JAMES F. BRAILSFORD: THE X RAY DIAGNOSIS OF PATHOLOGICAL CONDITIONS OF THE GALL-BLADDER.

FIG. 1.—Radiograph showing a collection of faceted stones in the gall-bladder with a large branching stone in the pelvis of the right kidney.

FIG. 2.—Radiograph of same patient as Fig. 1, showing that all but one gall-stone has been passed.

FIG. 3.—Radiograph showing a collection of rounded stones in the gall-bladder and a deformity of the descending colon due to carcinoma.

FIG. 4.—Radiograph showing a collection of gall-stones in the gall-bladder and isolated stones in the cystic duct.

FIG. 5.—Radiograph showing a normal gall-bladder and a deformity of the duodenal cap due to an ulcer.

J. F. DOBSON: LATE RESULTS OF OPERATION FOR RENAL CALCULUS.

FIG. 1.—Shadow of calcareous gland simulating calculus.

FIG. 2.—The same with pyelogram.

FIG. 3.—Left renal calculus; right ureteric calculus.

FIG. 4.—The same case, the right calculus now in the kidney.

FIG. 5.—Pyelogram of the right side, showing hydronephrosis.

Cholecystography had a setback in its early days owing to a proportion of the patients showing a reaction to the injected dye. This was chiefly due to the use of sodium tetrabromophenolphthalein, many preparations of which were impure and very toxic, while a solution of some preparations gave no denser shadow than water. Since Whitacre and Milliken showed that sodium tetraiodophenolphthalein could be used in smaller quantities, that it cast a better shadow, and the chemists have manufactured purer preparations of the dye, few toxic effects have been seen. They have not been entirely eradicated. Using this dye I have only seen five severe reactions—two in private practice and three in hospital. For nearly two years I saw no reaction, but recently a patient within fifteen minutes of the injection showed all the signs of severe shock.

This patient, a woman of about 30 years of age, gave a history of eight former operations, after several of which thrombosis had occurred in her legs. She now complained of pain in the gall-bladder area; she had been seen by several surgeons, who had diagnosed gall-stones, and advised that the gall-bladder should be removed. Owing to her previous experiences she did not wish to have an operation until more definite proof of the lesion had been obtained. She was acquainted with the details of a cholecystographic examination, but had been advised not to have it done. She, however, insisted on the test being done. The dye was injected at 11 p.m., and after fifteen minutes the patient developed all the signs of severe shock, which gradually passed off during the next hour. The next morning radiographs

were taken; they showed a gall-bladder shadow normal in size, shape, and density, and after taking food it gradually diminished in size. The patient said that she felt no effects whatever of the shock, and that the experience was not to be compared with the feeling after an anaesthetic.

It may be urged that it is preferable to do a laparotomy than risk a chance of a reaction, but the x-ray investigation in many cases proved that the laparotomy would have been useless. Further, the x-ray examination enables us to give a fairly accurate opinion of the function of the gall-bladder, and a laparotomy may fail to do this. It is also probable that the patient who reacts to the dye would be a very unfavourable subject for a general anaesthetic and a laparotomy, and so far it has been my experience that those patients who react have a gall-bladder which fills in a normal manner.

It will be seen, therefore, that while there are many patients with symptoms so severe and urgent that a laparotomy is essential, there are patients with symptoms so indefinite and atypical that no surgeon would care to do a laparotomy. In this latter type of case an x-ray investigation of the gall-bladder will often prove of much value.

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THE LATE RESULTS OF OPERATION FOR RENAL CALCULUS.

BY

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(With Special Plate.)

An attempt has been made during the last two years to trace the late history of all the cases of renal and ureteral calculus upon which I have operated since the war. The cases investigated number about a hundred, and a very large proportion have replied to inquiries. It would perhaps be useful first to give the results and then to discuss certain points of interest which arise.

Pyelo-lithotomy (28 Cases).

Untraced	...	...	...	...	...	1
Perfectly satisfactory	...	...	...	...	...	24
Complaint of backache (x ray negative)	...	...	...	...	...	1
" " haematuria (investigation refused)	...	...	...	...	...	1
Late fistula and nephrectomy (perfectly well since)	...	...	...	...	...	1

One of the satisfactory cases died three years after operation from cancer of the larynx.

Nephro-lithotomy (18 Cases).

Not traced	...	...	...	...	...	2
Perfectly satisfactory	...	...	...	...	...	13
Unsatisfactory	...	...	...	...	...	3

Uretero-lithotomy (14 Cases).

Perfectly satisfactory	...	...	...	...	...	11
Well, but deposit in urine (not investigated)	...	...	...	...	...	1
Backache and shortness of breath (not investigated)	...	...	...	...	...	1
Late fistula and nephrectomy (since perfectly well)	...	...	...	...	...	1

Nephrectomy (29 Cases).

Perfectly satisfactory	...	...	...	...	...	23
Well, but has developed disseminated sclerosis	...	...	...	...	...	1
Well, but suffers from asthma	...	...	...	...	...	1
Physically well, but melancholic	...	...	...	...	...	1
Not able to work (not investigated)	...	...	...	...	...	1
Well, but slight backache (not investigated)	...	...	...	...	...	2

Nephrostomy (7 Cases).

Well and healed (6 years and 3 years)	...	...	...	...	...	2
Well and healed (lived 9 years)	...	...	...	...	...	1
Well, but slight watery discharge (1 year)	...	...	...	...	...	1
Fairly well, but still discharging and has backache (4 years)	...	...	...	...	...	1
Fairly well, but some discharge	...	...	...	...	...	1
Perinephric abscess and death two years later	...	...	...	...	...	1

For Bilateral Renal Calculus (5 Cases).

Perfectly well	...	...	...	...	...	2
Well, but cloudy urine	...	...	...	...	...	1
Well, but operation on second kidney refused	...	...	...	...	...	1
Recurrence and fatal anuria four years later	...	...	...	...	...	1

In one of the cases of pyelo-lithotomy there was a considerable degree of hydronephrosis, yet four years afterwards the patient is perfectly well.

The three unsatisfactory cases after nephro-lithotomy are the following.

Case 1.—In June, 1920, right nephro-lithotomy was performed on a man for a single calculus in the kidney. There was a small stone in the corresponding ureter, which, however, was passed just before the operation. He recovered satisfactorily and remained free from symptoms for a time. Some two years later a recurrence of calculus was found in both kidneys, and the patient died from acute haemorrhagic pancreatitis five years after the original operation.

Case 2.—In 1920 nephro-lithotomy was performed on a woman aged 48; one stone was removed from the right kidney. Six years later she reported that she had had one or two attacks of haematuria since her operation, and x-ray examination revealed a single calculus in the pelvis of the left kidney and two or three calculi in the right kidney. Owing to the unsatisfactory condition of the patient further operative treatment was not thought advisable.

Case 3.—A woman, aged 28, was operated upon in 1925. Three stones were removed from the right kidney, one by an incision into the pelvis and two through an incision through the lower calyx, which contained purulent urine. She was readmitted a year later with a discharging sinus. X-ray examination was negative. The kidney was explored and found to be so densely adherent to the surrounding structures that nephrostomy only was done. The patient's general condition improved very much, and a subscapular nephrectomy has now been successfully performed. In this case primary nephrectomy would have been preferable to a conservative operation.

The following three cases are remarkable.

Case 4.—In a woman who was operated upon in 1921 the left kidney contained multiple calculi; its function was very deficient. The kidney was explored and found to be hydronephrotic. There was a large quantity of putty-like material in the pelvis in addition to several calculi. It was thought desirable to perform nephrectomy, but the patient's husband, a doctor, demurred. The patient made a good recovery; she had some pain and frequency for a time, but this disappeared after a course of vaccine treatment. Five years later she was perfectly well. There is, however, no information as to the functional capacity of the kidney that was operated on.

Case 5.—A man, admitted in 1919, had suffered for some months from attacks of typical renal colic on the left side. The pain commenced in the loin and radiated downwards into the testicle and the thigh. Slight haematuria always accompanied the attacks of colic. X-ray examination showed the renal areas to be free from calculus and demonstrated a shadow in the pelvis on the left side, but not in the normal course of the ureter. An opaque ureteral catheter was passed up the left ureter and was arrested; an x-ray photograph showed the catheter in contact with the shadow, which was therefore thought to be a calculus impacted in an abnormally placed ureter. Unfortunately a pyelogram was not taken. Extra-peritoneal exploration of the ureter was performed, and the left kidney was found just below the pelvic brim with a calculus in the pelvis. Nephro-lithotomy was performed. Seven years later the patient was perfectly well.

Case 6.—A man, aged 33, was admitted in 1924 with the usual symptoms of a calculus in the left kidney. A skiagram showed the shadow of a calculus, and no suspicion was entertained that it was in any way unusual. Cystoscopy showed adequate function of both kidneys. Exposure was difficult, and the organ was found to be a

horseshoe kidney with the ureter in front and running downwards over the isthmus. The stone was in the pelvis and was extracted by an incision on the anterior surface. Two years later the patient was perfectly well and had gained 28 lb.

Case 7.—In one instance a stout woman developed a fistula after uretero-lithotomy; a small stone was impacted in the ureter just above its entrance into the bladder wall. The kidney was not functioning, and a catheter was arrested by this stone. The ureter was exposed and found to be very little dilated. An incision was made at the level of the pelvic brim and efforts were made to extract the calculus, without avail. The bladder was displaced, the uterine artery tied, and the stone extracted through a direct incision; it was tightly gripped by the ureter. The wound healed, but three weeks later a fistula formed. A dilated and infected kidney was removed. The patient is now well.

Recurrence.

The after-history of seven cases was investigated where the clinical symptoms were very suggestive of calculus, but in which x-ray examination was negative. Six of these cases have had no further trouble, one has had one attack of colic since.

In the series of cases investigated a certain number are known definitely to have had recurrence of calculus.

	Recurrences.
After pyelo-lithotomy	0
„ nephro-lithotomy	2
„ uretero-lithotomy	0
„ nephrectomy	0
For bilateral calculus	1
After nephrostomy	0
	—
	3

Other cases presented symptoms which might possibly be due to recurrence of calculus.

	Possible Recurrences.
After pyelo-lithotomy	2
„ nephro-lithotomy	0
„ uretero-lithotomy	2
„ nephrectomy	3
For bilateral calculus	1
After nephrostomy	3
	—
	11

Two of these cases have been x-rayed with negative results.

We have here definite and certain evidence that recurrence occurred in 3 cases, and we have in other 11 cases symptoms developing later on which might possibly be due to recurrence. Unfortunately it has not been possible to investigate all these cases, but I have recently seen a woman of 56, upon whom I operated fourteen years ago for bilateral renal calculus; she has been well until recently, but now has recurrence in both kidneys. Further, in some of the cases operations had been performed previously for calculus. In two of the nephrectomy cases stones had been removed from the kidney by other surgeons many years previously. In one of the cases of nephro-lithotomy a stone had been removed ten years previously by another surgeon. One case of renal calculus occurred in a patient for whom suprapubic lithotomy was done ten years previously.

According to Braasch and Foulds evidence of recurrence of calculus is found in 10 per cent. of cases after operation, the incidence of recurrence being higher after nephro-lithotomy than after pyelo-lithotomy. Undoubtedly some "recurrences" are due to small stones remaining undetected at the first operation.

According to Rovsing recurrence is due to infection with urea-decomposing organisms. Urinary fistula following operation even of short duration is the common cause of this infection. He states that pyelo-lithotomy, since it frequently causes a fistula, is contraindicated, and nephro-lithotomy without drainage should be performed instead. It is evident that recurrence of calculus is a very serious danger, and stones left behind at operation are no doubt in part responsible. This risk will be largely eliminated by radiography of the kidney during operation.

Rovsing's views on the risk of a staphylococcal infection from a temporary urinary fistula are no doubt correct, though I imagine few surgeons would agree that even a temporary leak is at all common after pyelo-lithotomy. Rather is it thought that recurrence is more likely after nephro-lithotomy than after pyelo-lithotomy. The latter operation is usually done for single, comparatively small stones, with a kidney little damaged and not seriously

infected. The former operation is performed in cases of multiple or large calculi, with some or even a considerable hydronephrosis, or with an infection of more or less severity. The risk of recurrence being less after pyelo-lithotomy than after nephro-lithotomy indicates clearly the advantage of removing a calculus before it has had time to produce those changes in the kidney which favour recurrence.

In addition to the risk of recurrence of calculus in the kidney there are other changes which sometimes occur at a late stage after conservative operations for calculus. In this series of cases nephrectomy for pyonephrosis (with no recurrence of calculus) was performed in two cases—in one four years after removal of a stone from the ureter, and in the other eighteen years after a nephro-lithotomy; in another case nephrostomy was performed for a pyonephrosis one year after nephro-lithotomy.

The figures above quoted show clearly that although the results of operations for renal calculi are on the whole exceedingly good, the risk of recurrence is such that every effort ought to be made when the opportunity is present to adopt such measures as may be possible to avoid this unsatisfactory sequel. In this connexion we must consider first the diagnosis of calculi, and secondly, the methods practised for their removal.

DIAGNOSIS OF RENAL CALCULUS.

The diagnosis of renal calculus rests very largely on the results of the x-ray examination.

Cases with Typical History, Colic, Haematuria, etc.

In the majority of cases the results of x-ray examination are conclusive as to the presence or absence of calculus, though sometimes a negative finding is inaccurate. It has happened to me on one or two occasions to see a calculus in the bladder which had not been recognized by the radiologist; it is reasonable to assume that a similar stone in the kidney might escape detection. It has also happened that when an x-ray examination has been negative patients have subsequently passed a calculus. On a few occasions when the symptoms were very suggestive and the x-ray examination negative I have taken a pyelogram and have repeated the x-ray examination on the following day, hoping that some of the sodium bromide would have been absorbed by a calculus, which would then throw a shadow. I have not as yet had such a case. In such cases resort should be had to pyelography; a lighter area may indicate the presence of a stone, and in any case it will probably demonstrate the cause of the patient's pain—such as a small hydronephrosis or a kinked ureter, etc.

Cases with Atypical Symptoms.

There are a number of patients with renal calculus who suffer very little pain, merely a vague aching in the back, without such obvious changes in the urine as to drive them to seek advice. An x-ray examination of the urinary tract should not be omitted as part of the routine investigation of cases of indefinite backache, particularly if there are any changes in the urine. In some cases the calculi are absolutely latent, and may only be detected accidentally. There are cases of haematuria where pain is negligible. A complete x-ray investigation of the whole urinary tract is an essential step in the examination of a case of haematuria. Similarly I have seen cases of calculous pyonephrosis with large quantities of pus in the urine where the history of pain is of the vaguest.

The Interpretation of the X-ray Photograph.

In this matter the practice of different surgeons varies; some prefer their own interpretation, some attach more importance to the opinion of the radiologist. My own practice is to accept the view of the radiologist, though I see all films myself and form my own opinion, usually before seeing his report. Consultation between the two persons concerned is necessary in any case of doubt. As to pyelograms I prefer my own interpretation. It is necessary to remember that the x-ray examination is only a part, though a most important part, of the complete investigation of a case of suspected renal calculus.

Occasionally mistakes may be made as to the number of stones in the kidney. Sometimes two overlapping stones are regarded as one, or two partially overlapping stones as one large stone. On one occasion the x-ray film indicated the presence of two calculi in the pelvis of the kidney, and at the operation only one calculus was found; only after considerable search was it discovered that the second shadow was due to a deposit in the twelfth rib, which had been removed to facilitate the exposure of the kidney. The shadow was demonstrated by x-raying the portion of rib removed.

There can be no doubt of the value of profile radiography in the diagnosis of renal calculus, and it should be done as a routine.

X-ray Photography during Operations on the Kidney.

This method of ensuring the removal of all fragments of calculi in the kidney I have used only in two cases, but they were both very instructive, and with a better apparatus (the one used was a makeshift) and more experience of the method it will undoubtedly be of great value. We did not attempt to screen the exposed kidney, but took two or three films as soon as the kidney was exposed. In an ordinary light operating theatre it must be a matter of extreme difficulty to accommodate the eyesight sufficiently to obtain a satisfactory view with the screen. The main difficulty was in withdrawing the kidney sufficiently to obtain a film which did not show the edges of the wound. However, as this merely interferes with the shadow of the kidney pelvis, it is not so very important. The calculi which are most likely to be overlooked are small bodies in the calyces and the substance of the kidney. A valuable feature of this method is that it will enable us to say that indefinite shadows in the kidney area, associated with a definite calculus and themselves simulating calculi, are extra-renal.

In the first case x-ray examination previous to operation showed a calculus in the pelvis of the right kidney and a small shadow in the kidney area. The right kidney was exposed and an x-ray photograph was taken; this showed the stone present in the pelvis, with some other small shadows also in the pelvis, but none in the substance of the kidney. The pelvis was incised, and a large stone and two or three small gritty fragments were removed.

In the second case x-ray examination showed a calculus in the right kidney with some small additional shadows in the kidney area. The kidney was exposed and a stone felt in the pelvis, the skiagram of the exposed kidney showing no calculus in the kidney substance. Pyelolithotomy was performed.

There may on occasions be considerable difficulty in distinguishing between the shadow of an enlarged gland and that of a renal or ureteral stone. The following case is an example.

Case 3.—A woman was admitted to hospital in 1925 complaining of renal pain. The urine contained a little albumin and a few pus cells. The x-ray photograph showed a shadow which was thought to be a calculus impacted in the upper part of the ureter (Fig. 1). A pyelogram (Fig. 2) was taken; this showed a little hydronephrosis with some dilatation of the ureter down to the level of the shadow, which was clear of the ureter. Exploration revealed a calcareous gland with adhesions and fibrous thickening obstructing the ureter. The patient was completely relieved of her symptoms by freeing the ureter.

In cases such as this profile radiography with the opaque catheter in position, and perhaps a pyelogram, will be a great help in diagnosis.

DIAGNOSIS OF CHANGES IN KIDNEY AND URETER CAUSED BY THE PRESENCE OF CALCULUS.

It is not sufficient merely to recognize the presence and the number of calculi; the extent to which the function of the kidney has been disturbed and the presence of secondary destructive changes must also be ascertained.

It may be obvious that a pyonephrosis has developed; the presence of a tumour, a large quantity of pus in the urine, the absence of indigo-carmin from the affected kidney on cystoscopy, together with general symptoms, make the diagnosis sufficiently obvious. It then only remains to ascertain the presence of the second kidney, to prove its functional capacity, and, considering all the

clinical features of the case, to determine whether nephrectomy, a nephrostomy, or nephrostomy with secondary nephrectomy is indicated.

Advanced renal changes may, however, be present in the absence of a palpable kidney. In many cases where a calculus in the pelvis or ureter has been in position for some time some degree of hydronephrosis is present. It is important not only to ascertain the extent to which the kidney tissue has atrophied, but also to form some estimation of the degree of infection present.

Confining ourselves for the present to the consideration of cases of unilateral calculus, and to cases where radiography shows a shadow in the kidney area and no suggestion of a calculus in the ureter, we wish to determine by cystoscopic methods the presence or absence of a hydronephrosis, and to ascertain as far as possible the extent of the infection which has occurred.

Hydronephrosis can be recognized by pyelography. Is it desirable to take a pyelogram in every case of renal calculus? In practice it is not possible, but in a tolerant patient it should be done. The advantage of a preliminary pyelography is that it may enable the surgeon to determine before operating whether a nephrectomy is likely to be necessary. The alternative is to decide this point when the kidney is exposed, it having been previously ascertained that the second kidney is efficient.

Determination of the Functional Capacity of the Affected Kidney.

This may be done by relying on the evidence obtained after an injection of indigo-carmin. In some cases this may be sufficient. A more scientifically satisfactory method is to catheterize the ureter, take the phenolsulphonephthalein proof, and collect a specimen of urine from the affected side for chemical and bacteriological examination.

The presence and capacity of the second kidney can be ascertained by cystoscopy after an injection of indigo-carmin. With an adequate excretion of the dye, and in normal time, the presence of the second kidney may be accepted. The more completely satisfactory proceeding is to catheterize the ureter, take the phenolsulphonephthalein proof, have a chemical and bacteriological examination of the urine, and perhaps take a pyelogram.

I would not urge that these investigations should be a routine proceeding. There is no doubt that some patients become very restive under repeated and uncomfortable investigations, and sometimes a necessary operation is declined. The surgeon should not allow his urological curiosity to outweigh the dictates of common sense. On the other hand, the man who would explore a kidney for calculus without previously ascertaining, not merely the presence, but something of the functional capacity of the second kidney, is exposing his patient to very unnecessary risks.

Let us assume that we have determined the presence of a calculus in the pelvis of the kidney, with some degree of hydronephrosis and some impairment of kidney function. We ought to ascertain, if possible, the presence and degree of infection of that kidney. It is very desirable to do this, as with a considerable degree of hydronephrosis and a definite infection recurrence of calculus formation is rather probable, and a primary nephrectomy may be preferable to a conservative operation. It is not easy to determine this; the amount of pus, the profusion of growth of organisms, and the extent of impairment of renal function are to be taken into account. In some cases the desirability or otherwise of nephrectomy can only be determined on the operating table. It must be remembered that a kidney which is functioning badly may recover considerably after the stone is removed.

URETERAL CALCULUS.

Not infrequently radiography shows a doubtful shadow. An opaque catheter passed up the ureter will almost always clear up the difficulty.

The presence of a calculus in the ureter having been recognized it remains to ascertain, if possible, the extent of the changes in the kidney. The ureter may be completely blocked; there may be no secretion on that side, and

the ureteral catheter is arrested by the stone. In such case one can carry investigation no further than to ascertain the facts about the second kidney. It is very desirable, however, to ascertain the presence or absence of dilatation of the ureter above the calculus, and in all cases an attempt should be made to take a uretero-pyelogram.

It is possible that with a calculus in the ureter there may also be an obvious pyonephrosis. This presents no difficulties in diagnosis. The problem is to ascertain in the less advanced case to what extent the kidney tissue has been distended or destroyed, and what are the prospects of recovery of the kidney after the ureteral obstruction is removed, or what are the chances of recurrence of calculus. The surgeon will not here have the advantage of exposing the kidney at the operation, at any rate in cases where the stone is in the pelvic ureter. In the absence of proof it is generally wise to extract the stone and await events. If recurrence takes place or pyuria is persistent a secondary nephrectomy may be done.

CHOICE OF OPERATION.

Whether surgeons are too ready to practise conservative operations and too unwilling to remove a doubtful kidney is arguable. The risk of recurrence being bilateral must always be borne in mind, and if there is a recurrence of calculi the patient is better off with two damaged kidneys containing stones than with a single such kidney. On the other hand, is an infected and somewhat dilated kidney, one likely to be the seat of a recurrence, a factor in inducing calculus formation in the second kidney?

Exposure of the Kidney.

The retroperitoneal route is the usual, and the choice of incision is immaterial. The surgeon need not fear to divide muscles, as hernia is extremely rare, and he should never hesitate to remove the last rib. The kidney should be drawn out and handled as gently as possible.

Pyelo-lithotomy.

A sufficiently large incision should be made in the pelvis, not encroaching on the ureter. The stone should be extracted with the utmost gentleness; large forceps should never be passed into the pelvis and the stone forcibly removed. By the use of small forceps and little levers even a considerable stone can be extracted without bruising the edges of the wound. The wound in the pelvis is sutured whenever possible, and that is practically always, and in addition the thickened fatty tissue is sutured in place as a reinforcement.

I have little experience of extended pyelo-lithotomy, where the incision in the pelvis is carried on into the substance of the kidney. It may involve ligation of a retropelvic artery, which might devitalize a considerable area of kidney tissue.

Nephro-lithotomy.

This is necessary usually in cases of large calculus or of multiple calculi. The incision in the kidney should be as small as possible, having due regard to the fact that the calculus or calculi must be removed intact and not in fragments, and the kidney tissue must not be lacerated. At one stage in his career my late chief, Mr. Harry Littlewood, was in the habit of splitting the kidney from end to end for the proper exposure and extraction of calculi, and he had surprisingly few after-haemorrhages; but the functional capacity of a kidney so treated must have been very seriously diminished.

The discovery and removal of small calculi in one of the calyces may be extremely difficult. In one case, where there was a calculus in the pelvis and another small shadow in the kidney area, after the first stone was removed by pyelotomy the second supposed calculus could not be detected even by incision of the kidney. A stream of fluid from the nozzle of a syringe passed through the kidney incision washed a small calculus into the pelvis, whence it was easily removed. Possibly it would be well in all cases to wash out the pelvis and calyces with a stream of sterile water under pressure to remove any tiny calculi which might be left behind.

During the course of a nephro-lithotomy one is occasionally called upon to decide whether it is really wise to attempt to preserve the kidney.

Nephrectomy.

Simple as it is in many cases, nephrectomy may be impossible with an adherent pyonephrosis. A sufficient exposure of the kidney, deliberation, and the greatest care in recognizing and separating the various important structures which are adherent—the inferior vena cava, the duodenum, the colon—are essential. I prefer to separate the pelvis and ureter from the vessels, to tie veins and arteries separately, and to divide the ureter at a low level as the last step. It is important not to tear the pelvis, and I never use a large clamp on the pedicle if it can possibly be avoided. One cause of a persistent sinus after nephrectomy is the inclusion of a portion of the pelvis in the pedicle, and this is favoured by the use of a clamp. An extracapsular nephrectomy is far preferable to a subcapsular, as in the latter case it is not easy to separate the vessels from the pelvis. In some cases, however, the subcapsular operation is the only possible method.

Nephrectomy is possible in the majority of cases of calculous pyonephrosis. There are, however, definite contraindications. Where pyuria has been present for years, and the patient is anaemic, feeble, and emaciated, a prolonged and difficult operation is attended with considerable risk.

In one case a large adherent pyonephrosis was removed intact with great difficulty; the patient made a very slow recovery, remaining feeble and anaemic for some months, ultimately, however, regaining her health. The tumour was not examined for some time after the operation, and it was then found that the suprarenal capsule, firmly adherent to and indistinguishable on the surface of the kidney, had also been removed.

I have not wounded the inferior vena cava in performing nephrectomy for a calculous pyonephrosis, but have done so twice in doing nephrectomy for other conditions. In both cases the vessel was controlled by forceps left in place, and recovery occurred without incident and without any subsequent ill effects.

Nephrostomy with Secondary Nephrectomy.

This is sometimes satisfactory, though in the majority of cases probably a primary nephrectomy would be preferable. Nephrostomy alone has its dangers, and a secondary nephrectomy, usually a subcapsular operation, may be extremely difficult.

Nephrostomy Alone.

On occasions this is the only proceeding which is permissible, usually because of the general condition of the patient. The kidney is explored and incised with as little disturbance of the perirenal fatty tissue as possible; the calculus or calculi are extracted, any septa which prevent drainage are broken down (it is not advisable to do this with the knife owing to the risk of haemorrhage), and provision is made for drainage and antiseptic instillation. I think the late results of these cases are better than is commonly thought.

The following are illustrations.

Case 9.—A lady, aged 67, had suffered for years from backache and pyuria; a large pyonephrosis had developed, with rapid deterioration of health. She was too ill to be removed even for an x-ray examination. The kidney was exposed, a large calculus measuring 3 in. by 4 in. was extracted, and the kidney drained. The wound healed completely in a very short time, and the patient lived for nine years in reasonable health and comfort.

Case 10.—Another case in which even less was done. A lady of 76, who suffered from rheumatism and had just undergone two operations for glaucoma, developed a large pyonephrosis. Under a local anaesthetic the kidney was incised and drained, no attempt being made to find a stone. She is now, a year later, in reasonably good health, with a slight pyo-urinary discharge which gives little trouble.

Case 11.—A woman, aged 53, was admitted with a pyonephrosis, which was drained. No calculus was detected at the time, but subsequent x-ray examination showed a small calculus in the lower part of the pelvis of the kidney. Nephrectomy was declined. The wound closed, but re-discharged two months later. She had no further trouble for eighteen months, when it discharged again for a period of sixteen months. Since then it has not

discharged, and so far as her kidney is concerned the patient is quite well (six years afterwards). She is, however, troubled with gall-stones.

Case 12.—A woman, aged 60, suffered from a calculous pyonephrosis with multiple calculi. Nephrostomy was performed and the calculi removed, practically no kidney tissue remaining. The wound healed very quickly, and the patient is now, three years later, in good health.

Case 13.—A woman, aged 34, had many calculi in a large pyonephrotic kidney. She was too ill for nephrectomy. The calculi were removed and nephrostomy done. A year later the patient was in good health and doing all her own housework. There was a slight watery discharge from the wound.

Case 14.—A woman, aged 58, with pyonephrosis and a large branching calculus, underwent nephrostomy with removal of the calculus. Four years later she was in moderate health and able to do some housework, but the wound was discharging.

Case 15.—A woman, aged 63, with large calculous pyonephrosis. The calculi were removed and nephrostomy performed. Nephrectomy was advised and refused. The patient improved and the wound healed. She was admitted two years later with a perinephric abscess which proved fatal.

It is evident that some patients may recover perfectly after a simple nephrostomy or may be left with a sinus which causes little trouble; but in all reasonably promising cases a secondary nephrectomy should be done.

Extraction of Calculi in the Ureter by Cystoscopic Procedures.

These methods have been practised extensively in America of late years, and varying reports are given. According to Peacock, ureteral dilatation was successful in inducing the passage of the calculus in 50 per cent. of cases so treated. Various procedures have been recommended—for example, passage of a ureteral catheter alone; dilatation of ureter by passing catheters of varying size or by dilating forceps; dilatation and injection of olive oil and other substances; enlargement of ureteral orifice (1) by diathermy, (2) by operating cystoscopic scissors, subsequent passage of catheter, and injection of oil.

My personal experience of these methods is comparatively limited. In one case in a woman a stone presenting at the orifice of the ureter was persuaded into the bladder by passing a Luys's cystoscope and by incising the lower end of the ureter on to the stone. In another the ureteral catheter withdrew the calculus. In another case the ureteral orifice was enlarged with the diathermy terminal and oil injected; this was followed by the passage of the calculus. In still another case mere dilatation and injection of oil sufficed.

There can be no doubt that these cystoscopic methods are of great value. Probably some of the stones which pass after such instrumentation would have passed in any case; but some would remain impacted, would increase in size, and induce destructive changes in the corresponding kidney.

I have no experience of division of the lower end of the ureter with the cystoscopic scissors. The objection to this would appear to be that haemorrhage would occur and obscure the field. Enlargement of the orifice by the diathermy terminal has not this disadvantage, but is not without its dangers. Marion¹ reports a case in which stenosis of the orifice occurred, the calculus was not passed, and the kidney, becoming pyonephrotic, had to be removed.

Recently I have had a case in which a small triangular calculus was impacted at the lower end of the left ureter, the pointed tip being visible through the cystoscope. Enlargement of the orifice by the diathermy terminal, dilatation, and injection of oil were unsuccessful, and transvesical uretero-lithotomy had to be performed.

On the whole, probably dilatation of the orifice with injection of oil will be as efficacious as any other procedure. In the case of small calculi this ought to be done before uretero-lithotomy is considered.

Uretero-lithotomy.

Various methods of approaching the pelvic portion of the ureter are practised. I prefer the extraperitoneal, outer border of the rectus incision (Battle). I have not usually found it necessary to tie the deep epigastric vessels. When the ureter is dilated it may be incised at any convenient point and a pair of forceps passed down; the stone is usually extracted without difficulty. But in cases where the ureter is not appreciably dilated removal is not so easy.

In some cases an attempt to extract a stone by forceps passed down the ureter from an incision at the level of the pelvic brim has failed, the ureter has had to be exposed at a lower level, perhaps after tying the uterine artery, and the stone extracted by a direct incision at the seat of impaction. In most instances this has been quite satisfactory, but in one case a fistula formed and a secondary nephrectomy became necessary.

By these methods it is almost always possible to extract a calculus from the ureter; but there are cases, where the stone is impacted close to the wall of the bladder, which are exceedingly difficult, and in some a combined ureterotomy and cystotomy has been done. In one such case after the bladder was opened a No. 1 urethral bougie was passed down through the preliminary incision in the ureter past the stone into the bladder. The tip was then seized and pulled downwards, the conical upper end of the bougie drawing down the stone to the orifice, when it was easily extracted by an incision in the bladder wall.

Operation for Bilateral Renal Calculus.

A number of cases of bilateral renal calculus have been seen and some have been operated upon. The most satisfactory cases are those in which there is a single calculus in the pelvis of each kidney, with little dilatation of the kidney and only a mild degree of infection. When the calculi are multiple it is always a question whether an operation is worth while. I have at the present moment four such cases under observation; two (both recurrences after previous operation, one of my own, one of another surgeon) could not possibly survive any further interference, and in the other two the symptoms are very slight and I am disinclined to interfere. The operations should be done at two sittings, and it is a question which kidney should be attacked first. I prefer to do the better kidney first.

The two following cases are of interest, the first possessing a wandering calculus and the second being an example of recurrence.

Case 16: Wandering Calculus.—A woman, aged 33, was admitted with a history of right renal colic; no pain in left side. The first x-ray photograph taken (Fig. 3) showed a calculus in the pelvis of the left kidney and a shadow on the right side in the course of the ureter, the significance of which, however, was not realized at the time. The second radiograph (Fig. 4), however, showed a calculus in the pelvis of the right kidney in addition to the one on the left side. Further x-ray examination showed that the calculus was sometimes in the ureter and sometimes in the kidney. A pyelogram (Fig. 5) taken of the right side showed a considerable degree of dilatation both of the ureter and of the pelvis. Left pyelo-lithotomy was performed, and three weeks later the right kidney was exposed: the kidney was enlarged, the pelvis and ureter dilated. The calculus, found in the ureter, was pushed up into the pelvis and removed. A year later the patient was very well, but had slight pain and occasionally the urine was rather cloudy, with a sediment.

Case 17: Recurrence.—A woman of 50 with several calculi in both kidneys. Left nephro-lithotomy was performed, four stones being removed from the lower pole of the left kidney. Three months later right nephrectomy was done for a pyonephrosis containing five calculi. A year later the patient was readmitted with calculous anuria, and a small stone was removed from the ureter. The patient recovered, but died a year later at home from anuria. In this case perhaps palliative treatment would have been preferable.

The Treatment of Renal or Ureteral Calculus Complicated by Other Lesions of the Urinary Tract Demanding Operation.

Marion² is of the opinion that in such cases the renal calculus should be removed first, in view of the risk of an infection developing in the damaged kidney during convalescence from the operation on the other lesion. In cases of renal calculus complicated by the presence of a stone in the bladder I have removed the vesical calculus first and the renal stone at a later date.

There have been a few examples of the association of renal calculus and ureteral calculus on the same side. It is sometimes difficult to decide exactly what to do. In cases where the kidney is badly infected and dilated a nephrectomy is indicated. According to Marion it is not necessary in such cases to remove the ureteral stone, as this will remain latent. I have had one such case in which the ureteral stone was passed some time after the nephrectomy. In another case the patient passed the

ureteral calculus a few hours before the time fixed for his operation. In another case the renal stone was removed from the pelvis and olive oil injected down the ureter by a glass syringe, the nozzle of which was passed through the pyelotomy incision and fitted snugly into the upper part of the ureter. The ureter became distended and this subsided suddenly. The cystoscope was passed at the end of the operation and a small calculus was seen in the bladder lying in a pool of oil. This was passed a few days later.

I have endeavoured to give, as accurately as possible, the late results of these operations for renal calculus. It is very difficult indeed to obtain absolute accuracy of statement on such a subject unless one has the advantage of a large staff to carry out the necessary inquiries and to make the necessary investigations. There is, however, sufficient evidence to show that the frequency of recurrence after operations for renal calculus is such that it demands very serious investigation.

REFERENCES.

¹ Levy: *Journal d'Urologie*, xviii, No. 1, p. 1. ² Marion: *Ibid.*, xxi, No. 1, p. 61.

PERNICIOUS ANAEMIA AND THE LIVER DIET.

BY

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THE following is an account of the history of three patients treated by the liver diet introduced by Minot and Murphy¹ in 1926. Recent accounts from all sides are showing the good results obtained in promoting remissions in cases suffering from severe relapses. These three patients have been under treatment for a year or more. The cases are recorded in order to show what may happen afterwards.

CASE I.

A man, aged 45, had an attack of gastro-enteritis in November, 1925, which lasted several weeks. Six months later his tongue became sore, and during the summer his throat and tongue were very sore from time to time. Early in the autumn the nausea and vomiting returned, and when admitted to hospital in October, 1926, he presented the typical picture of pernicious anaemia. His mother had had anaemia for a long time, and eventually died from it; her sister was definitely known to have died of pernicious anaemia.

Investigation showed a characteristic blood count. The blood bilirubin was high. There was complete achlorhydria. A haemolytic streptococcus was isolated from the duodenal contents, but it could not be found in the faeces. From the first he was given arsenic, and hydrochloric acid in large doses, as recommended by Hurst.

After a month in hospital he was given liver; owing to his gastric symptoms he had great difficulty in taking it, and the ingenuity of the nursing staff was fully exercised in making it palatable. In one form or another he managed to take about 3 ounces a day. An autogenous vaccine from the haemolytic streptococcus was also administered.

The improvement in the blood picture began at once, before the liver was given; this continued afterwards, especially as regards the haemoglobin. Shortly after this improvement began the haemolytic process abated and the blood bilirubin content fell, but did not reach normal limits. After leaving hospital he kept fairly well, and for a time was on his diet, and took arsenic and hydrochloric acid. After March he was able to return to work until August, when a relapse began, and the soreness of the tongue and vomiting returned. As soon as the nausea was less liver was again given, together with acid and arsenic. There was soon considerable improvement, again notably in the haemoglobin. The blood bilirubin, estimated by the van den Bergh test, fell to a low level, but the red cells improved less satisfactorily. He then left hospital by his own wish, and at home continued to take a proprietary preparation of liver similar to that which he had had in hospital.

An unfortunate relapse has again occurred, and the outlook seems far from favourable. The red cells and haemoglobin have fallen, and the blood bilirubin has again become high.

CASE II.

A woman, aged 54, had had bouts of diarrhoea for three years, and some anaemia was noticed a year before admission. For the last four months she had had a good deal of vomiting, and had been laid up in bed. On admission to hospital she was very ill. Petechial haemorrhages were present everywhere; the heart was large and feeble, and the spleen was increased in size. There was complete achlorhydria. The teeth were septic. Five blood transfusions were given during the first six weeks, and arsenic and hydrochloric acid were also prescribed. After a little time a steady improvement set in. Before leaving hospital she began the liver diet, and since then she has taken it regularly at least

three times a week. The red cells have never returned to a higher level than $3\frac{1}{2}$ million, but the haemoglobin has kept up to about 80 per cent. There has been a normal level of bilirubin in the blood for nearly a year. Before she went out the heart returned to normal size, and the spleen could no longer be felt. She has now felt very well for fifteen months, and has been able to do her housework.

CASE III.

A woman, aged 33, became ill three years prior to admission, the symptoms being mainly dyspeptic. After a year she began to have attacks of diarrhoea, and vomiting became frequent; at times her tongue was sore. A year later her appendix was removed, but without benefit. The anaemia gradually started about this time; for four months she had noticed jaundice. Lately her ankles had become swollen, and she had suffered much from shortness of breath. Her mother had died of pernicious anaemia.

On admission to hospital she was seriously ill; the tongue was sore, and she was markedly yellow. The heart was very feeble and much enlarged, a gallop rhythm being audible over the mitral area. The electro-cardiogram showed heart-block, with a P-R interval of 0.32 second. There was a good deal of numbness and tingling of the hands and feet. Complete achlorhydria was present, and from the duodenum a haemolytic streptococcus was grown; this was not present in the faeces. A vaccine prepared from this organism was given.

At first a blood transfusion was given and she was put on arsenic and hydrochloric acid. Improvement in the anaemia began at once, and was most noticeable in the haemoglobin. At the same time there was a fall in the blood bilirubin, so that, on leaving hospital, it was well below the normal. Liver was not given at first as she could not take it; later, when her stomach was less troublesome, she started the diet, and has kept rigidly to it ever since—a period of ten months. She takes at least 4 ounces of liver three times a week, but lately has been using an equivalent amount of a proprietary preparation. As soon as the anaemia improved her heart returned to normal, and the heart-block disappeared. She left hospital last March, and has since kept very well. The red cells keep about $3\frac{1}{2}$ million per c.mm., but the haemoglobin is maintained at a high level. Haemolysis has not risen above the normal limit.

During the last ten months she has had hydrochloric acid with her meals, and courses of arsenic from time to time. There has been no increase in the sensory symptoms.

COMMENTS.

The Administration of Liver.

Various methods must be tried if the patient cannot take the liver easily. A paste in a sandwich of dry bread is often satisfactory. Sometimes the taste can be covered by the use of one of the strongly flavoured sauces; it goes fairly well with marmite. Small lightly boiled lumps are taken fairly easily, or it may be eaten with lemon juice or lettuce.

The After-Treatment.

These three cases are not of much value in illustrating the effects of the liver diet in the acute stages. It is unfortunate that there is such difficulty in getting patients to take liver when the gastric symptoms are severe.

As to the value of liver in the after-treatment, when once a remission has been secured, Cases II and III bear out the claims of Minot and Murphy,² who have had patients on liver for much longer periods than eighteen months without relapse. The first patient seems to have relapsed because for some months he neglected to take any precautions. The rather poor success subsequently seems to show that in the later relapses the treatment may be less effective. The after-treatment is unquestionably extremely important: "once pernicious anaemia, always pernicious anaemia," potentially at any rate. If, as Hurst has so often suggested, the achlorhydria is the weak point in the patient's defences, it is most important for the patient to continue taking acid. It is true that difficulties with this arise in the acute stages, when the gastric symptoms are severe and the mouth and pharynx sore; but apart from these it is usually well borne. Dilute phosphoric acid may be less effective, but is often much easier to take. It is, perhaps, too much to suppose that the artificial acid barrier can entirely replace the natural in warding off further intestinal infection. Hence it is further of the greatest importance to keep watch against sepsis arising again in the mouth and nasopharynx. The continuance of the liver diet, whatever its mode of action may be, should help in preventing any tendency to relapse.

Prevention.

The history of the prodromal stages in these cases has been given at some length. It is worth while to emphasize this pre-anaemic phase, during which the patient may