VESICAL EXCLUSION IN THE TREATMENT OF CARCINOMA OF THE CERVIX UTERI.

By DAVID BAND AND HENRY WADE.

I. CYSTOSCOPIC APPEARANCES IN CARCINOMA OF THE CERVIX UTERI.*

By DAVID BAND, F.R.C.S.E. (*By Invitation.*)

A FATAL issue in carcinoma of the cervix uteri is generally brought about through one of the following complications:—

(1) Renal infection: (*a*) Ascending pyelo-nephritis; (*b*) blood-borne pyelo-nephritis. (2) Renal suppression. (3) Toxæmia from septic absorption.

Of these the two primarily affecting the urinary tract are of the greatest importance, though in association with toxæmia and septicæmia from a fungating cervical carcinoma metastatic abscess formation in the kidney is also of frequent occurrence.

Outlying glandular metastases in cervical carcinoma are late in appearing, and the involvement of the urinary tract occurs by direct extension of the neoplasm either forwards or in an upward and outward direction.

Anterior extension involves the bladder base and causes malignant ulceration of the bladder. A severe cystitis leads to vesico-vaginal fistula, ascending infection, pyelo-nephritis and death. Extension in an upward and outward direction in the broad ligament leads to encroachment on the ureter, which may become infiltrated by malignant tissue. Following obstruction in the ureter there is dilatation of the upper urinary tract hydro-nephrosis and hydro-ureter. Occlusion of the ureter brings about cessation of urinary excretion from that kidney, and, if bilateral ureteral occlusion occurs, there can only be complete post-renal anuria. The degree of dilatation reached in the upper urinary passages varies inversely with the rapidity of development of the obstruction.

Since the potential of both kidneys is normally far in excess of that required to maintain renal efficiency, a considerable degree of damage from backward pressure may be borne by the renal parenchyma before any clinical evidence is available

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which might indicate what is going on. One ureter may become completely obstructed and the kidney rendered functionless. The loss may be met with success by compensatory hypertrophy of the opposite kidney. The single functioning kidney, however, permits of no obstructive or infective lesion, and when that occurs urinary secretion at once ceases or becomes grossly impaired.

These points are well illustrated in the following cases:—

Case I.—A woman, aged 59 years, was admitted to the Royal Infirmary suffering from anuria and uræmia. A very large carcinoma of the cervix was present with pronounced extension into the pelvic tissues. The anuria had persisted for ten days before death occurred. Autopsy demonstrated a widely infiltrating carcinoma of the cervix which had involved both ureters. On the right side the growth had involved the ureter in the broad ligament and extended to the bladder at the ureteral orifice, which was surrounded by malignant nodules. The left ureter was occluded by malignant invasion about an inch above the bladder. The left ureteral orifice was normal, though slightly retracted. The bladder was contracted from disuse, and the mucosa was thrown into ridges and œdematous folds. The right renal pelvis and ureter were grossly dilated; the parenchyma was shrunken and atrophic. The right kidney was about one-third its normal size.

The left renal pelvis and ureter were dilated to some extent. The parenchyma was markedly hypertrophic, though pale and œdematous.

There was no evidence of infection in the urinary tract.

In this case malignant invasion of the aortic glands was present.

In this instance, following the occlusion of the lower end of the right ureter by carcinoma, compensatory hypertrophy of the left kidney had maintained urinary function until the left ureter had become similarly involved. The difference in the appearance of the two kidneys, particularly in the degree of atrophy, indicated that a considerable interval of time had elapsed between the respective obstructions. The low level of involvement of the right ureter would have provided cystoscopic evidence of what was impending.

Case II.—A female, aged 58 years, was admitted to the Royal Infirmary with advanced carcinoma of the cervix. Her symptoms suggested that the disease had been present for two years, and for a fortnight urinary incontinence had been present in addition.

Cystoscopic examination was difficult owing to the leakage of media through a vesico-vaginal fistula, but with the aid of continuous irrigation a large ulcer with irregular edges was seen on the bladder floor, and through this a fistulous opening communicated with the vagina.

Because of her miserable condition, bilateral transplantation of the ureters was undertaken. At the operation it was noted that the right

ureter appeared healthy and was normal in calibre, while the left ureter was dilated and thickened; at its lower end it entered a mass of malignant tissue.

Following the operation the patient was comfortable and passed up to 9 oz. of urine per rectum daily for four days. Thereafter the secretion diminished and the patient died on the tenth day.

At autopsy it was found that the sutured serous coat of the colon at the site of the implantation had healed by primary union and was satisfactory. The left renal pelvis was extremely dilated, and the renal parenchyma was atrophic and reduced to about one-sixth of its normal amount. No infection was present in the kidney or ureter.

The right renal pelvis was slightly distended and showed some chronic granular inflammatory changes in the mucosa. The parenchyma was enlarged—from compensatory hypertrophy. Advanced fatty and cloudy degeneration were present, and minute abscesses could be seen scattered throughout the cortical zone at one pole. The right ureter was patent. A large fungating growth of the cervix was present which had ulcerated into the bladder and extended into the broad ligaments, especially at the left side, where the lower end of the left ureter was involved in the malignant mass.

In this case involvement of the left ureter had brought about dilatation and atrophy of the left kidney. No infection was present. The right kidney had undergone compensatory hypertrophy, but, following the ulceration of the bladder and fistula formation, ascending infection had occurred. The absence of infection in the left kidney and ureter indicates that occlusion of the ureter on that side had preceded ulceration and infection of the bladder. The cortical site of the minute abscesses in the right kidney suggested that the infection had been blood-borne from the infected neoplastic mass.

These two cases illustrate well how carcinoma of the cervix had proved fatal through mechanical interference with the urinary tract. In the one the original growth had metastasised to the aortic glands; in the other, local necrosis and infection had supervened. In both cases by cystoscopy the advance of the neoplasm anteriorly could have been diagnosed at an early date had the opportunity occurred.

Cystoscopic Features.—From time to time the value of cystoscopy in such cases has been commented on by Continental writers. More recently British and American authors have described the information obtained by cystoscopy as a guide to radical operative treatment. They wished to know if any difficulty might be met with in stripping the bladder and found that cystoscopy tended to confirm and supplement information received from bimanual examination.

When the cervix and uterus were mobile and the cervix

could be withdrawn by volsella to the ostium vaginæ, a satisfactory operation could be confidently expected. In such cases there was no implication of the bladder or ureter, and the cystoscopic appearances were negative. Anterior extension and involvement of the bladder which could be recognised cystoscopically were always accompanied by fixation, and the ordinary methods of examination sufficed to determine inoperability. In borderline cases, however, the cystoscopic recognition of abnormal bladder appearances may be the deciding factor against operability.

TABLE I.

Analysis of Six Cases without Urinary Symptoms.

No.	Age.	M. S.	Duration of Symptoms (Months).		Cong.	Oed.	Ridg.	U.O.	Elev.	Fixat.	Later Condition.
			Vag.	Blad.							
1	47	S.	3	–	–	+	–	–	+	–	9/12 Serious infiltration.
2	46	M.	5	–	+ L.U.O.	–	–	– fix.	–	+ L.U.O.	Nodule ant. fornix.
3	50	M.	12	–	+ inter U.O.	–	–	Cong.	+	+ retract. inter U.O.	16/12 General extension.
4	50	M.	11	–	–	–	–	–	–	–	8/12 Nil. ant. nodule post.
5	60	M.	24	–	–	–	–	–	–	–	Carcinoma of body.
6	50	M.	2	–	–	–	–	–	–	–	Pan-hyst. and cure.

Radium therapy has now superseded radical operation in the treatment of the major proportion of cases of cervical carcinoma. A cervical carcinoma, judged inoperable by the usual methods of examination, may be influenced in very hopeful measure by the use of radium. The information obtained from the use of the cystoscope is now of considerable importance, if the extent of the disease is to be accurately delineated. Again, the effect of radium on healthy as well as neoplastic tissues renders it essential that due attention be paid to a neighbouring organ, both as a guide to technique and dosage and for the purposes of prognosis.

These factors amplify the importance of a knowledge of the state of the bladder wall in dealing with cervical carcinoma in its various stages, and particularly where anterior extension has occurred or is suspected (Tables I. and II.).

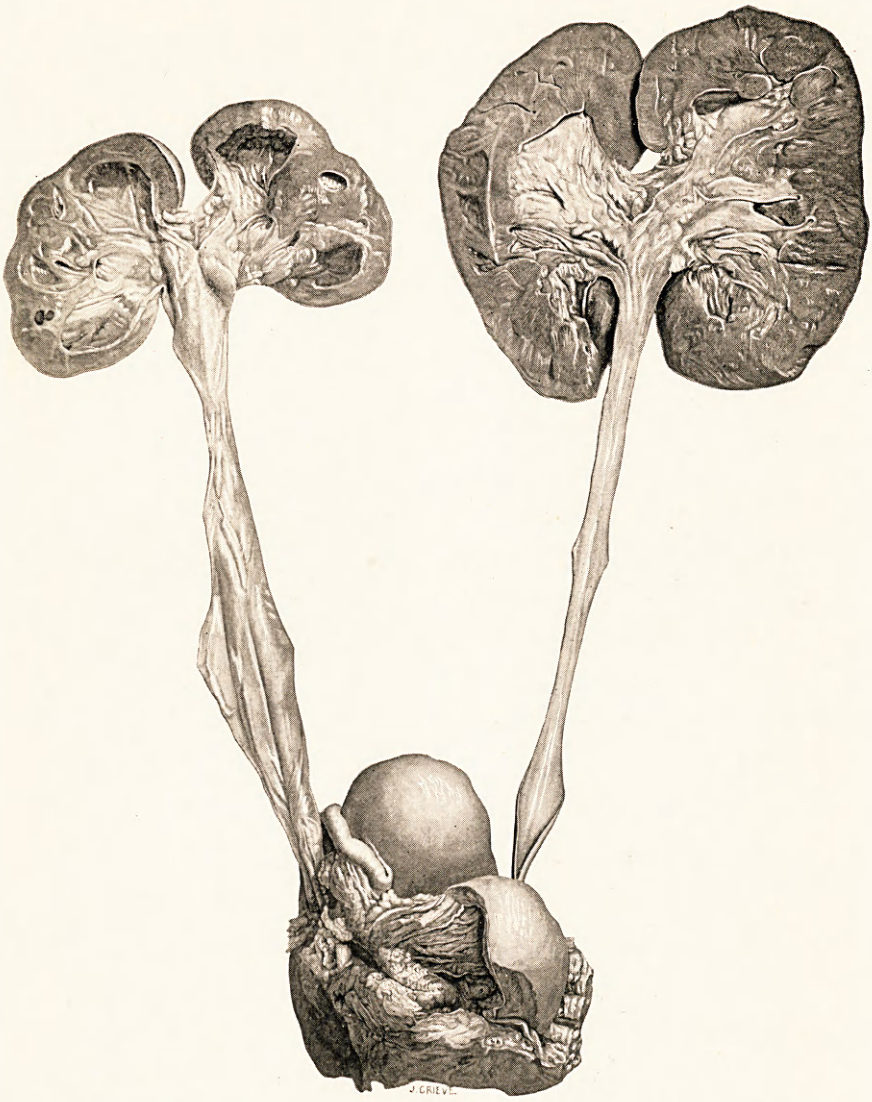

FIG. 1.—Autopsy specimen. Involvement of the right ureteral orifice by an extension of the neoplasm anteriorly in a case of carcinoma of the cervix.

TABLE II.

Analysis of Nine Cases with Urinary Symptoms.

No.	Age.	M. S.	Duration of Symptoms (Months).		Cong.	Oed.	Ridg.	U.O.	Elev.	Fixat.	Later Condition.
			Vag.	Blad.							
7	56	M.	4	1 freq.	Catrh. +	+	+	+ Pat.	−	−	24/12 No recurrence.
8	50	M.	8	4 freq.	−	−	−	+ Cong.	+	+	8/12 Marked infiltration.
9	58	M.	6	days and freq.	+	+	+ L.U.O.	+ L.U.O. retract. Ulc. above.	+	+	Hopeless; ceased report.
10	57	M.	36	4 dys. and freq.	−	+	+	+ L.U.O. retract. Puckered above.	+	+	8/12 Local satis. but infiltration.
11	40	M.	7	3 freq.	−	−	−	−	+	− +	7/12 Confined; dissemination.
12	39	M.	4	?	−	+	−	+ Oed. above L.U.O.	+	− +	3/12 Hopeless; severe hæmorrhage.
13	43	M.	24	1 freq.	+	+	+	+ Retract. nod. and ulcers.	+ Nod.	+	Pyelogram and ureterogram normal.
14	58	S.	3	incont.	+	+	+	+ Retract. U.O. fistula below.	+	+	Bilat. ureteral transplant. Death.
15	45	M.	3	pain.	+	+	+	+ Ulcer and retract.	+ Nod.	+	Hydro. R.K.

Involvement of the bladder from anterior extension of a carcinoma of the cervix may be recognised in six stages of increasing gravity:—

(1) Elevation of the bladder floor.
(2) Fixation of the bladder floor judged by digital manipulation of the cervix.
(3) Circulatory changes: (*a*) Congestion; (*b*) petechial hæmorrhage.
(4) Transverse ridge formation.
(5) Œdema.
(6) Malignant invasion: (*a*) Ulceration; (*b*) hypertrophic nodule; (*c*) vesico-vaginal fistula.

(1) *Elevation of the Bladder Floor.*—This is a common enough appearance, seen, for example, in retroverted uterus, but it has generally been found that considerable depression of the eye-piece of the cystoscope is necessary before the bladder is entered. The elevation is more marked in the trigone and in the region of the ureteral orifices. The significance is only that of a retro-vesical collection or swelling.

(2) *Fixation.*—This observation can be made by moving the cervix by means of the fingers per vaginam or by volsella. The latter method is to be recommended if the question of operability is to be considered. Fixation may be accounted for by a zone of inflammatory reaction in the anterior fornix, and undoubtedly such a zone exists, bounding the actual limits of neoplastic invasion.

(3) *Circulatory Changes*—(a) *Congestion.*—In many women, especially multiparæ, the trigone and mucosa at the ureteral orifices are found in a mildly congested state. No catarrhal lymph should be present. The effect of radium per vaginam has been noted to increase the degree of congestion in the bladder and even to give rise to œdematous folds. These points must be taken into account and their significance estimated. (b) *Petechial Hæmorrhage.*—This is a significant feature, especially when localised and associated with œdema or retraction of neighbouring mucosa. The advancing neoplasm interferes with the circulation, both venous and lymphatic, in the bladder wall. Local varices may be present.

(4) *Transverse Ridging.*—This is the first definite sign of imminent implication of the bladder wall by carcinoma of the cervix. Fixation of part of the mucosa to the advancing inflammatory zone and œdema of other parts cause the mucosa to be thrown up into transverse folds, like a ploughed field.

(5) *Generalised Œdema.*—This stage is found when the growth has all but reached the bladder and the circulation of the mucosa has been grossly obstructed by the inflammatory zone. In cases of cervical carcinoma under radium treatment this appearance is frequently met with, and it indicates the intense reaction produced by radium in normal tissue, particularly where some chronic inflammatory change pre-exists.

(6) *Malignant Invasion*—(a) *Ulcerative.*—These ulcers are of the typical appearance seen in carcinoma of the bladder arising *de novo.* The raised irregular margin and sloughing base and the surrounding cyanotic rim of congestion are easily recognised. They often occur in an indrawn puckered area of the bladder floor, the surrounding parts of which stand out

in œdematous relief. These ulcers are particularly common in the region of the ureteral orifices.

(b) *Hypertrophic Node.*—In association with the ulcer the hypertrophic node may be present. This is a very gross manifestation of malignant involvement of the bladder. It is an irregular heaped-up nodule, which is pale in colour. Secondary ulceration and yellowish sloughing may occur.

(c) *Fistula.*—Vesico-vaginal fistulæ occur in the trigone and may affect in addition one or other ureteric orifice. The bladder is very contracted, and only a passing view can be obtained. The edges of the fistula are irregular and elevated and frequently ulcerated. The fistula appears as a dark opening. The bladder walls are thrown into darkly congested œdematous folds.

Involvement of the Ureter.—It is known that in the operable case no change had been noted in the cystoscopic appearance of the ureteral orifice. In such cases, too, catheterisation of the ureter had invariably been successful, and subsequent dissection gave definite proof of the absence of ureteral involvement by neoplastic extension. It has been noted frequently, however, both in the operating theatre and at autopsy, that the ureter may be involved in the base of the broad ligament by upward extension, while the bladder remained healthy. The site of encroachment of the ureter may be an inch or so proximal to its point of entry to the bladder, and it may be brought about either by neoplastic tissue or by perineoplastic inflammatory changes. The effect is that of occlusion of the ureter, and subsequent dilatation of the urinary tract above.

When the wall of the ureter is affected by a chronic inflammatory process, shortening occurs, and this is recognised cystoscopically by retraction of the ureteral orifice and gaping. Since the site of involvement is in the broad ligament, at the lower limit of the ureter, particular regard should be paid to the ureteral orifice when testing for fixation. In one of the cases studied, where known extension had occurred to the bladder and broad ligament, retraction of the ureteral orifice preceded any change in the outline of the pyelogram and ureterogram. Thus the earliest lesion of the ureter from extension of a cervical carcinoma, by producing shortening of the ureter, may be diagnosed by simple cystoscopy. If, in addition, pyelography and ureterography indicate that the upper urinary tract is undilated and non-infected, the surgeon has to hand all the information he may require, either for

dealing practically with the condition or for purposes of prognosis. In this respect, intravenous urography may have an important part. By its means the urinary tract may be visualised without catheterisation of the ureters, and the estimation of the drug excreted in the urine forms a valuable test for renal function.

The appearances of the ureteral orifices met with are, in order of gravity:—(1) Fixation; (2) retraction; (3) circulatory changes; (4) irregular gaping; (5) ulceration and nodule formation.

Fixation, retraction and circulatory changes are important in that they are produced by lesions in the wall of the ureter situated above the ureteral orifice. Irregular gaping, and ulceration or nodule formation occur when the orifice itself is involved in neoplastic tissue.

Table III. demonstrates the frequency with which a change occurs in the appearances of the ureteric orifice. It is also noteworthy that the earliest sign of extension of the neoplasm can, in most cases, be found there. In cases where early anterior extension had occurred, its proximity to the ureter could be judged by a vascular change or a tendency to fixation at the ureteral orifice.

TABLE III.

SUMMARY OF CYSTOSCOPIC APPEARANCES.

Thirteen Cases of Carcinoma of the Cervix.

Cong.	Oed.	Ridg.	U.O.	Elevation.	Fixation.
7	8	6	9	10	10

Ulcer.	Retract.	Fix.
3	5	1

Urinary Symptoms.—Urinary symptoms do not give a satisfactory indication as to bladder involvement in cases of cervical carcinoma. Many women do not describe as a complaint a certain tendency to irritability or slight frequency of micturition. In many women such symptoms are of old-standing, and of little significance. In drawing up Tables I. and II., I have only considered such bladder symptoms as the patient had noticed during her present illness and had regarded as of importance. It is found that urinary symptoms are never pronounced except in the presence of serious bladder involvement, such as ulceration or fistula formation.

Prognosis.—In dealing with cases of untreated cervical carcinoma, Gemmel has estimated the expectation of life for a patient with vesical involvement to average eight to fifteen months from the time of onset of the bladder complication.

A review of the present small series of severe cases after radium treatment for eight months has been tabulated (Table IV.). All were alive. Of these 23 per cent. were in good health but infiltration of the broad ligament persisted. In 40 per cent. the cervical carcinoma had extended widely but the patients were still in fair health. In the 23 per cent. group the use of radium therapy had maintained good general health and had brought about eradication of the cancer in the cervix itself, but the neoplasm persisted in the broad ligament. It is here that the ureter will undoubtedly become involved, and lead to death from backward pressure and renal incompetence. The question must arise whether life may not be maintained in comfort by a procedure which will deviate the urinary stream and provide for urinary function uninterrupted by any such mechanical means.

TABLE IV.

EIGHT MONTHS' PROGRESS FOLLOWING RADIUM THERAPY.

Thirteen Cases of Carcinoma of the Cervix.

No Recurrence.	Local Improvement Infiltration.	Local Advance.	
		General Health Good.	General Health Bad.
No. 1 (2 years)	3	5	4
7 per cent.	23 per cent.	40 per cent.	30 per cent.

TABLE V.

Carcinoma of the Cervix Uteri.

Year.	Total.	Mortality.	No Recurrence.	Improvement.	I.S.Q.
1927	15	–	–	5	10
1928	16	–	1 (6 per cent.)	6 (36 per cent.)	9 (54 per cent.)
1929	17	2 (12 per cent.)	3 (18 „)	3 (18 „)	9 (53 „)
1930	22	6 (28 „)	9 (41 „)	2 (9 „)	5 (23 „)

In Table V. the results are given of the treatment of carcinoma of the cervix by radium in one gynæcological charge. A very marked improvement has occurred in the results attained during the last year or two. It is too early yet to

classify these figures as final, and that applies particularly to the prospect of complete cure in the "no recurrence" group. But the falling numbers of those cases which remain uninfluenced by radium therapy are of especial significance and indicate the increasing value of the use of radium and the improvements that have taken place in the technique of its administration. A group remains, the occupants of which have fallen from the "no recurrence" group, or in whom, in spite of local eradication malignant disease persists in the surrounding tissue. It is in this group that the general health is maintained until involvement of the urinary tract occurs, and ascending infection or backward pressure lead to renal incompetence and ultimately death. The general health will be maintained for at least eight months from the date of involvement of the urinary tract. Cystoscopic recognition of imminent involvement precedes the actual exposure of the renal parenchyma to backward pressure and consequent diminished functional activity. These are important factors which tend to weigh heavily in favour of any procedure which will undertake to deviate the urinary stream with a reasonable degree of safety to the sufferer. Intra-sigmoid transplantation of the ureter has a permanent place in surgery. The operation is well borne by the previously undamaged kidney and ureter. Following the operation the patient has comfort and complete urinary control. After successful transplantation the lesion in the pelvis may be attacked with renewed hope. Radiation or radical surgery may be directed entirely to the carcinoma and its eradication without tempering the efficacy of the method in order to allow for the protection or preservation of components of the urinary system.

II. The Operation of Vesical Exclusion as an Aid to Gynæcological Treatment.*

By HENRY WADE, C.M.G., D.S.O., F.R.C.S.E. (*By Invitation.*)

THE problem we have to consider is what improvement in treatment can be effected when carcinoma of the cervix uteri invades the urinary bladder?

It has been demonstrated to us to-night that this invasion occurs by the spread of the disease upwards along the cellular tissue planes of the pelvis, so that the lower ends of the ureters are first invaded and subsequently the bladder wall.

* Read 11th March 1931.

I have been told that if such cases remain untreated the expectancy of life is approximately seven to fourteen months, and that the cause of death is the impaired renal functional activity, due to invasion of the ureters and the consequent backward pressure on the kidneys.

I believe I am also correct when I state that, although as gynæcologists you have every occasion to be satisfied with the results that attend your treatment of primary carcinoma of the cervix uteri by radium therapy, you hesitate to employ it in cases where the bladder is involved, owing to the likelihood of a permanent and severe vesico-vaginal fistula resulting from a partial or complete destruction of the growth. If, therefore, it be possible to anticipate this complication by an antecedent operation of vesical exclusion, wherein the bladder as a reservoir for the collection of urine, is dispensed with, these cases could be dealt more readily and more radically and better results achieved.

I also suppose that if this operation of vesical exclusion proved safe and expeditious and permitted the patient afterwards living a life of relative comfort, its use in conjunction with the radical operative treatment of hysterectomy and cystectomy might be considered in certain suitable cases. This latter problem has exercised the minds of gynæcologists for many years. A pioneer in this field was that great gynæcologist, whom I rightly may call the Father of American Surgery, Franklin Martin of Chicago, to whom, as to others, the question that arose was how best to deviate the urine stream and he came to the conclusion that this could be done best by transplanting the ureters into the colon or rectum. The experimental work he carried out on dogs proved disappointing, but in 1898 he published the details of a suggested operation for a one-stage bilateral ureteral transplantation in such cases.

My justification therefore for appearing before you this evening is to tell you of my experience as a general surgeon of vesical exclusion, and to hear from you how far, if at all, similar methods would be applicable in circumstances I have referred to.

The function of the kidneys is to excrete the waste products of metabolism and these are discharged in solution in the urine. This fluid is originally collected within the calyces and pelvis of the kidney and by rhythmic contractions of the ureters, which occur at intervals from ten to twenty seconds the fluid is carried down and discharged into the urinary bladder. The urinary bladder thus exists to collect and store the urine,

and thus permit of it being voided at intervals sufficiently lengthy to permit of the normal activities of life. As one would expect from an organ whose function is entirely that of storage, the membrane lining the bladder is not absorptive and possesses a high degree of power of resistance to infection; so great is this that it may safely be assumed that a primary inflammation of the bladder occurs very seldom, and when cystitis is met with its source will usually be detected in the kidneys, the prostate, urethra, or some other part of the genital tract.

Under certain circumstances surgical operative procedures are advisable wherein it is found expedient to dispense with the bladder as a cavity in which to collect urine, and in these cases there are performed operations which I would designate as those of vesical exclusion. The indications for the performance of this operation are the presence of three diseases:—(1) congenital malformations known as extroversion of the bladder, or vesical exstrophy, which may be complete or partial; (2) severe vesico-vaginal fistula which for various reasons cannot be cured by the ordinary plastic operations employed in these cases; (3) tumours of the bladder where a cure can only be effected by the operation of total cystectomy.

In the practice of general surgery a number of palliative operations are performed with great benefit in cases of irremovable malignant disease. Thus, a palliative colostomy in a case of irremovable carcinoma of the rectum relieves the patient of much suffering and may prolong life for several years. It is natural, therefore, when malignant disease of the bladder is being treated, to consider whether a palliative operation of vesical exclusion would also be of value. At first sight, it would naturally appear to be so, and its practice is recommended by certain surgeons. When a patient is suffering from advanced malignant disease of the bladder, he leads a life of extreme misery, suffering from recurring spasmodic vesical contractions with the painful expulsion of a few drops of blood-stained urine every few minutes. Instead of this act being followed by relief, however, the spasmodic contractions recur and his agonies persist. From this fact it might be presumed that an operation wherein the urine stream was deviated would be followed by relief, and the patient's comfort thereby enhanced and his life prolonged. In my experience, this is not the case, for the spasmodic contractions from which the patient suffers are not due to the presence of urine in the bladder, but to the infiltration of the walls of the bladder with malignant disease and by these contractions nature is attempting to expel the tumour growth.

I have thus found that when the ureters are transplanted into the loins in the case of malignant disease of the bladder, the painful spasmodic contractions persist and are as severe and as painful as before this operation was carried out.

When the treatment of malignant disease of the bladder is being considered, whether it exists primarily in that organ, or is due to secondary invasion from a neighbouring structure, it will thus be found that the performance of vesical exclusion in itself is not sufficient, but when combined with other procedures it will be of value.

Methods of Vesical Exclusion.

(1) *Nephrostomy.*—The urine stream may be deviated on to the loins by the performance of the operation of nephrostomy, a procedure wherein the kidneys are exposed and the pelves drained, for preference through the lowest minor calyces. This is an operation which we very frequently perform in the treatment of renal calculus or hydronephrosis. It is easy to carry out and as a temporary measure in these cases is very efficient. As a means of permanent drainage, however, it is unsatisfactory. The sinus produced is situated in an inaccessible region for the patient to attend to himself. The reinsertion of the drain after it has been removed is a very difficult procedure, and in this operation it is impossible to ensure that the entire urine flow escapes by the tube, a varying quantity always passing down the ureter to the bladder.

(2) *Ureterostomy.*—This is an operation of very simple performance and virtually unattended by any danger to life. It can best be carried out through a grid-iron incision in the anterior part of the loin above the fore-part of the iliac crest. The ureter is exposed extra-peritoneally, mobilised and divided below the pelvic brim, the distal end ligatured and the ureter brought to the skin surface and fixed there. I have performed this operation in a number of cases of malignant disease of the bladder antecedent to total cystectomy. It has the advantage that both ureters can be transplanted at one operation. There is no risk of anuria following it, and, as I have said, it is unattended with danger.

The disadvantage that accompanies it is that of collecting the urine as it is voided on the skin surface. We have devised various forms of apparatus to achieve this, but none has proved perfectly successful, as it is difficult to provide an apparatus which will collect the urine completely with the patient in the upright, sitting and lying down postures.

(3) *Ureteral Transplantation into the Colon.*—The ideal method of vesical exclusion is undoubtedly that of ureteral transplantation into the colon and the establishment of a cloaca thereby.

The operative procedure for the transplantation of the ureters into the pelvic colon or rectum has been evolved in the course of treatment of congenital extroversion of the bladder. That most distressing abnormality is one in which the cloacal membrane persists and in consequence the child is born with the anterior wall of the bladder and all the structures in front of it absent. The symphysis pubis is un-united and epispadias is usually present. A vascular swelling weeping urine is evident in the lower part of the abdomen due to the herniated posterior bladder wall. Of those born with this malformation, it is reckoned that 50 per cent. are dead by their tenth year, and 66·67 per cent. are dead by their twentieth year. The cause of death has probably been renal infection.

A rarer form of the abnormality is that known as sub-symphyseal vesical exstrophy or epispadias in the female where the vesical neck and anterior wall of the urethra are absent, and congenital incontinence results.

I need not remind you of the numerous attempts to create a functional bladder cavity by plastic operations. Uniformly these proved failures in complete vesical exstrophy.

In 1878, Thomas Smith transplanted both ureters into the rectum extraperitoneally. In 1892, Maydl first carried out the operation of trigono-sigmoid-anastomosis, an operation in which a portion of the bladder wall with the ureteral orifices attached to it was implanted into the sigmoid colon. This operation was successfully practised by others so that Buchanan in 1909 collected the records of 80 patients treated in this way with a mortality of 28·7 per cent., the cause of death being recorded in 20 of these. Of these 7 died from peritonitis and 9 of pyelonephritis and anuria.

Bergenhem, in 1894, was the first to implant the ureters separately with a rosette of bladder attached into the rectum by the extraperitoneal route. Records are available of 26 cases thus treated. The mortality was 11·5 and in 2 of these it was due to ascending renal infection.

In 1901, Peters of Toronto, published a paper on trans-plantation of the ureters into the rectum by an extraperitoneal method for exstrophy of the bladder. It was a modification and improvement of the Maydl operation and for some time after was more widely practised. It is of course, however, only applicable to the treatment of cases of vesical exstrophy.

Operation of Vesical Exclusion

In the August number of *Surgery, Gynæcology and Obstetrics* for 1911, there is contained an article by Stiles on epispadias in the female, and its surgical treatment, with a report of two cases. He treated these by transplanting the ureters separately into the pelvic colon, employing a technique similar to the Witzel operation for gastrostomy, an opening being made into the colon through which the ureter was introduced and subsequently the ureter was buried on the surface of the colon by a seromuscular enfolding of the peritoneum covering it.

In my opinion the operation of ureteral transplantation was first placed on a scientific basis by Coffey of Oregon. As is often the case, it occurred to him when investigating experimentally another subject. He was studying the effect of transplanting the bile duct. He made an anatomical observation and a physiological deduction. By experimental tests on animals he proved the accuracy of these and then successfully carried out his operation on the human subject based on these principles. He noted that where nature carries fluid by a tube into a channel subject to varying pressure, she protects the outlet of the tube by a mucous valve and thus prevents regurgitation. In this manner the orifice of the bile duct into the duodenum, the ureters into the bladder, the salivary ducts into the buccal cavity are protected. Experimentally, he found that when the bile ducts were transplanted direct into the duodenum backward pressure with dilatation of the bile duct resulted. A similar result followed when the ureter was transplanted directly into the colon. The essential feature of his operation therefore is the creation of this mucous valve by carrying the ureter for some distance in the submucous layer between the muscular coats and the mucous membrane of the bowel before it enters that channel. When this technique is employed, regurgitation, dilatation and infection do not take place. When, however, the ureter is implanted into the colon and is buried within the coats of the bowel, there naturally follows a reaction œdema at this part and in consequence a temporary obstruction of the ureter producing anuria is liable to result.

Charles Mayo, who was the first to adopt the Coffey technique, modified it slightly with a very important result. When anchoring the ureter into the bowel he left a strand of catgut passing down the lumen of the ureter into the bowel, a wick down which the urine passed through the area of œdema and thus anuria was prevented.

The operative procedure that is now employed widely is thus known as the Coffey-Mayo technique, or as I will now

call it the first Coffey operation. Personally, I have employed it in several cases, and it has been of great interest to note that when the first ureter is implanted, on the evening of the operation urine has been voided per rectum and continued to be passed during the patient's convalescence, proving the efficiency of the Mayo catgut wick in preventing anuria. If we were certain that anuria could be prevented in all cases by this means, the technique might be employed for bilateral transplantation, and all our difficulties would be overcome. Unfortunately no one feels so confident of this as to adopt it for this purpose, and it is still the practice of the Mayo-Clinic to do the implantation in two stages.

To permit of bilateral one stage ureteral transplantation, Coffey has devised two other operations, the second Coffey operation, the tube method as he calls it, which he now practises in preference to the first, as he considers that it is superior. The second Coffey operation is briefly one where the rectum and pelvic colon are first of all carefully cleansed and then packed with sterile gauze. Through a transperitoneal exposure the ureters are revealed, isolated, and ureteral catheters are tied into them. The colon is then opened in two places and the catheters are inserted into the bowel attached to the gauze packing, so that when this is withdrawn the tubes are carried out through the anal outlet, and the urine collected from each kidney thereby. The ureters are buried beneath the muscular coat of the bowel by a technique similar to that employed in the original Coffey operation. Ultimately when the ureteral catheters come away a permanent valvular drainage is established. When it was originally published, I employed this technique, for of course it had certain obvious advantages in permitting of both ureters being transplanted at once. For various reasons I found it unsatisfactory, and that it is capable of improvement is evident by Coffey having introduced a technique, which I will call the third Coffey operation, which he has tested experimentally on animals, but not so far employed in the operating theatre. In this third operation, he ligatured the ureter and buries it beneath the unopened mucous membrane of the colon, but before doing so inserts a stitch through the lower end of the ureter and mucous membrane of bowel, which when it cuts out re-establishes the channel and produces the permanent opening of the ureter into the bowel. If it proves safe and successful in the human subject, it will go far to solve a problem we are considering to-night, and that

problem is this: In vesical exstrophy we are dealing with healthy young people handicapped by a physical deformity. On the whole they are favourable subjects for operative treatment, and in none of them is the time taken of urgent moment and we can afford to play for safety and do the operation deliberately in two stages. But to-night the treatment of vesical exstrophy does not concern us. We are dealing with malignant disease of the cervix uteri, or possibly the uterus, which has invaded the urinary bladder. I am especially concerned with primary malignant disease of the bladder or prostate, wherein to effect a cure the entire organ must be removed. If ureteral transplantation in two stages has to be carried out, this will occupy a period of approximately five weeks, after which the third operation for removal of the primary disease has to be done. Time is lost and the strain on the patient is very great. If a safe method of bilateral transplantation in one stage is available, a fortnight alone would be required before the radical operation was done, and finally, if this bilateral transplantation can be carried out with reasonable safety with no undue shock and moderately expeditiously, it might be possible to carry out the entire treatment by a single operation.

In the *Annals of Surgery* for June 1930, Coffey has an article on the transplantation of the ureters for cancer of the bladder with cystectomy. He gives in detail the steps of an operation he has performed in carrying out total cystectomy and bilateral ureteral implantation at one stage. He employed the Coffey No. 2 technique, the tube method, as it is called, and the immediate result was thoroughly satisfactory. The advantages of doing the entire operation in one stage are obvious, and in it we have the ideal which will ultimately be achieved and generally adopted. As I mentioned, however, personally I feel convinced that the tube technique, although it has proved satisfactory in these cases, is capable of being improved upon, and personally it is my intention, when opportunity presents, to adopt the Coffey No. 1 technique, which has been so satisfactory in my hands for the two stage transplantation for the bilateral operation with the modifications which I hope will overcome the risk of anuria associated with it.

Discussion.

Dr Haig Ferguson said that he had listened with great pleasure to the excellent address and convincing demonstration by Mr Band and Mr Wade respectively. The gynæcologsit had much to learn from the general surgeon and *vice versa*. It had always to be remembered

that the gynæcologist was really the founder of and the pioneer in abdominal surgery.

Mr Wade's reference to Sir Thomas Smith as a great pioneer in urological surgery recalled a case of interest in which Mr Smith, as he then was, treated a large vesicocervical fistula which ultimately, as the result of the failure of several plastic operations, extended into the vagina. The opening into the bladder ultimately admitted two fingers. Sir Thomas Smith closed the fistula by, so to speak, corking it with the cervix. This was entirely successful for a time, both the menstrual flow and urine gaining exit through the urethra. The patient was very comfortable for about a year, but ultimately in spite of every care the bladder became septic and filled with calcareous deposit, the result of the admixture of menstrual blood. This had to be dealt with at frequent intervals, but in spite of all precautions the kidneys, uterus and tubes became infected resulting in the patient's death in about two years. The specimen showing the implantation of the cervix into the bladder is preserved in the Royal College of Surgeons' Museum. If there had been no menstrual discharge the operation might have been a success.

Another case had come under Dr Ferguson's care where the pelvis was fractured during a forceps delivery in the country, and the patient was ultimately sent into the Infirmary as a vesicovaginal fistula case. On examination, it was found that the whole of the anterior vaginal wall and lower part of the bladder had been destroyed and the ureters were seen discharging urine into the vaginal vault. No plastic operation was possible and the ureters were transplanted into the colon at two separate operations in collaboration with Sir David Wallace. The patient was now well, the rectum functioned just like a bladder and there had been no kidney complication.

Mr Wade had conclusively shown how transplantation of the ureters in certain cases could give great relief to the patient and had further demonstrated that it opened up a wide field from a gynæcological point of view for dealing more adequately than had been possible hitherto, with certain malignant conditions in the pelvis.

Professor Hendry found in Mr Wade's demonstration some hope for those patients in whom there had been irreparable damage to the anterior vaginal wall or urethra during labour. One of the worst of these cases in his experience occurred in a girl of 17 who had been treated for eclampsia by *accouchement forcé*, in a Poor Law Hospital, with resulting necrosis of practically the whole anterior vaginal wall.

In cases of carcinoma of the cervix he was very interested to know what was the essential involvement of the ureter. He had formed the impression that in many cases the actual tissue of the ureter remained free from malignant involvement but that the ureter was occluded by pressure from malignant tissue outside.

In the first of Mr Band's cases the fact that there was atrophy

of the right kidney without any preceding pyelitis seemed to indicate that pressure rather than tissue invasion might be the lesion.

It was most important in assessing the operability of a case of carcinoma of the cervix to realise that mobility of the uterus was not everything. There might be considerable mobility with at the same time an extension of the epithelioma on to the anterior vaginal wall, sufficient to make a radical operation impossible. That could be very easily confirmed by cystoscopic examination.

In advanced cases of malignant disease of the cervix which had benefited greatly by the application of radium, the cause of death appeared very often to be a renal involvement, rather than a local recurrence. This would certainly support Mr Wade's plea for special attention to renal function.

Miss Tod said that in cases where radium had been used the appearances of the bladder were often deceptive. There had been cases in which more radium had been inserted and it had been found later that the condition from which the patient was suffering was a violent radium reaction, and nothing worse could have been done. Mr Wade's operation should prove of tremendous help in cases where the disease had spread down the anterior wall of the vagina. She had seen two cases sent into the Marie Curie Hospital where the anterior wall of the vagina had been practically destroyed, and had it been possible to apply radium by Mr Wade's technique life might have been prolonged for some time, for the condition of the patients was comparatively good.

The hospital records showed fewer deaths from kidney complications than was expected; most deaths being due to metastases in the liver. In such cases deep X-ray therapy might have been of value. The figures from the Fondation Curie encouraged one to think that more encouraging results might be achieved than has been possible so far.

The *President* said there were many cases where one hesitated to use radium because of the discomfort to the patient. If one could exclude the bladder one could employ this treatment with safety and it opened up a very big field from the operative point of view. In the Wertheim technique the ureters were the main trouble and the main worry, and even Wertheim himself had roughly one in twenty cases of ureteral necrosis occurring ten to twelve days after the operation, and although the patient might be temporarily or permanently cured of her carcinoma, she was perfectly miserable. If ureteral transplantation was carried out first one could tackle the problem of clearing out the pelvis with an easy mind. One could dissect out glands, one could clear the ureters, one could take away the bladder or a portion of the bladder, and it would make things very much easier for the operating surgeon if he fancied that line of treatment. Exactly the same rule held for radium. For the last two years he had never undertaken Wertheim's operation without having a cystoscopic report regarding the condition of the bladder. Gemmell, two years ago, had laid great emphasis on this point, after examining a great many gynæcological

cases in Liverpool. If a clean bill could be given as to the bladder involvement an ordinary Wertheim could be done with comparative safety. Mr Band had laid emphasis on the condition of the ureteric orifices: Gemmell seemed to have overlooked that in his paper and concentrated more on the question of œdema.

Mr Wade (in reply) said one had to remember that all this work was still in the pioneer stage as yet. Coffey was still feeling his way. In his opinion the Stiles' technique, on theoretical grounds, was not so sound as that employed by Coffey, in that it did not produce so efficient a mucous valve as was the case with the latter. One did get occasionally a renal infection, but perhaps a third technique could be found to eliminate this complication. Certainly, there were great prospects of further advance along these lines.

Mr Band (in reply) said that it was thanks to the President that it was possible to prepare this paper. Two years ago he had brought to Mr Band's notice Gemmel's paper on this subject illustrating the co-operation that existed between the gynæcologist and cystoscopist in Liverpool, and subsequently had given every facility for the examination of a series of his cases cystoscopically and had permitted Mr Band to follow them up, making use of his case records. Many of these cases were examined when the cervical carcinoma was at an early stage of development, and accordingly a considerable proportion had no bladder abnormality. Professor Hendry had inquired as to what followed when one ureter was involved by an extension of the carcinoma. One could not pronounce a definite opinion at this stage because of the small amount of material examined and particularly because so few were investigated by dissection either at autopsy or operation. The impression had been gained, however, that the ureter was primarily involved by a peri-neoplastic inflammatory process which might adversely affect the function of the kidney above, and that the other kidney, remaining undamaged, assumed sole function. The affected kidney rapidly tailed off in its functional activity and atrophied before ascending infection occurred. When malignant involvement of the ureter occurred from the extension upwards of the cervical carcinoma, involvement of the bladder might be at a minimum. Only in those cases where the bladder is more severely involved and ulcerated would the concomitant cystitis lead to ascending infection and pyelonephritis.

Dr Tod's question regarding the effect of radium per vaginam on the normal bladder mucosa was one of great importance. The effect of radium on the normal bladder would produce those same appearances which were recognised cystoscopically and associated with those of early, actual involvement of the bladder. The first case on the first table was that of a woman who had had, after two years' treatment, no recurrence of cervical carcinoma. In her bladder there had been seen changes due to congestion and œdema. It was thought that these were due to carcinoma, but they must have been due to the effect of radium therapy, otherwise her clinical cure would not have been possible.