

Section of Urology

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Reflections on Nephrectomy [*Abridged*]

PRESIDENT'S ADDRESS

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WITHOUT a detailed analysis of cases, I shall submit such sporadic thoughts and impressions as have resulted from a consideration of the subject of nephrectomy, including the relatively small number of nephrectomies that have fallen to my lot up to May 1950—namely 213.

So-called painful kidneys.—Those without obvious cause for the pain. The diagnosis of such nephralgia, supposed to be clinched by the doubtful test of reproduction of the usual pain on ascending pyelography, has seemed to me equally doubtful.

I have never purposely performed renal denervation, decapsulation, or sympathectomy for supposedly renal pain with normal pyelograms—in other words, for what, even if the pain is really renal and possibly spasmodic, seems a psychological or nervous condition, perhaps better treated non-operatively, especially since, as in peeling sympathetic fibres from the renal vein, one might inadvertently open it and have to remove a functionally normal kidney. We do not, I think, perform carotid sympathectomy for headache of undiscovered cause, but prefer to use drugs. I do not see why it should be otherwise with the kidney. I do not like to perform operations in order to achieve only psychological benefit. I prefer to send such patients to a physician or psychiatrist.

If surgeons are going to remove various parts merely because these are occasionally painful, they are going to be busy, and there will soon not be much left of their patients.

It seems relevant to mention here the case of a young woman whom I once saw, and whom X-ray films had shown to possess a double pelvis and ureter on each side, but no other urinary tract abnormality—that is to say, no dilatation, infection, stone, or growth; yet nephrectomy had already been done about two years before for apparent renal pain—and it is a fact that such complex kidneys may occasionally be painful, and may even bleed.

This woman was complaining, when I saw her, of recent similar pain on the other side, and it seems to me that nephrectomy was as unsuitable a form of treatment for the first side as it obviously was for the second.

In cases of hydronephrosis, if a plastic operation fails, the second operation is probably a nephrectomy. I have never had to do a secondary nephrectomy for a failed plastic operation of my own for hydronephrosis, although perhaps others may have had to nephrectomize my failures; but I recall doing one secondary nephrectomy after a plastic operation done by another surgeon, and called for because of increasing pain and dilatation. I also well remember assisting a distinguished urologist at a difficult secondary nephrectomy about three weeks after he had done a plastic operation for hydronephrosis. There was pus around and in the kidney, and the patient narrowly survived.

On the other hand, if a plastic operation for hydronephrosis fails, the second operation is not necessarily a nephrectomy. On two occasions I have done a second plastic operation after the symptomatic failure of the first done by other hands, and neither patient has so far come to nephrectomy.

With regard to the textbook risk of renal necrosis after ligation of vessels compressing the upper end of the ureter, which might call for secondary nephrectomy, I have often ligatured radial-sized vessels crossing the pelvi-ureteric junction, but have never had to remove the kidney after this procedure. I suppose that localized aseptic atrophy is the usual sequel.

Nephrolithotomy, with its risk of post-operative hæmorrhage, is listed by Swift Joly as the most serious operation for renal stone, pyelolithotomy being the most benign, with nephrectomy intermediate.

When renal or ureteric stones are single, small, and passable, it may be, as Bacon says in his essay "Of Studies", that "bowling is good for the stone and reins"; although I prefer to advise skipping. But, when renal stones are big and multiple, the affected kidney largely destroyed, and the opposite kidney efficient, I think that Bacon would nowadays agree that for such stones bowling is not good, and nephrectomy is better.

I can recall only one secondary nephrectomy needed to stop bleeding after a nephrolithotomy of my own, the second operation being done six days after the first. The patient had suddenly bled through the loin wound, losing about $1\frac{1}{2}$ pints of blood, and becoming shocked and clammy, with a pulse-rate of 150. In one other nephrolithotomy I did immediate nephrectomy, being unable otherwise to control the bleeding, although I suppose that in both these cases, had the kidney been a solitary one, I would have been forced to persevere with less certain means of arresting the bleeding. Both these patients made a good recovery.

Recurrent renal stones after nephrolithotomy may be held usually to call for nephrectomy, the opposite kidney permitting. Still more so might nephrectomy seem to be called for after two previous lithotomies on the same kidney.

However, I recently performed a third right nephrolithotomy on a man of 26, excising the scars of two previous nephrolithotomies by other surgeons, and removing eighteen small stones from the hydronephrosis. My reasons for abstaining from nephrectomy were the patient's youth and the presence of a stone in the neck of the opposite upper renal calyx. Fortunately these reasons were sufficient, as I discovered a third reason only at subsequent left nephrolithotomy, when I found that his left kidney, though not enlarged, was polycystic, the surface being studded with innumerable cysts varying in size from a hemp-seed or smaller to a marble. After operation his blood urea rose to 124 mg. % by the third day, falling to 46 by the ninth day, and, three and a half months later, to 23. He is now well and stoneless, but his future is not too bright.

Polycystic kidney.—Nephrectomy is, of course, but rarely indicated here. Although no nephrectomy for this condition is included in my series, my late chief, L. B. Rawling, removed a typical polycystic kidney from a woman of 25, who had suffered from attacks of left lumbar pain with vomiting, and whose left kidney formed a nodular hard swelling, extending down below the navel. The opposite kidney, felt through a separate incision, was normal in size and outline. Seven years later she had a baby, and later still she wrote to say that her son, aged 3 years, was well, and that she herself had enjoyed perfect health since her operation over ten and a half years previously.

Temple Mursell also records a case of nephrectomy for polycystic kidney. The patient, a coal-miner, had had several attacks of profuse hæmaturia, and had had to abandon work because of lumbar pain. With a post-pyelographic diagnosis of renal neoplasm, Mursell exposed and removed a large polycystic kidney. Over three and a half years later the patient wrote that he was quite well, and working more than ten hours a day. Nearly ten and a half years after nephrectomy he was still well and engaged in active work. Mursell commented: "Perhaps the fact that for ten years the man has never been ill or missed a shift in his mine work is as satisfactory evidence of good renal function as any test to which he could be subjected." Mursell also says: "Had the operation been abandoned when polycystic kidney revealed itself, there can be no question that the patient would have had no prospect but chronic invalidism, and would never again have been fit for work." (See Mursell, T., 1929, *Brit. J. Urol.*, 1, 64; 1935, *Brit. J. Urol.*, 7, 40.)

Such cases as these show that, given an efficient opposite kidney, with sufficiently urgent symptoms from apparently unilateral polycystic renal disease, there is a definite, if small, place for nephrectomy in its treatment.

Of the various pre-nephrectomy tests of opposite renal efficiency, the intravenous injection of 0.4% indigocarmine, when followed by dark blue effluxes from the ureteric orifice on the side of the kidney to be left behind, has never disappointed me. A good, but less simple, alternative, is a figure of about 2% for the urea content of the urine from that kidney, collected about one and three-quarter hours after the ingestion of 15 grammes of urea by a patient thirsting for six to eight hours. I have also come to rely on good urographic excretion and outlines. But, if in doubt, I prefer the blue test, as being more personal between patient and surgeon.

In spite of the proved efficiency of the remaining kidney, I can recall two or three cases of temporary oliguria after nephrectomy. In one case, that of a doctor's wife, beer and black coffee on the third day apparently worked wonders. In the other case, or it may be two cases, there were, in addition to oliguria, transient renal pain and hæmaturia, the symptoms being thought to be due to temporary renal congestion.

The approach to the kidney.—I have been well served by either the oblique or curved lateral loin muscle-cutting incision, or else a paramedian transperitoneal incision, with a posterior peritoneal cut lateral to the colon.

With the former incision I resected the last rib in one of my first nephrectomies, but have not since needed rib-resection, since manual separation of the wound edges, as Thomson-Walker used to do, with possible dislocation upwards of the last rib, has been enough to gain the needful room.

With the transperitoneal incision, more room can be obtained by extending the incision down towards the pubes; and, on the rare occasions when still more room is needed, by a lateral cut, including the rectus muscle, from the paramedian incision at about the level of the costal margin.

Apart from the rare need for such a lateral extension, converting the incision into a T-shape, one of the advantages of this incision is that no muscle fibres are cut, and another is that the kidney and ureter down to the bladder can be removed at one sitting and through one incision. I know of no other incision which combines these advantages. I have used it, for instance, in a case of renal trauma when it was desirable to inspect other abdominal organs; in cases of large renal neoplasm or hydronephrosis—for example, one hydronephrosis delivered whole, and weighing 8 lb. 4 oz. (3.75 kg.); in a case of papilloma at about the middle of the right ureter, which, obsessed by the patient's obesity and high blood pressure, I had not removed at the time of lumbar nephrectomy for papillomata; and also in two cases of hydronephrosis and megalo-ureter containing stones at the lower end—in the first case, two large stones palpable respectively *per rectum* and *per abdomen*; and in the other, a paravesical packet of eight cherry-sized stones.

The first of these last two specimens was shown to this Section (Nephro-ureterectomy for Large Ureteric Calculi, *Proc. R. Soc. Med.* (1943) 36, 204), when the criticism was voiced that the incision employed involved a risk to the peritoneum in such septic cases. I believe, however, that, with care, such a risk is more theoretical than practical, especially when one considers what sepsis the peritoneum can successfully deal with in cases of appendicitis; and especially nowadays when many of us operate in the antiseptic shade of chemotherapeutic umbrellas. In the case of tubercle, however, I should think it wiser to operate extraperitoneally. In the course of lumbar nephrectomy for tubercle I have, while watching operations, twice seen the kidney ruptured in good hands. In these cases of spilling of tuberculous pus the wound broke down and took months to heal.

Although this accident has so far not happened to me, I must confess to a similar accident resulting from an attempt to prevent the very thing that happened. I had divided the renal pedicle in an advanced case of left renal tuberculosis with pyo-ureter, which I had followed down to the pelvic brim, and had here applied two clamps to the ureter. In case the upper clamp should come off, I foolishly (and for the only time in my life) applied a third clamp between the other two, thus rupturing the ureter and spilling pus. I saw this patient some years later. His abdominal wall was distorted with scars and sinuses for which I was responsible.

I have never employed the posterior incision for nephrectomy, since, although it has the advantage of not cutting muscle fibres, it seems to me to suffer from the serious disadvantage of a less adequate exposure than the other incisions mentioned.

I have not tried other and doubtless excellent approaches to the kidney of which one hears much nowadays, and which involve the removal of one or more ribs, and possibly the transpleural route.

In *lumbar nephrectomy*, where the cutting of muscles involves the oozing of blood, I have always left a tube in the wound, except once in a tuberculous case, after a friend had told me that a drainage tube predisposed to sinus formation in tuberculous cases. However, a rise of temperature to 103° F. a few days later led then to the insertion of a tube for a suppurating hæmatoma.

In *transperitoneal nephrectomy*, on the other hand, where no muscle fibres are cut, I have often dispensed with a drainage tube, and never had cause to regret its omission.

Sometimes the kidney may be difficult to find, as I well remember in a case of painful hypoplastic left kidney set in a large mass of perinephric fat in a man of 28.

Intravenous pyelography had shown no left-sided secretion, no urine came from a left ureteric catheter, and this was repeatedly arrested at 11 cm., radio-opaque fluid running down to the bladder, but none upwards.

These facts and the absence of the left half of the sacrum suggested a congenital condition, which was the case, the left kidney being represented by a small flat plaque of cystic kidney-coloured tissue ending below in a solid fibrous cord of about the size of a skin nerve and about four inches (10 cm.) long, which, below, was continuous with the ureter which I had catheterized, and of which I removed the upper half inch (1.25 cm.).

Operative time.—Provided that accuracy is not sacrificed to speed, I have always thought it in the patient's best interests to operate as quickly as possible.

The less anæsthetic and surgical trauma, the less the blood loss, and the sooner the patient is back in bed, the better, and the lower the mortality.

With anæsthesia at their disposal surgeons have lost the incentive, and even the ability, to be speedy, which they had in pre-anæsthetic days. Though pain is abolished, shock remains; and, if one does not normally practise speed when, as with a fit patient, it is not essential, it will not be possible to do so when, as with a very ill patient, speed is vital.

In a recent paper on "Synchronous Combined Total Gastrectomy", the authors thought that the operative time might bear some relation to the mortality (Hume, J. B., and Blackburn, G. (1947) *Brit. med. J.* (ii), 817).

In this series of 213 cases, the time of operation (by which I really mean from first incision to last stitch) was noted in 209 cases. The period varied from twenty-three minutes for multiple stones in a woman of 71, to two hours and twenty-five minutes for a huge hypernephroma in a youth of 18; the average time for the 209 cases was one hour and one minute. I am unable to compete with those who say that they whip out kidneys in ten minutes. I always like to sew up, and that alone takes me about ten minutes.

Operative mortality.—In the present series up to May 1950, the mortality for the last 85 cases was nil. The previous case, however, which I have thought fit to include among the deaths, was a secondary nephrectomy on May 5, 1943, for calculous pyonephrosis in a man of 57. He died on June 7, 1943, the day after cystostomy for old perineal fistulæ and abscesses. This was performed thirty-three days after the nephrectomy.

Going backwards I can add 15 more survivals to the 85 before arriving at another death, that of a postman of 53 years. The memory of this fatal case has been a warning to me. He presented himself with hæmaturia, which was sometimes initial, suggesting that the blood came from the prostate, which was enlarged and seen to ooze. However, I also performed pyelography, both descending and ascending. I considered the ascending pyelograms to be within normal limits—the only time I can recall missing the diagnosis of renal neoplasm from a misreading of the pyelogram. I usually prefer to make my own interpretation of such films, having removed many renal neoplasms where the expert radiological diagnosis was, for example, "normal", "obscured by gas", "calyceal spasm", "polycystic kidney", &c.

However, to return to our postman. Six months later I recognized him in another hospital. He had had no more hæmaturia, but had a lump in the right loin, seemingly too anterior to be renal. However, it was—a hypernephroma; and, assisted by the other surgeon, I took it out transperitoneally. On the whole, I had not thought it renal, and cannot have enquired about chest X-ray films; and the other surgeon, who did think it renal, had omitted this examination; so that, between us, the chest had not been X-rayed. This was another unusual feature of this unfortunate case, for this is the only case of renal neoplasm on which I can recall operating without the routine chest X-ray film. Ten days later he died, and post-mortem examination revealed multiple lung secondaries. It is rare, at the time of proposed nephrectomy for neoplasm, to find radiological evidence of pulmonary secondaries; so that it is indeed a strange and sad coincidence that the only such patient in whose case an X-ray picture of the chest was omitted should have been the very one to have lung secondaries. Among the many lessons of this case is that of a double cause of hæmaturia in the same patient.

Including these 2 cases, I find that there were 13 deaths in the total of 213 cases, representing a mortality of 6.1%; but in the last 100 cases there was only one death, and that, as already stated, over four weeks after nephrectomy and after a subsequent operation on the bladder.

In these days, when there seems to be a certain diffidence in confessing to any operative mortality at all, it is instructive to recall that in 1899 Tuffier's tables gave the mortality of 200 lumbar nephrectomies as 28.4%, and of 161 transperitoneal nephrectomies as 44.1%; while Sir Henry Morris in 1900 reported 95 nephrectomies with 17 deaths.

Apart from one case each of septicæmia with renal carbuncle, and shock with renal, and perhaps suprarenal, trauma, my deaths occurred either in cases of calculous pyonephrosis (including infected hydronephrosis) or else in cases of neoplasm.

The absorption of poisons from a long-standing pyonephrosis weakens the heart. I remember assisting, at St. Peter's Hospital, at a nephrectomy for this condition, the patient dying the same day, and post-mortem examination revealing a streaky myocarditis. In a nephrectomy of my own for pyonephrosis it took about three weeks for the pulse-rate to settle from 130 to normal; and in another case death occurred on the table at the end of the operation.

If, in freeing a large pyonephrosis, its cavity be accidentally opened, and pus pour from it, it is often wise just to insert a tube, leaving the nephrectomy to be done at a second stage, when the advantages of the delay are seen in the smaller size of the mass and in the greatly lessened chance of infecting the peritoneal cavity. One patient, aged 61, with a right-sided, non-calculous, non-tuberculous pyonephrosis, had it thus removed in two stages, the nephrectomy being done three weeks after nephrostomy; and one and a half years later had his prostate removed, also in two stages.

Again, in attempting the removal of an adherent pyonephrosis, if the peritoneal cavity be opened, the hole should, if possible, be immediately closed, lest a thin-walled part of the pyonephrosis should also be penetrated, and pus leak into the peritoneal cavity.

On January 1, 1950, after an interval of twenty-one years, I saw the first patient on whom I performed nephrectomy, on December 10, 1928, at St. Bartholomew's Hospital. It was a secondary right nephrectomy for calculous pyonephrosis. Stones had been previously removed elsewhere, and I had difficulty in persuading the patient that nephrectomy was the right thing to do.

The mortality of nephrectomy for neoplasm is reputed higher than that of nephrectomy for non-neoplastic conditions, and my figures, small as is the total number—three deaths in 31 nephrectomies for neoplasm, or just under 10%—seem to support this view.

Referring to post-nephrectomy survival in cases of renal neoplasm, F. J.-F. Barrington (1939, *Clin. J.*, 68, 6) stated that "most of the patients operated upon are dead or have obvious signs of recurrence within two years". This statement, while seeming unduly pessimistic, contains a large element of truth. Thus, of 5 renal neoplasms removed by me in 1936, one patient died six and three-quarter months later, another after three years, and a third after seven years, from local or general recurrences; a fourth patient developed a secondary deposit in the left great femoral trochanter three and a half years after operation; while the fifth patient, a girl of 6, who had an adeno-carcinoma replacing the lower half of the left kidney, and who has sent me a Christmas card every year since 1936, is the only survivor of the 5.

But I think that that year may give an unfair picture, as many of us, doubtless, have patients alive and well several years, some of them more than ten years, after nephrectomy for neoplasm.

Some well-known textbooks speak of preliminary ligation of the renal vessels as an advantage of transperitoneal nephrectomy for growth, as tending to prevent the manipulative forcing of neoplastic cells into the circulation. It may be that such preliminary ligation is possible with a kidney of about normal size—an exception with neoplasm. But, unless one performs transperitoneal nephrectomy for all renal neoplasms, irrespective of size, it is difficult to see how this advantage will be achieved.

Reserving, as I have so far done, transperitoneal nephrectomy for massive growths, my experience has been that the renal pedicle is the very last thing that I find, so that I can rely only on gentleness to try and prevent metastases.

Of course, if it can be proved that, in the cases of renal neoplasm where kidney enlargement is minimal, and in which therefore preliminary transperitoneal pedicle ligation might be possible—if it can be proved that post-operative secondaries are rarer than after lumbar nephrectomy, then it might follow that lumbar nephrectomy for neoplasm should no longer be done. But I know of no such proof; it would need a large series of cases; and the findings of one large series often conflict with those of another large series. For the present, therefore, I shall continue to reserve transperitoneal nephrectomy for massive growths. In 2 such cases the lower ribs were everted on the side of the mass; I do not remember seeing this sign in non-neoplastic conditions.

Complete nephrectomy usually implies partial ureterectomy, and complete nephro-ureterectomy implies partial cystectomy. Such an operation, probably to be considered only in cases of neoplasm, and especially papillomatosis, of the renal pelvis and ureter, not only repels one from its extensiveness, but has been declared by Macalpine to be harmful. All that is necessary is removal of the kidney and ureter down to the bladder, leaving the intramural part to be dealt with, if necessary, by cystoscopic diathermy. In the case of a fat lady of 68, whose right kidney, and subsequently right ureter, I thus removed for papillomata, no further hæmaturia or bladder papillomata developed during her remaining nine years.

Cases of renal papillomata show that one cannot rely on absence of dilatation of the ureter as proof that distal ureteric papillomata do not exist. I have had cause to regret that, at the time of nephrectomy, I did not remove more of the ureter—for instance, in one man with a fat, muscular, vascular loin, when the theatre temperature, on June 3, 1947, was 93° F. In such cases I should now seriously consider transperitoneal nephro-ureterectomy down to the bladder.

With regard to solitary cysts, I have never, as some do, tried to shell them out entire, any more than I have ever tried to shell out a hydrocele entire, but, analogously with a hydrocele, have usually contented myself with clipping away the wall of the cyst down to the renal edge, and have thus avoided the bleeding of which one hears as sometimes attending the attempt to remove that part of the cyst wall which lies against the kidney, and which it seems to me unnecessary to remove.

On the other hand, when, as with some cysts, hæmaturia has been a prominent feature (hæmaturia due, one may suppose, as in some cases of hydronephrosis, to rupture of

capillaries congested by pressure), and when, even at operation, the possibility of the co-existence of a renal neoplasm could not be excluded, I have performed nephrectomy.

In the case of one such huge cyst of the right upper renal pole in a man of 34, who had twice had port-wine hæmaturia—once eight years previously, and then not again till eight days before being seen—and who had also had an occasional ache in the right loin during the last three years, his doctor, as luck would have it, watched me deliver, through a lumbar incision, and above, and continuous with, the relatively small, though normal-sized, right kidney, a huge tense rounded mass of the appearance and consistency of the right lobe of the liver. The absence of guts, however, cheered me, and, as I was wondering what it was all about, the hæmorrhagic cyst burst with a shower of what looked like chocolate sauce. I think the doctor was duly impressed, but I am not certain in what way; and the patient did very well.

52 nephrectomies for tubercle without a death may be satisfactory, but in several cases post-operative symptoms left much to be desired, increased frequency and hæmaturia persisting, possibly due to the fact that I have never removed the ureter for tubercle below about the level of the pelvic brim at the time of nephrectomy, nor felt called upon subsequently to remove the ureteric stump.

It may be that in some cases results would be better if the ureter were removed down to the bladder. However, what one gains on the swings one may lose on the roundabouts, since the complete routine removal, at one sitting, of kidney and ureter down to the bladder is a more serious procedure than nephro-ureterectomy down to the brim only. Even in the hands of an expert craftsman I recently heard that, I think in 10 such cases of full removal, 3 patients had died from tuberculous meningitis.

In one of my patients, fourteen years after nephrectomy for tubercle, the urine, while persistently free from tubercle bacilli, was infected, and, while the bladder was of good capacity (13 ounces), recent right loin pain led to the discovery of a right hydronephrosis and huge hydro-ureter above a low right ureteric stricture, presumably tuberculous, since a right-sided lymph-gland, removed at the time of lateral uretero-vesical anastomosis, showed tuberculosis. The anastomosis, over a year and a quarter afterwards, has so far been followed by good results as regards symptoms and blood-urea, this being 26 mg. %.

Another patient, nine years after left nephrectomy for tuberculous pyonephrosis at the age of 45, also began to develop right-sided hydronephrosis, perhaps due to the excessive bladder contractions of persistently increased frequency. Unfortunately his subsequent failure to attend hospital for the next two years prevented any attempt at operative relief, for, when he finally appeared, his blood-urea was 330 mg. %.

In cases of marked persisting frequency after nephrectomy for tubercle, uretero-colostomy seems to be gaining in popularity. In such cases, if the ureter is not so dilated as to suggest uretero-vesical anastomosis as an alternative, it may be that grossly increased frequency justifies uretero-colostomy. However, until urologists can achieve a more valvular effect than they claim for their uretero-colostomies, I think it would take a lot of increased frequency to persuade me to undergo this operation for a non-neoplastic condition. I recently saw, for the first time, a fine man of 32 who, nine months after left nephro-ureterectomy for tubercle in 1946, had right uretero-colostomy done for increased frequency. He has no increased frequency now, certainly, but he has recurrent attacks of pyrexia and right loin pain, right hydronephrosis and hydro-ureter, and a blood-urea of 79 mg. %.

Conditions not primarily renal, in which nephrectomy is indicated. I have had only one case of primary carcinoma of the ureter, the patient being a man of 69 with painless hæmaturia.

Cystoscopy was negative, and intravenous pyelography showed dilatation of the left kidney and ureter down to the iliac region, where the outline was narrow and irregular, a finding confirmed by ascending ureterography, which allowed the diagnosis of ureteric neoplasm to be made. On being further questioned, he admitted slight recent aching in the left loin.

On December 9, 1947, I did left lumbar nephrectomy with the ureter down to below the pelvic brim, and well below the firm spindle in the iliac ureter. Examination of the removed specimen showed that, both macro- and micro-scopically, I was well clear of the growth, a papilliferous transitional-celled carcinoma, an inch and a half (3.8 cm.) long, sharply demarcated below.

However, when I saw him on February 9, 1949, fourteen months after operation, although he looked well and weighed a stone more, he had again had occasional hæmaturia during the last five months, and cystoscopy showed fluffy growth on the left side of the bladder. After two cystoscopic diathermies, I did a partial cystectomy on March 29, 1949, a year and a quarter after the nephro-ureterectomy, and removed the left ureteric stump in continuity with the bladder, which showed no growth, including the site of diathermy. The ureter, however, contained the same sort of papilliferous growth as before, infiltrating the muscular wall, with scattered groups of tumour cells in the vessels and adjacent fat.

On January 9, 1950, two years and one month after the first operation, the patient died with paralytic ileus following on a metastasis in the third lumbar vertebra, for the development of which I doubtfully hope that my delay in completing his ureterectomy was not responsible.

Another primarily non-renal condition for which I have removed the kidney was a huge left retroperitoneal sarcoma in a man of 54, with some dilatation of the faint left intravenous pyelogram. There had been no hæmaturia, yet the respiratory mobility of the mass, and a recent left varicocele, seemed to suggest the diagnosis of left renal neoplasm, a diagnosis not dispelled until after the operation, when it was seen that the large mass merely embraced the lower pole of the kidney, which, apart from obstructive dilatation, was normal. Posteriorly the otherwise encapsuled mass had been found to be attached, and had had to be shaved away, necessarily leaving growth behind. The respiratory mobility must have been a rocking movement on this posterior attachment. The patient had deep X-ray therapy, put on two stones in weight, and resumed work as a head gardener, but within five months redeveloped palpable growth at the same site, followed by root-pains and death about one year after operation.

Another primarily non-renal condition for which nephrectomy may be indicated, and, if done, is definitely curative, is uretero-vaginal fistula of the same side, developing after a gynæcological operation in the pelvis, the kidney above the fistula being later found to be slightly dilated. Having previously been content with nephrectomy for this condition, as being quick, easy, and final, I then thought I would try and emulate my friends, and re-implant the ureter into the bladder. This patient, aged 54, had had a hysterectomy for fibroids, followed, ten days later, by laparotomy for intestinal obstruction. I re-implanted her right ureter into the bladder, but unfortunately a stricture developed at the site, and I could pass no instrument up this ureter; so, on December 10, 1934, I removed her obstructed kidney, the patient surviving her four major interventions very well.

In another case of uretero-vaginal fistula, a left-sided one, I failed to find the ureter because of adhesions, and immediately did left nephrectomy. Had this kidney been the patient's only one, I suppose I should have persisted till I did find the ureter, or stopped and waited a month or two, hoping for the adhesions to resolve. However, when the kidney is not a solitary one, one would hesitate to condemn the patient to a month or two more of delay and leakage.

Thus, for uretero-vaginal fistula, although prepared to attempt re-implantation of the ureter into the bladder, I think at present that nephrectomy is more attractive as being an easier operation and the one certain cure.

Nephrectomy during pregnancy.—I have always suggested, if possible, postponing nephrectomy till after parturition.

However, I remember the case of one very large woman who continually poured blood down her right ureter, the urine from which contained pus and *B. coli*, while the left-sided urine contained neither. Apart from a little upper and lower right calyceal dilatation, the pyelograms were normal. Right nephrectomy became necessary to save life, when subcapsular and submucous hæmorrhages were obvious, and microscopy showed active pyelonephritis.

After operation, the patient, whose doctor had accurately diagnosed hæmorrhagic pyelonephritis, confessed to being four months pregnant, her obesity having previously obscured this condition, which proceeded uninterruptedly to full term.

Besides this case, I can recall one other patient in whom nephrectomy was urgent to save life threatened by continued hæmaturia, the blood in this case coming from the left kidney, and pyelograms being normal. The kidney also was normal, except that a walnut-sized cyst was present near the lower pole, the floor of the cyst being curiously trabeculated. Microscopy of this area showed atypical chronic nephritis.

As regards the vexed question of reno-renal reflex, I have had 2 cases, both in women, where this seemed to exist. The one which I regard as the more suggestive was that of a woman of 34 suffering from exclusively left-sided renal pain, who was found to have multiple right renal calculi, the left kidney being stoneless and of normal function. Since right nephrectomy on July 31, 1941, she has had no further abdominal pain.

Post-nephrectomy complications.—I have encountered severe bleeding from the renal pedicle four times. In the first, during a left nephrectomy on August 2, 1933, for infected calculi in a man of 57, I regret to say that, being unable to grasp the pedicle, I packed the wound firmly with a roll of gauze, and sewed up the wound over the gauze. The patient died within a few hours, and I have never repeated the procedure.

Of the other 3 cases of severe pedicle bleeding, 2 were in right hydronephroses, and the third was in a case of ruptured left kidney. I left two clamps on in all three for about three days, removing them in the patient's bed under general anaesthesia. No further bleeding occurred, and all the patients did well.

The ruptured kidney case, operated upon on February 15, 1946, was that of a man of 21, whom I first saw at a distant hospital seven days after the accident. Temperature and pulse- and respiration-rates were normal, urinary output good, and the hæmaturia steadily lessening. I therefore suggested temporization and intravenous pyelography. Twelve days later I was asked to see him again, his condition having suddenly become very bad. I asked to see the urosectan films, but these had not been done; so, after having seen good indigocarmine effluxes from the right ureteric orifice, in spite of bladder clots, I explored the left loin, and found a mass of clots, of which I removed a dishful, and the kidney pulped into three or four well-separated adherent pieces. I shelled out the lower pieces,

but the uppermost one was firmly adherent at one spot to the bed in which it was lying. There was room for only one clamp between the kidney and its bed, and that clamp came off, and an arterial spurt hit me in the forehead. I reapplied the clamp, and managed to get a second one on, both being removed sixty-eight and a half hours later. As stated, the patient did well.

Even in the emergency of traumatic bleeding from the kidney, it is essential, before proceeding to nephrectomy, to assure oneself of the efficiency of the opposite kidney. I remember reading about a patient in whom the omission of this precaution, before the removal of a ruptured kidney which had no fellow, was responsible for a most interesting paper on acute uræmia.

Of course, in renal-pedicle bleeding of lesser degree, when it is not necessary to leave a clamp on, it is enough to compress the pedicle with a large swab, or several swabs, against the vertebral column for two or three minutes (and it is amazing how long three minutes can seem under these circumstances).

At the end of that time the bleeding has usually much diminished, and it is easy to remove the gauze cautiously, and grasp the source of bleeding, ligaturing it in the ordinary way.

It was, I think, in a severe case of this sort that a surgeon, visiting St. Peter's Hospital, told us that he had once left behind a packet of 12 swabs. The theatre sister was sure that no single swab was missing, but, in the emergency, was uncertain of the total number of packets of twelve swabs put out.

Although I have occasionally ligatured the renal vessels separately, I have usually, when possible, put three strong clamps on the renal pedicle, cut the kidney away distal to the upper two clamps, and then applied several ligatures of No. 4 catgut round the whole pedicle.

I have but rarely transfixed the pedicle, since, although theoretically attractive as tending to prevent the slipping of a ligature, this practice involves the possibility of vessel puncture.

Bleeding from the inferior vena cava.—As a dresser I was once present when a surgeon wounded this vessel during a right nephrectomy, death resulting in about two days. If one is faced with a difficult nephrectomy, one hopes for a left-sided, rather than a right-sided, one.

I have once put a lateral ligature over a curved forceps applied to the inferior vena cava, when bleeding occurred at the junction of a right lumbar tributary with the main vein, during removal of a renal neoplasm. The exposure was good, and the ligature easy.

Quite recently, and for the first time, I have had occasion to adopt the manœuvre which, in his last lecture at St. Bartholomew's Hospital, I heard Sir Anthony Bowlby state that he had successfully employed in a case of bleeding from the inferior vena cava—namely, leaving a clamp on it for, I think, three days.

In my case (the fatal one in August this year, which occurred subsequently to the series previously decided upon as ending in May) there was some bleeding from the right side of the anterior aspect of the inferior vena cava in a man of 74, while I was separating with the finger adherent fibro-fat during a right nephrectomy for infected calculous pyelonephritis. After due pressure, I applied a ligature over a curved clamp, and then removed the clamp. As bleeding, though much reduced, still continued, I reapplied a clamp, and left it in position. The patient, who had not lost much blood, improved next day enough to eat an egg, but collapsed that night, his pulse becoming imperceptible at the wrist, and died early next morning.

Unfortunately, I thus did not have the clinical chance of testing the efficacy of the hæmostasis by removing the clamp after three days; but fortunately a post-mortem examination was obtained, which proved that no further bleeding from the vena cava had occurred, death being due to heart failure. The heart muscle was soft, and there was marked stenosis at the division of the left coronary artery. Thus the post-mortem examination gave one the melancholy satisfaction of knowing that the patient had not bled again, and had, as one may say, died cured.

Another rare complication more likely with a right than with a left nephrectomy is a duodenal fistula. I have not met with one myself, but have always thought that, if I did, I would adopt, as an alternative to gastro-jejunostomy, Joly's successful manœuvre, which I heard him describe here. He kept the patient lying on the side opposite to the fistula (I think it was a right nephrectomy), and gently plugged the track with paraffin-soaked gauze. The skin was thereby protected, and thus food, tending to run along the inner curve of the duodenum, rather than the outer, was not lost.

Although I have not damaged the duodenum, I have twice damaged the large bowel—once the cæcum, and once the hepatic flexure; at least, those were the probable areas damaged. Again the nephrectomies were right-sided, and both patients did very well.

The first, a man aged 23, operated on on July 7, 1930, had right renal calculi and also what was reported on as a banana-shaped calculus in the right ureter, this stone being of about the length and width of an adult index finger, and extending to the pelvic brim.

Having lifted up the kidney, and easily freed the ureter down to the pelvic brim, I found there a flat dense band tethering the ureter on its inner side. Being unable to free this, I applied two chole-

cystectomy forceps to this band and to the ureter itself below the stone, where the duct felt of normal size, cutting the band as close to the ureter as possible, and applying a ligature over the lower and inner forceps.

During the next few days swelling and cedema appeared behind and above the wound, which discharged pus. At the onset of offensiveness in this, the house surgeon had it tested for stercobilin, which, to my surprise, was present. But the next day, the sixth after operation, there was no need for this test, semi-solid faeces emerging from the lower end of the wound. During the time of faecal discharge, namely from the sixth to the sixteenth day, the temperature varied daily from 99° to 100° or 101° F., and on one day to 103° F.; but the bowels continued to act naturally, encouraging the hope of spontaneous closure of the fistula, a hope happily realized. The final scar, though wide, showed no bulge on coughing, and the patient has since then had twenty years' good health.

Nine years previously the patient had had an emergency operation for acute appendicitis, no tube being inserted till four days later, when a second operation was performed for an "abscess on the intestine".

From the semi-solid nature of the faeces, and from the fact of their being discharged from the lower end of the wound, it would seem probable that the tough adhesion encountered at the pelvic brim contained a piece of large bowel, most likely caecum, unnaturally adherent posteriorly as a consequence of the previous operations and suppuration, after which his urinary trouble had begun. Sloughing of the part strangled by the ligature would explain the faecal discharge after some days.

The other case of bowel damage was even more startling. On May 14, 1946, I had drained a right perinephric abscess, containing 4 or 5 ounces of thick yellow pus, but no tubercle bacilli or other organisms (although there was a poor growth of atypical *B. coli*), in a woman of 23, from whose right functionless kidney, containing many X-ray calcifications, thick yellow pus was later seen issuing into the bladder. *Staphylococcus albus*, but no tubercle bacilli, were found in this pus. Twenty days after drainage I removed the right kidney—a very difficult procedure, the kidney being set as in plaster of Paris. Thinking that I had opened the peritoneal cavity on the inner side, I made to close the gap, after removal of the kidney (which proved microscopically to be tuberculous, with areas of caseation and calcification), only to find, to my horror, that I was looking at the lumen of the gut, opened extraperitoneally. In an attempt to discover which part of the gut it was, I inserted a finger, and found that it could be passed directly inwards, and also distally, in L-shaped fashion. I think it must have been the hepatic flexure. I sewed up the rent with a continuous suture about 1 to 1½ inches (2.5–3 cm.) long, buried this, and put a tube down it; and was pleased that faeces did not discharge until the sixth day. The discharge ceased to be faecal in eight days, becoming merely purulent, and finally stopping altogether. Like the other patient, this one, apart from some pyrexia and the discharge, remained well throughout, and ended with a good scar.

In a discussion on some of the accidents of renal surgery reported in the *Transactions* of the Philadelphia Branch of the American Urological Association for 1928, Rathbun says that some of the reported cases of wounds of the large bowel "have been followed by persistent faecal fistula, many of them requiring secondary operation for closure". In so far as this did not apply to the 2 cases just described, my patients and I were lucky.

Apart from the cedema preceding an intestinal fistula, I can recall 2 cases of wounds puffy with surgical emphysema after renal operations, one of which was a right nephrectomy, and the other, I think, also a nephrectomy. One thought of gas gangrene, but the state of patients and charts obviously excluded this, and the condition seems to have been one of enclosed air and some slow idiosyncrasy in its absorption.

More alarming are cases of pneumothorax, of which I have had several. The first occurred on July 17, 1930, during a very difficult left nephrectomy in a woman of 26, who two years previously was said to have had a pyelitis of pregnancy. She had a small stone wedged in the left renal pelvis, and a huge loculated adherent pyonephrosis.

After patiently freeing this, I finally found that the upper pole was so densely adherent that I could not free it by any justifiable amount of force. So, pulling the kidney down, I applied two pairs of cholecystectomy forceps to the resulting cone of tissue, keeping very close to the kidney, and cut between the two forceps, when the upper one came off, disclosing a half-crown-sized rent in the dome of the diaphragm, through which I could see and touch lung. The kidney, diaphragm, and pleura must have been firmly welded together. I well remember having to kneel on the theatre floor in order to suture the rent with 5 or 6 interrupted sutures.

Next day the patient's respiration-rate was 60 a minute, falling to normal by the third day. It was further interesting that she had clavicular pain, worse on the left than the right. This also soon vanished, and she had another baby within two years.

One case of pneumothorax occurred after a right nephrectomy, on October 22, 1946, for infected calculous hydronephrosis in a man of 32. Post-operative pyrexia and raised pulse- and respiration-rates on the second day led to the physicians being called in, when 1,300 c.c. of air were aspirated from the right side of the chest three days after operation. Temperature and respiration-rates having subsided, and the patient seeming well, and the opposite kidney having, of course, been previously proved efficient, I was amazed to learn, ten days after operation, that the blood-urea was 440 mg. %. The patient's tongue was moist, he had no headache, and his general condition seemed good. However,

there had been relative oliguria, and there were occasional slight twitchings round the mouth, and also slight hiccup. The blood-urea gradually fell to normal in twelve days.

Looking back for a possible explanation of this unique sequence of events, I seem to remember, before applying the ligatures to the renal pedicle, having to brush a few fibres off the tip of my clamp. These fibres may have been diaphragmatic, and air may have been sucked into the pleura at inspiration through a small unperceived hole in diaphragm and pleura during the first day or two after operation. Anyway, since then I have been very careful to see that the tip of my pedicle clamp is quite free. To explain the uræmia, I can only think of a toxic nephritis due to absorption of organisms or poisons from the compressed lung.

Recently looking through my notes, I discovered two other cases of post-nephrectomy pneumothorax.

One was in a youth of 18, whose case has already been mentioned, and who died on the table after removal of the kidney for left calculous pyonephrosis, death being due to cardiac failure from marked toxic degeneration, owing to poisonous absorption from the pyonephrosis.

At the post-mortem examination, which showed very considerable toxic change in the heart, with mottled pallor of its muscle, and dilatation of all its cavities, very dense perinephric adhesions and scar tissue were found to be still present, with penetration of the peritoneum and of the left cupola of the diaphragm, the left lung being almost completely collapsed. Dr. Keith Simpson said that there was no evidence that this had accelerated death in any way.

The other case was that of a man of 55, who had had six operations for renal stone in eight years—two operations on the right side, and four on the left, where he now had a calculous pyonephrosis, and where the site of an old urinary fistula had reopened nine days before a very difficult left nephrectomy, which was but partial, for a few bits of kidney were left adherent to the colon, and, it was thought, a little bit of the upper pole was left behind, the operation being partly extra- and partly intra-capsular.

Eleven days later 300 c.c. of air were aspirated from a left pneumothorax, and, three days later still, a further 800 c.c.

Two weeks later (that is, four weeks after operation), he had improved to the stage of walking, when, having had a little blood-streaked sputum in the last four or five days, he suddenly coughed up half a pint of bright blood, and died almost immediately.

Post-mortem examination showed the left lung to be air-containing and partly re-expanded. A small exostosis was present on the right side of the seventh or eighth thoracic vertebra; and immediately adjacent to this was a small walnut-sized aneurysm, springing from the corresponding intercostal artery just beyond its origin from the aorta. There were adhesions between the aneurysm and the lower lobe of the right lung. Rupture of the aneurysm had occurred, filling the right lung and making it almost solid.

It cannot be a coincidence that 3 of these 4 cases of pneumothorax occurred during removal of a left calculous pyonephrosis.

The remaining case, as already stated, occurred on the right side during the removal of an infected calculous kidney, in the course of which it was thought that a few diaphragmatic fibres, and possibly a small piece of the underlying pleura, had been caught in the clamp.

The predilection of post-nephrectomy pneumothorax for the left side is explicable by the greater protection afforded to the pleura on the right side by the liver.

It is owing to such cases, for instance, as that of rupture of an intercostal aneurysm into a lung that it is difficult to be truthful and yet avoid mortality.

I regret that time does not allow of an adequate analysis of even the present relatively small number of cases.

“Art is long, life is short, and judgment difficult.”