight his way to convalescence. He gradually went downhill and lived for six months, but his end was a much happier one than it would have been had his bladder not been removed.

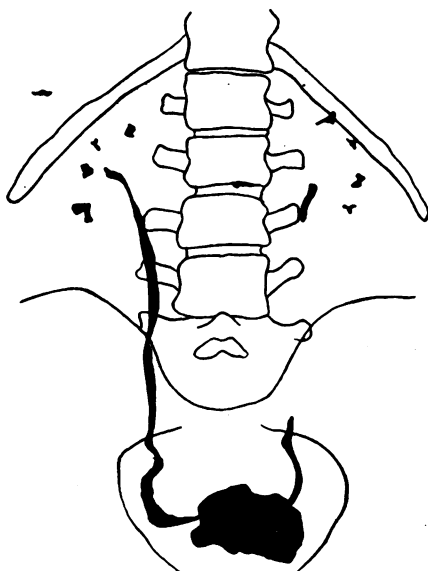


FIG. 9 (*Case 6*).—Urogram before transplantation of ureters.

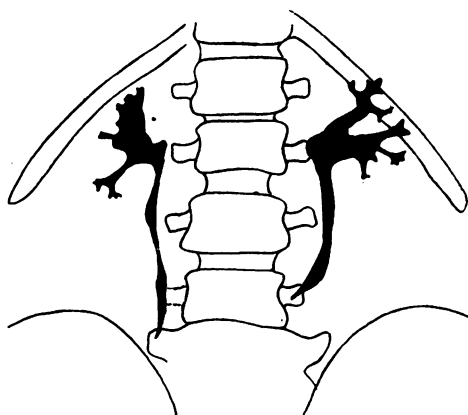


FIG. 10 (*Case 6*).—Urogram two months after cystectomy. Ureters transplanted by original technique described.

Case 6 was only operated on four months ago and is the subject of the cinematograph film, which I am showing this evening. It is one of those rare cases of rapidly infiltrating and spreading carcinoma of the mucous membrane and submucous layer and was kindly handed over to me by Mr. Hugh Donovan. Both

ureters were almost normal and were transplanted by my own technique, described in this paper. The urine was first collected from the rectal tube four hours after operation and continued to be secreted freely afterwards. The temperature never rose above 99.2° . Cystectomy was performed three weeks later. The patient has now returned to duty as a railway porter and feels and looks perfectly fit. He can hold urine for four and a half hours by day and often sleeps the night through undisturbed. Pyelograms show normal kidneys.

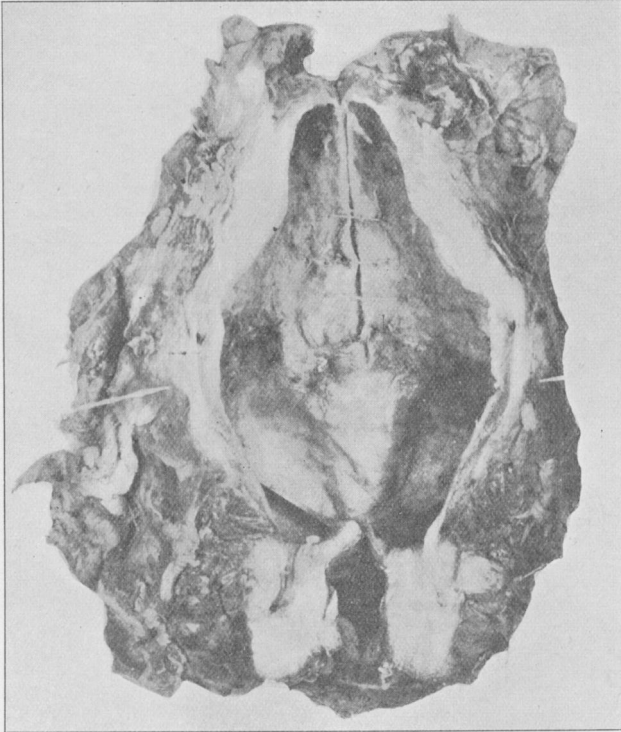


FIG. 11 (Case 6).—Transitional celled carcinoma.

My 7th and last case is a rather unusual one and not “on all fours” with the other cases.

Case 7.—The patient is a man of 42 who had ectopia of the bladder, which had undergone malignant change. His kidneys were little damaged, although both were infected, but the pyelograms showed little departure from the normal, except moderate dilatation of the left ureter. I opened the abdomen with the intention of transplanting the ureters into the pelvic colon, but found it uniformly loaded with fat—even the longitudinal band being affected. I dared not, therefore, risk implantation into the bowel, so after removing the bladder, I brought both ureters to the skin in much the same position as they had occupied before. The patient now wears the same apparatus which he had previously worn for many years, and is quite happy with it. Pyelograms show practically the same pictures as before operation.

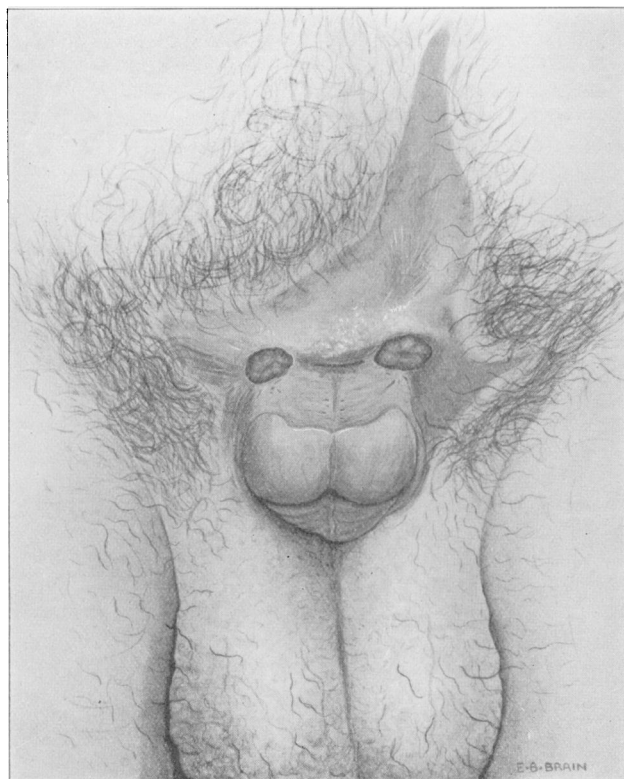


FIG. 12 (*Case 7*).—After removal of epitheliomatous extroverted bladder and transplantation of ureters on to skin, the pelvic colon being so loaded with fat that intestinal implantation was inadvisable.

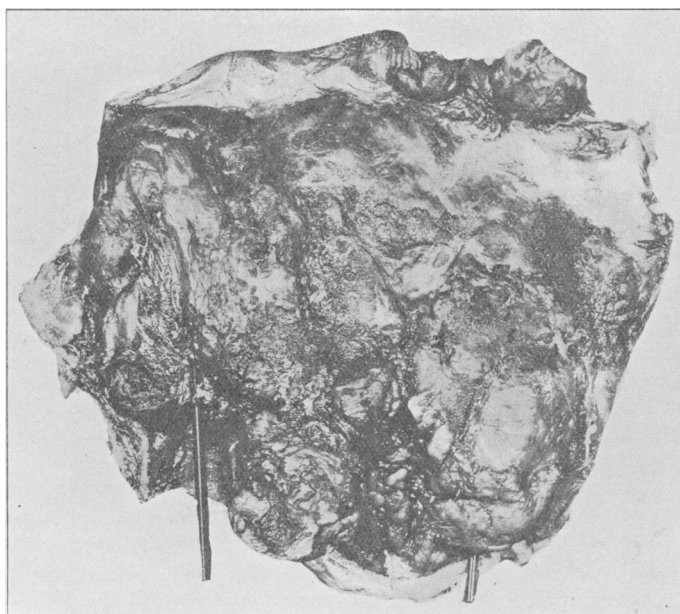


FIG. 13 (*Case 7*).—Epithelioma of extroverted bladder.

There are four other cases in which I have transplanted both ureters into the bowel for malignant growths of the bladder. All were very extensive growths, and in three cases the growth was obviously too far advanced for cystectomy to give any hope of a cure and was not, therefore, contemplated. One of these three patients died. In the fourth case the ureters were implanted as a preliminary to cystectomy

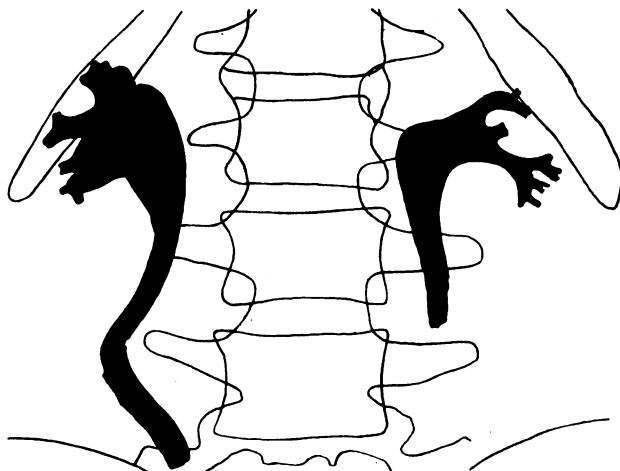


FIG. 14.—Case of carcinoma of prostate in a boy aged 16 years, before transplantation of ureters.

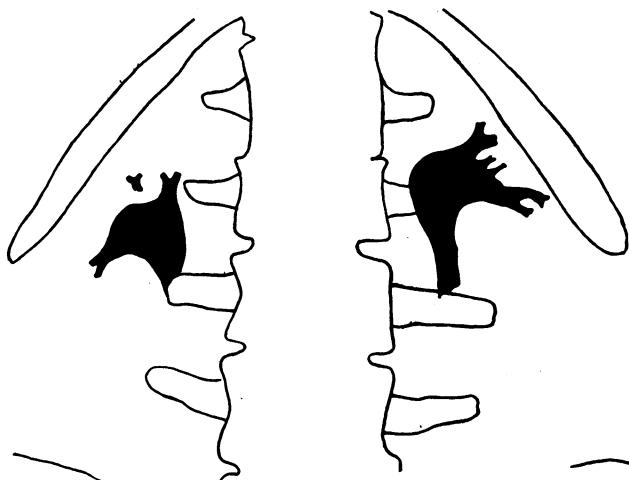


FIG. 15.—Same case as in fig. 14, three and a half months after transplantation of ureters by original technique described.

later, but unfortunately the patient died. The right ureter sloughed, and peritonitis and acute pyelonephritis supervened. The left ureter and kidney were normal and healthy. In estimating the risk of the operation, therefore, this case in which the ureters were implanted as a preliminary to cystectomy, must be included in my statistics, which makes one death in eight cases—a mortality of 12.5%.

Name, age and date	Symptoms	Previous history	Growth
<i>Case 1.</i>			
G. M., æt 56. 15.8.25	6/12 hæmaturia, pain, frequency. Gen. condition good.	Lt. nephrectomy 1916 for "papilloma of kidney."	Papillary carcinoma, size of hen's egg, infiltrating base region lt. ureter.
<i>Case 2.</i>			
E. G., æt 43. 4.11.31.	Continuous hæmaturia plus pain, frequency and obstruction for 6/12. Gen. condition v. poor.	Intermittent hæmaturia 5 yrs. Suprapubic op. for papilloma 1926. 2nd suprapubic op. 1929. Repeated cystoscopic diathermy. Treated elsewhere.	Whole bladder covered with growths, several of which were infiltrating carcinomas.
<i>Case 3.</i>			
A. P., æt 34. 2.6.32.	Hæmaturia. Repeated attacks of retention. Had to urinate knee-elbow position. Pain, strangury. Severe uræmia. Blood-urea 141%.	Intermittent hæmaturia 5 yrs. Cystoscopic diathermy. Treated elsewhere.	Bladder filled with multiple malignant papillomata of various sizes.
<i>Case 4.</i>			
Mrs. P., æt 41. 18.6.33.	Continuous pain, strangury, hæmaturia 6/12. Stinking urine. Physical wreck.	Intermittent hæmaturia 18/12. Polypus removed from uterus 6/12 previously.	Extensive necrotic growth lt. side, base lt. lateral wall. Several sessile growths. Carcinoma.
<i>Case 5.</i>			
E. R., æt 55. 4.7.34.	Continuous hæmaturia plus clots, pain, strangury 3/12. Clot retention. Pt. exsanguinated and v. weak. Prelim. s.p. drainage necessary.	Intermittent hæmaturia 5 yrs. Supra-pubic op. for papilloma 1918. Treated elsewhere.	Large infiltrating, necrotic post. wall extending on to trigone. Transitional-celled carcinoma. Specimen unfortunately lost.
<i>Case 6.</i>			
A. C., æt 48. 15.5.36.	Hæmaturia. Terminal pain. Some increase of frequency.	Intermittent hæmaturia 7/12.	Rapidly spreading carcinoma of mucous membrane and submucous coat involving two-thirds post. wall and half antr. wall. Transitional-celled carcinoma.
<i>Case 7.</i>			
G. W., æt 42. 23.4.36.	Congenital ectopia vesicæ. Last few months exposed mucous membrane had become thick and rugose and finally ulcerated.	Congenital ectopia vesicæ. Had worn a metal shield for collecting urine.	Epithelioma.

Ureters and kidneys

Cystectomy

Immediate result

Final result

- Rt. u.* practically normal. Transplantation Coffey's tube tech: into pelvic colon 25.8.25. 20.10.25 (delay due to holidays): *Lt. u.* broke off and could not be found. Vert. incision, extraperitoneal op. Sem. ves. and vas. saved. Section through upper portion prostate. Excellent. Control urine 4 to 8 hrs. Returned to normal work. Retained normal ejaculation. Lived 5 yrs. 7/12 in absolute comfort until last few months. Died of papillary carcinoma originating in *lt. u.* with wide dissemination. No growth in pelvis. *P.M.*: Kidney and ureter healthy. *Micro. Sect.*: Normal k. except for several tiny metastases in cortex.
- Both u.* moderately dilated. Simultaneous transplantation Coffey's tube tech: 17.4.31. 19.5.31: Trans. inc. Extraperitoneal op. Section through middle prostate. Seminal vesicles removed. Excellent. Returned to normal work. Control urine 6 to 8 hrs. Pyelograms normal. Died of acute septicæmia secondary to tooth sepsis: Cellulitis of neck spreading into axilla. *P.M.*: Both k. healthy. No dilatation of u.'s. *Micro. Sect.*: Round-celled infiltration in cortex, secondary to septicæmia.
- Rt. u.* 3 times normal size infected. Trans.: Coffey's tube tech: 29.7.32. *Lt. u.* size index finger rigid. Trans. descending colon 28.9.32. Bladder drained 6 wks. before 1st trans. Blood u. 51% at op. 18.10.32: Vert. and trans. incision. S.P. sinus excised. Extraperitoneal op. sect. through mid. prostate. Sem. ves. removed. Uninterrupted convalescence. Discharged 17.11.32. Blood-urea 64%. Control urine $3\frac{1}{2}$ to 4 hrs. Lived 18/12 in comfort and died of uræmia without evidence of recurrence of growth. No p.m.
- Rt. u.* dilated size little finger. Mod. dilatation pelvis kidney. *Lt. u.* dilated size thumb. *Lt. kidney* large hydronephrosis. Simultaneous transplantation without tubes 27.6.33. Stormy recovery plus rigors. 25.7.33: Vert. inc. Transperitoneal op. attempted but abandoned owing to adhesions. Extraperitoneal op. Urethra cauterized and left. Convalescence uneventful. Surprisingly good. Pyelograms 4/12 later show *lt. kidney* normal, *rt. kidney* slightly dilated, but less than before op. Control urine $3\frac{1}{2}$ to 5 hrs. Lived 1 yr. 9/12. Died recurrence of growth in spine. Great pain during last 6/12. Developed stone in *rt. kidney*, but without symptoms. *Lt. kidney* remained healthy. No p.m. available.
- Lt. u.* twice normal size and infected. *Rt. u.* rather larger than normal. Bilateral trans: Coffey's tube tech: 31.7.34, preceded by blood trans. 28.8.34: Transperitoneal op. Whole prostate and sem. ves. removed. Blood trans. both before and after op. Good recovery, but Gen. condition v. poor. Discharged 26.9.34. Urine control $2\frac{1}{2}$ to 3 hrs. Never regained his health although comfortable and free from pain, but gradually petered out. Lived for 9/12. Disappointing result.
- Both u.* slightly dilated. Bilateral simultaneous transplantation by own technique (as described). 10.6.36. 7.7.36: Transperitoneal op. Whole prostate and seminal ves. removed. Incontinent for 1st few days after rectal tube removed. Later control urine 3 hrs. Has returned to work as railway porter and is in first-rate health. Can do good day's work. Pyelograms normal. Control $4\frac{1}{2}$ hrs. by day, 7 hrs. by night.
- Rt. u.* thickened and dilated to twice normal size. *Lt. u.* dilated. *Both* infected. No dilatation pelvis of k.'s. 28.4.36: Bladder dissected off abdominal wall. Abdomen opened, to transplant u.'s into bowel, but bowel wall was loaded with fat to such an extent it was thought unsafe to attempt transplantation: they were transplanted on to the skin at lower end of wound. Uninterrupted recovery. Has returned to business as photographer. Wears same apparatus he has worn for many years to collect the urine. Pyelograms normal. *Lt. ureter* still dilated.

Such is my experience. It is only a small one, although it has been spread over a number of years, but I now feel that we have something worth while to offer patients suffering from malignant growths of the bladder not amenable to local excision or treatment. Further, I am now convinced that if a patient has a growth so situated, or of such a structure as to make his cure by local treatment doubtful, we are justified in *urging* him to undergo the radical operation of total cystectomy, before local measures have been tried and have failed, and before he has passed through a period of pain, strangury, and hæmorrhage, which undermine his health and resistance, though making it obvious, even to the patient himself, that something radical is called for.

To get the best results we must be prepared to operate on these patients before the kidneys are damaged and before the growth has passed beyond the limits of the bladder and the health is so undermined as to make success doubtful.

I am optimistic for the future.

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