RESULTS

The final results of operative treatment must be considered from two points of view: first, freedom from recurrence, and secondly, the condition in which the patient survives. Throughout the foregoing remarks I have tried to lay all possible emphasis on the value of precise local knowledge of the epitheliomas of the pharynx in dealing with them by operation. Such knowledge makes possible the exact orientation of any necessary operation, and so increases the prospect of cure and at the same time diminishes the need for mutilation. The view is sometimes expressed that the more extensive an excision the more likely is it to be successful; this is by no means necessarily true, for if the operation is not exactly oriented in regard to the growth its mere extent is unlikely to save it from failure. This criticism applies to many cases in which extirpation of the larynx is practised in dealing with pharyngeal growths. There are, in my opinion, very few cases in which that formidable mutilation is of use in the treatment of such growths. Most of the cases in which the tumour cannot be got away without laryngectomy are incurable by any operation, and where the tumour can be got away by local excision the mere addition of laryngectomy, in my opinion, gives no further security. It will be noticed that in the small number of illustrative cases I have mentioned, the only residual disabilities left have been the occasional fixation of one vocal cord, and in one case some fibrous constriction of the oesophagus. I should not feel able to record as a true success the cure of a pharyngeal carcinoma won at the expense of laryngectomy. One of the most beneficent effects of the introduction of radiotherapy has been its

tendency to make us look with increasingly critical eyes at treatment by crudely mutilating operations.

With regard to the small number of actual results I have quoted, it must be understood that they are intended to be illustrative of the various clinical types of disease rather than to embody a full statement of experience. Such a statement to be satisfactory would have to be much more detailed and extensive. It would include a certain number more of successful results, a good many partial successes with freedom from recurrence up to some such trivial period as three years, and a considerable number in which the operation was fatal or a failure. The cases I have actually quoted may, such as they are, be put together in a list with a statement of the length of freedom from recurrence that followed in each case on the simple excision of the growth. In this way a more general view is obtained.

Case	Free from Recurrence
1. Ary-epiglottic fold (extensive glands) ...	7 years
2. Pyriform sinus	20 "
3. Lateral wall (large primary growth) ...	5 "
4. Lateral wall (moderately early) ...	7 "
5. Lateral wall (large primary; extensive glands)	7 "
6. Lateral wall (early)	3½ "
7. Posterior wall	8 "
8. Post-cricoid (extensive)	9 "

The eight cases thus show an average freedom from recurrence of over eight years. Even a group so small as this, especially when it is remembered that none of the patients suffered any serious mutilation, does, I think, suggest that in suitable circumstances the method of plain local excision with the knife has a definite usefulness.

THE MANAGEMENT OF URINARY CALCULI*

BY

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The symptomatology of stone in the kidney and ureter is legion. Briefly enumerated, the characteristic symptoms are: pain, which is often agonizing, haematuria, increased frequency of urination, nausea and vomiting, and, when infection supervenes, pyuria. During an attack of colic it is impossible to say what position the stone occupies, but the more pronounced the bladder symptoms of frequency and dysuria, the more probable it is that the stone is lying in the lower segment of the ureter.¹ A stone slowly passing down the ureter is characterized by intermittent attacks of colic. As the attacks recur the point of maximum pain gradually shifts from the back to the anterior abdominal wall, and follows a course downwards along the line of the ureter. Should the stone reach the lowest limit of the ureter and partly project through the ureteric orifice into the bladder, pain is felt at the tip of the penis at the end of urination.

When a stone becomes impacted in the ureter, the acute attacks give place to a fixed pain, usually in front, at an area along the outer border of the rectus abdominis muscle. If such a pain in front is accompanied by an ache in the posterior renal area, commencing dilatation in the kidney is probably taking place as a result of back pressure. If the impaction occurs in the terminal end of the ureter immediately outside the bladder wall, symptoms referred to the genital organs may result, owing to the anatomical proximity of the ureter to the genitalia and the intimate relationship between the nerve supply of these structures. In both sexes the stone may

cause pain during or after coitus. In the male, painful nocturnal emissions and pain in the testicle or along the course of the vas may also be felt.² The following case illustrates this symptom-complex, in addition to some other interesting features.

A man, aged 55, was referred to me in January, 1930, complaining of a continuous ache on the right side of the perineum and pain along the urethra following coitus. In 1927 he had had severe attacks of colic in the upper right abdomen. In October of that year an x-ray examination had shown two small calculi in the right kidney. Three months later these were found to have travelled down the ureter to the level of the iliac crest. Four months after that no shadows were observed on further radiographic examination. The patient, however, continued to have pain, at first in the right iliac region and then in the perineum. I found, on cystoscopic examination, a marked delay in the secretion of indigo-carmin from the right kidney, and a catheter which I passed into the right ureter was obstructed 4 cm. up. A radiogram taken with the ureteric catheter in position showed that the two calculi, first seen in the right kidney some thirty months previously, had become impacted in the lower end of the ureter. They were successfully removed by cystoscopic manipulations, and the patient has been free from all symptoms since.

Sometimes a calculus may give rise to no pain or colic at all, and is only discovered on investigating the cause of a chronic pyuria or haematuria. This absence of pain is usually associated with a large renal calculus. The smaller stones tend to move about and block the outlet of the kidney pelvis. Pain from over-distension follows. A stone may, however, pass from the kidney to the vesical end of the ureter without causing pain.

In February, 1928, I cystoscoped a doctor who had had intermittent symptomless haematuria for seven days. It was thought that he was probably suffering from a bladder papilloma. The bladder was quite normal, however, but a catheter passed into the left ureteric orifice, which looked

* A lecture delivered before the Northern Medical Society, Glasgow, December, 1931.

inflamed, was obstructed at 3 cm. A radiogram showed a stone lying against the tip of the catheter. Several attempts were made, without success, to remove the stone by non-operative measures. A few days after the third attempt the stone could not be seen in the ureter, but was found, on x -ray examination, to have ascended into the kidney. Two days later a further x -ray showed that the stone had passed back into the lower ureter, yet no pain or colic had resulted from these excursions.

Pain is sometimes felt on the opposite side to that in which the stone lies. This may be due to a compensatory hypertrophy occurring in the healthy kidney or to a reno-renal reflex. In September, 1927, I removed a small stone from the right kidney of a man who had been suffering from severe attacks of left renal colic. Incidentally, this patient returned in May, 1930, suffering from further attacks of left-sided colic. On this occasion a stone was found in the left kidney and was also removed. There is also a possibility of pain occurring in the opposite side as a result of a simultaneous lesion in the non-calculus kidney. For example, I recently saw in the medical wards a female patient who was considered to be suffering from a right-sided pyelonephritis. She had had intermittent attacks of right renal pain over a period of six years. A pyelogram and analysis of the secretion from the right kidney confirmed the diagnosis of pyelonephritis, but the x -ray films also revealed a stone in the left kidney. These cases emphasize the necessity of x -raying the whole urinary tract in every case of suspected calculus.

DIAGNOSIS

A mere radiographic examination of the urinary tract, however, by no means completes the investigation. Urological surgery is very fortunate in the accuracy of the various means available for diagnosis, and it holds its present prestige because of the efficiency of these methods.

If the diagnosis of calculus has been made by finding a shadow in the urinary tract on x -ray examination, what further investigation is required before deciding on the mode of treatment? It is first of all necessary to be certain that the shadow is really that of a calculus and not some other opaque body, such as a calcified lymphatic gland, a gall-stone, a phlebolith, or a faecalith. Thomson-Walker, some years ago, drew attention to the fact that calcified glands, which, in an x -ray, may look very like calculi, are frequently found in the vicinity of the kidney or ureter in patients who are suffering from symptoms which point to some disorder of the urinary tract. An x -ray examination, after passing an opaque catheter into the ureter, will differentiate a ureteric calculus from other doubtful shadows, while a pyelogram will show whether or not the suspicious shadow is within the kidney or is extrarenal. Other information will also be obtained from the pyelogram, which may greatly influence the mode of treatment. It will usually reveal the exact situation which the stone occupies, and so allow of its removal with the minimum damage to the kidney. It will demonstrate the degree of damage which the stone has inflicted on the kidney, and thus show whether removal of the kidney rather than the stone is indicated. Not infrequently the pyelogram will show that the kidney in which the stone lies is an anomalous one. In several of the cases on which I have operated for stone there has been a double renal pelvis and ureter, and in two cases the stone was lying in one segment of a horseshoe kidney. A previous recognition of the existence of a renal anomaly, particularly when it is of the horseshoe variety, is of distinct aid to the surgeon when operating for calculus.

X -ray examination, cystoscopy, ureteral catheterization, and pyelography should tell us, therefore, the number, size, and position of the calculi, whether or not there is

present a congenital renal anomaly, and the amount of damage that has been caused to the host. The secretion from the kidney can also be collected through the ureteral catheter for analysis, and the presence and type of infection ascertained. It is further necessary to confirm the presence and health of the second kidney. This can be done most expeditiously by giving the patient an intravenous injection of indigo-carmin when carrying out the ureteral catheterization. If the second kidney is healthy, the dye will appear strongly concentrated at the corresponding ureteric orifice in about four minutes.

Excretion urography is the most recent addition to the diagnostic aids at the disposal of urology, and it has a useful place in the investigation of calculus disease. Following the intravenous injection of a contrast substance containing iodine in stable organic combination, the drug is almost entirely eliminated by the kidneys, and satisfactory x -ray visualization of the whole urinary tract is frequently obtained. Uroselectan B and abrodil are the best preparations available for carrying out the examination. It is possible in some cases to identify suspected shadows by this method alone, to determine their intrarenal situation, demonstrate any coincident disease or anomaly in both kidneys, and, at the same time, to ascertain the differential renal function.³ The procedure, however, has definite limitations, and, if used exclusively for this type of case, will certainly result in diagnostic errors. When there is marked destruction of kidney tissue, visualization is absent or so poor that it is impossible to interpret the pyelogram. Owing to lack of detail, which is frequent in an intravenous pyelogram, suspected small shadows which are intrarenal may appear to lie outside the kidney; and, conversely, shadows without the kidney may appear to be intrarenal. The interpretation of shadows lying over an area of the lower ureters is also frequently impossible, owing to the difficulty of visualizing accurately this part of the urinary tract. The method can be of great value, however, when the stone is impacted in the lower ureter, obstructs the passage of a ureteral catheter, and possibly prevents the injection of opaque medium above it. It is important in these cases to ascertain the condition of the kidney and of the ureter, particularly as regards the degree of dilatation that is present. As the calculus will frequently hold up the contrast substance after intravenous injection, excellent visualization often results and the required information is obtained.

TREATMENT OF RENAL CALCULI

Except in some special circumstances which I shall mention, stones in the kidney should be removed. If that is not done destruction of the organ will generally result, bringing in its train chronic ill-health and possibly death from renal failure. It should also be remembered that the irritation produced by a calculus of long standing may predispose to squamous carcinoma of the renal pelvis. I have had two patients whom, I consider, confirm this hypothesis. In both the kidney was removed because of extensive destruction resulting from multiple calculi, and histological examination revealed the presence of a squamous carcinoma which had not been suspected prior to operation. One patient was a man of 54, whose history suggested that calculus formation had started eighteen years previously. The other patient was a man of 69, who dated back the onset of his symptoms to boyhood.

If a minute renal calculus is not causing the patient much pain an expectant attitude may be adopted, particularly when the pyelogram shows that no damage is being caused to the kidney. The patient should take abundant bland fluids and be kept on urinary antiseptics. Periodic lavage of the renal pelvis through a ureteric catheter, followed by an instillation of silver nitrate, may help to mobilize the stone and keep the kidney free from

infection. A case which I treated in this way had two calculi, not much bigger than match-heads, in the right kidney. The pyelogram showed no dilatation, and the patient, after some initial attacks of fairly severe colic, merely experienced an occasional ache in the back. To have removed these small calculi by operation would have caused more damage to the kidney than was already resulting from their presence. One of the stones was passed four months after the patient came under my observation; nearly a year elapsed before the second one came away. It is not often, however, that stones as small as these are seen in the kidney, and in most cases operation is necessary for their removal. The procedure to be adopted will vary according to the position which the stone occupies, the condition of the kidney in which it lies, and the health of the second kidney. If it lies in the pelvis of the kidney or in the proximal part of a calyx the stone should be removed through an incision in the wall of the pelvis, always providing that the kidney can be efficiently mobilized and displaced through the lumbar wound to an extent which allows a direct view of the line of incision. The advantage of a "pyelolithotomy," as this procedure is termed, is that no renal parenchymatous tissue is destroyed. If, however, the stone has impacted in the distal end of the calyx, or if, as occasionally occurs, the stone is situated in the renal substance, it should be removed by an incision through the cortex, made directly over the stone at right angles to the convex border of the kidney. This is termed a "nephrolithotomy." Should a short renal pedicle render mobilization of the kidney impossible, a nephrolithotomy may be necessary, even when the stone is in the renal pelvis. It may also happen, particularly when dealing with multiple calculi, that one is compelled both to open the renal pelvis and to incise the cortex. When a large calculus has destroyed the kidney to such an extent that only a thin shell of fibrosed renal tissue is left, or if a widespread infection or dilatation has resulted, there is no object in leaving the kidney. Providing the condition of the second kidney is satisfactory, it is better to perform a nephrectomy. When both kidneys are the seat of large calculi and there is much destruction of renal tissue, the tendency should be towards conservatism, for, in these cases, there is a strong possibility of recurrence. If, however, the outlet of the kidney is blocked on one or both sides, the obstructing stone should be removed, the side with the better function being operated on first. In cases of bilateral calculus, where a stone is present in the kidney on one side and in the ureter on the other, it is essential to remove the ureteral calculus first. If this is not done the work of both kidneys is temporarily thrown on the one with a blocked ureter, and an anuria may follow.

TREATMENT OF URETERIC CALCULI

The most common sites of impaction of a stone in the ureter are at the upper end, at the brim of the pelvis, or just outside the bladder. Stones impacted in the upper end should be removed by operation, but conservative methods should always be tried for those impacted in the lower ureter. The procedure which I adopt is as follows. The condition of the kidney and ureter above the site of impaction is first ascertained, for if gross hydronephrosis and hydronephrosis have resulted a nephrectomy or a nephro-ureterectomy is indicated, particularly if infection is present in the dilated kidney. The patient is always warned beforehand that the conservative treatment may not be successful. A catheter is passed up the ureter; if the stone obstructs its progress, novocain, 4 per cent., is injected. The anti-spasmodic effect of this injection sometimes allows of the immediate passing of the catheter beyond the stone. Having got above the

level of the stone, 3 c.cm. or 4 c.cm. of liquid paraffin or olive oil is injected. The cystoscope is withdrawn and the catheter left in place for an hour longer. The process is repeated four or five times if necessary, at about weekly intervals, the ureter being usually dilated at each sitting with ureteral bougies, prior to inserting the catheter. If, after two or three attempts, it is found impossible to get a catheter or bougie above the level of the stone, operation is usually advised. If after four or five successful catheterizations the stone remains undisturbed, operation is also advised.

When a part of the stone is projecting out of the ureteric orifice it is usually possible to displace it into the bladder by means of a ureteric bougie, or to pull it out with rongeur forceps passed through an operating cystoscope. Sometimes the stone is impacted just within the ureteric orifice, and the contracted state of the orifice prevents its passage into the bladder. In these cases the orifice can be enlarged by cutting with scissors through the operating cystoscope, or by diathermy, which is the method I prefer.

When operation is necessary to remove a stone from the ureter, exposure of the upper end is obtained by a lumbar incision exactly the same as that used for exposure of the kidney. When the stone is in the abdominal or pelvic segments of the ureter the approach is made through a vertical paramedian abdominal incision. The peritoneum is not opened, but is stripped off the abdominal wall and displaced inwards until the ureter is reached. In the pelvis the ureter is best identified as it crosses the bifurcation of the iliac vessels, whence, if necessary, it can be traced down to the bladder. The stone is removed through a small vertical incision, which is usually made directly over it. The opening in the ureter is closed by two or three fine catgut sutures which avoid the mucous coat. A drain is placed down to the wound in the ureter, and is left in position for at least four days. Some urinary leakage often occurs for the first few days, and, occasionally, this may continue for two weeks or even longer. I have never had a permanent fistula result from carrying out a ureterolithotomy.

SUMMARY OF CASES

In order that an idea may be formed as to what proportion of cases are treated by the different methods just outlined I have gone over the records of all calculus cases treated by me at the Royal Infirmary, Glasgow, from the inception of the urological department there in May, 1928, until the end of October, 1931. Cases that were sent to me by other surgeons for diagnosis only are not included in my figures. In this period there were ninety-seven cases of renal and ureteric calculi. Fifty-five of these were renal. Of these, four patients passed their stones without any surgical intervention. In three cases operation was not advised, because of old age in one case, the presence of bilateral branching calculi in another, and the existence of a renal tuberculosis in the opposite kidney in the third. One patient refused operation. Out of forty-seven cases operated on seventeen had a nephrectomy done. In twenty-two cases a pyelolithotomy was performed, in three a nephrolithotomy, and in four a pyelonephrolithotomy. In one case in which there was a perirenal abscess drainage of the abscess alone was carried out. There were two post-operative deaths, both of these following nephrectomies; one resulted from delayed chloroform poisoning and the other from general asthenia. This latter patient was a debilitated old man, who died two weeks after the operation.

Of the forty-two cases of ureteric calculus the stone was partly extruded through the ureteric orifice, and could be observed through the cystoscope, projecting into the bladder, in six. One of these stones was passed

spontaneously after the cystoscopic examination. Four were prised out into the bladder by a ureteral catheter or bougie, and then passed by the patient. In the sixth case the stones (there were two) lay within a cystic dilatation of the lower end of the ureter, which was seen as a semi-translucent prominence, about the size of a walnut, on the bladder wall. In this case the ureter was reached through a suprapubic opening into the bladder, and the stones extracted by slitting up the ureteric orifice. In twenty-five cases the stone was held up just outside the bladder wall—that is, about 3 cm. or 4 cm. above the ureteric orifice. Three of these were passed without any intervention. In eleven, ureteral dilatations were successful in removing the stone; seven of these required one treatment only, three had two treatments, and one had three treatments. In ten cases dilatation was not successful, and ureterolithotomy was performed. In one case a nephrectomy was done because of a coexisting pyonephrosis. In five cases the stone was impacted higher up, occupying positions between the brim of the pelvis and the fourth lumbar vertebra. Two of these were removed by dilatation, one requiring two treatments and the other three. Two others had a ureterolithotomy, and in one the kidney and the ureter, to below the level of the calculus, were removed because of a hydronephrosis. In six cases the stone was impacted in the upper or abdominal segment. These were all removed by operation. There was no post-operative mortality in the ureteric cases. It will thus be seen that in thirty-one of the forty-two cases the ureteric calculus was held up at the lower segment and only eleven of these required open operation.

BLADDER STONES

A vesical calculus may form in the bladder as a result of infective changes there, or it may have its origin in the kidney, whence it passes along the ureter into the bladder. If it is not expelled by the urethra it will increase in size by the deposit on its surface of uric acid, urates, oxalates, or phosphates.⁴

Urinary frequency is the most common symptom. Unlike the frequency due to enlarged prostate, it is most noticeable during the day, when the patient is moving about. Pain is another common symptom. It is usually referred to the back of the glans, and is particularly felt after passing urine, because then the mucous membrane of the bladder is in contact with the stone. Haematuria, when present, usually occurs towards the end of urination. It is increased by exercise, but is rarely so profuse as is that associated with neoplasm of the bladder. Sudden stoppage of the urinary flow in the middle of the act is also sometimes complained of.

In the majority of cases the presence of a bladder stone can be confirmed by a plain x-ray examination. As, however, uric acid stones may not be opaque enough to give a shadow, the veracity of a radiogram in a suspected case of bladder calculus should only be accepted when a shadow is present. The use of a bladder sound is also a fairly accurate way of confirming the diagnosis. If, however, the stone is lying in a diverticulum or in a post-prostatic pouch, if a tumour of the bladder is simultaneously present, or if the stone is covered with thick muco-pus, this method may fail. A cystoscopic examination will give the most accurate information regarding the size, shape, and number of stones present, and will also reveal any coexisting bladder lesion. An ulcerative growth covered by phosphatic deposit may cause some confusion in the diagnosis, but this can usually be cleared up by touching the part either with the beak of the cystoscope or with a ureteric catheter. An encrusted growth, unlike a stone, will yield to the touch of the instrument.

TREATMENT

Litholapaxy—that is, crushing the stone or stones within the bladder and completely evacuating the fragments—is the operation of choice in all uncomplicated cases. I have been surprised to find that many regard this procedure as “old-fashioned.” I think the reason for this attitude is that most general surgeons prefer the cutting operation, and students pass through their course of surgical study without ever having seen a stone in the bladder crushed. It is stated as an argument against litholapaxy that recurrence is more likely to take place because some fragments may be left behind. This fear is without foundation. At the completion of a crushing operation a cystoscopic examination will show whether any fragments have been left behind, and, if so, they can be dealt with immediately. If the condition which brought about the formation of the original stone persists—for example, a urethral stricture—recurrences may certainly take place, but this will also happen after the suprapubic operation. The mortality from litholapaxy is practically nil and convalescence is very short. The patient should be quite fit again in two or three days. The operation is contraindicated in the following circumstances:

1. When there is present some other condition requiring operation—for example, enlarged prostate or bladder tumour.
2. When the stone is encysted in a diverticulum.
3. When the stone is very large so that it almost fills the bladder, the walls of which are contracted down to the calculus.
4. When sepsis of the bladder, severe enough to demand suprapubic drainage, is present.
5. When there exists a tight stricture of the urethra which cannot be dilated sufficiently to admit a lithotrite.

In the presence of these complications a suprapubic lithotomy is usually indicated. I had to resort to this in nine cases out of nineteen, in spite of my preference for litholapaxy, for the following reasons:

	Cases
Urethral stricture	3
Enlarged prostate, requiring prostatectomy ...	1
Stone in diverticulum	1
Carcinoma of bladder, requiring partial cystectomy	1
Large stone in female patient filling the bladder so that it blocked the passage of any instrument ...	1
Stone impacted at bladder neck, following previous prostatectomy	2

The last two patients both died as a result of the operation. In one, the prostatectomy had been carried out by myself three years previously. The patient died suddenly a fortnight after removal of the stone, from pulmonary embolism, the cause of death being confirmed at necropsy. In the other, the prostatectomy had been carried out elsewhere, and the patient subsequently developed multiple calculi, some of which were incarcerated in the posterior urethra. The cause of death, which occurred twenty-four hours after operation, was shock and haemorrhage. These two fatalities occurring in this series of nineteen cases emphasize that the operative risk of suprapubic lithotomy is a very real one, although the operation itself is quite simple. I feel, therefore, that if the stone can be removed by crushing it is not fair to subject the patient to the risk of the open operation.

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