

## TWO UNUSUAL INTRARENAL VASCULAR LESIONS TREATED BY CONSERVATIVE SURGERY\*

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Direct surgery of the main renal artery is now well established for a variety of conditions, but operations upon the branches of this vessel are not commonplace. Doubtless, with the increasingly widespread use of renal angiography, this type of surgery will be undertaken more and more frequently. In view of this, and in view of the greater concern that urologists today have for preserving nephrons, the two case reports that follow may be of some interest.

### CASE REPORTS

Although the aetiology and haemodynamics of the lesions differed in the 2 patients, there are several relevant points of similarity that justify considering them together.

Both patients were young men, both sustained infarcts of the upper portions of their kidneys, and both had very severe haematuria. A large, blood-filled aneurysmal sac in communication with a named branch of the renal artery and the pelvicalyceal system was present in each instance. Selective renal angiography played a decisive role in the management, in that it enabled an accurate diagnosis to be made, and made the careful planning of each operation possible in order to preserve the maximum amount of functioning renal tissue. Both patients, therefore, underwent conservative renal surgery, and both have ended up with good results.

#### *Case 1*

The first patient was a 19-year-old male who was admitted to Groote Schuur Hospital, aphasic, and with a right-sided hemiplegia. In the past he had suffered from an attack of rheumatic fever, and as he was febrile and had very gross aortic valvular disease and tender subcutaneous nodules on the left foot, a diagnosis of infective endocarditis was made, although blood cultures were negative. This was probably because he had received penicillin before admission. Apart from a little protein, the urine showed no abnormal features. He had a leucocytosis and an elevated ESR, but the renal function as judged by the blood urea (36 mg./100 ml.) and creatinine clearance (117 ml./min.) was good.

A combination of penicillin and streptomycin soon re-

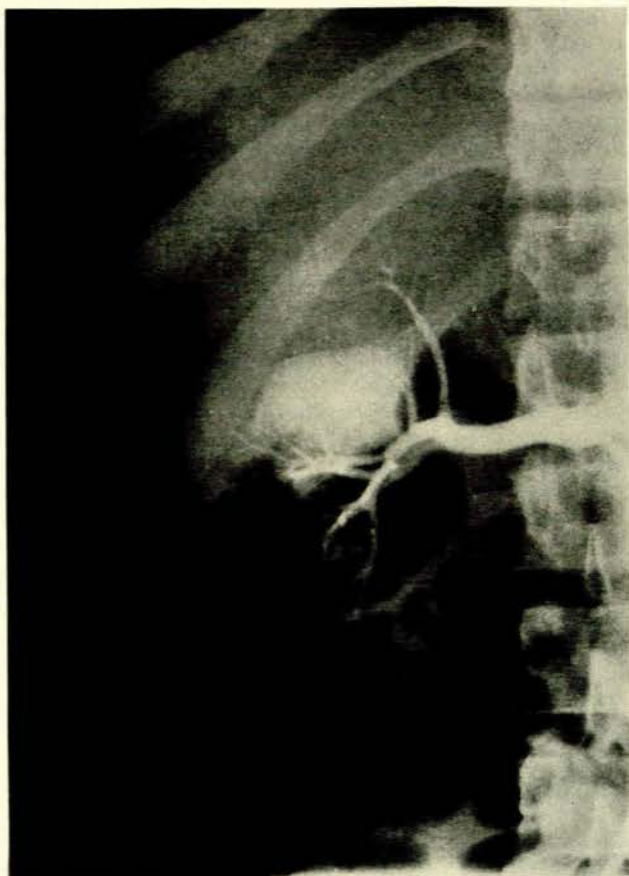
sulted in clinical improvement and his temperature settled satisfactorily, but a week after admission he was noted to have microscopic haematuria. A fortnight later he suffered an episode of really gross haematuria, to the extent of having right-sided clot colic and clot retention with hypotension. Transfusion of many pints of blood was necessary and after about 3 days the bleeding ceased and the urine cleared. Renal infarction had been diagnosed, and an IVP confirmed that there was indeed serious renal pathology by revealing a very poorly defined pelvicalyceal system on the right, only a small amount of dye being excreted into the lowermost calyx. No nephrogram was noted. At this stage, the creatinine clearance had dropped to about 20 ml./min.

It was not long before he started to bleed again, and by the time that he had had his selective renal angiogram, he had been transfused with a total of 28 pints of blood. The arteriogram showed pooling of dye in the upper portion of the kidney (Fig. 1). At no stage was there a good nephrogram on the right side.

By this time, it was quite clear that the haemorrhage would not cease spontaneously as it had done on the first occasion, and as the disease was potentially bilateral, he was operated upon with the idea of stopping the bleeding and at the same time of preserving as much renal tissue as possible. When the kidney was exposed, it was found to be swollen and reddened, with small, dark, patchy, congested areas scattered over the surface, representing small haemorrhagic infarcts. On the anterior surface, towards the upper pole, there was a pale-yellow, dry infarct about 5 cm. in diameter. The area corresponded to the territory of the upper branch of the anterior division of the renal artery. After controlling the pedicle, the infarct was incised, and the clot evacuated from the underlying cavity. A large arterial ostium was underrun with silk, and an obvious communication with a major calyx was also closed.

There were no complications following this procedure and the urine cleared rapidly. A month later his creatinine clearance was 82 ml./min., and a follow-up IVP done recently shows considerable improvement. The patient remains very well and he is now on the waiting list for surgery of the aortic valve.

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*Fig. 1.* The selective renal arteriogram of case 1, showing a large, dye-filled aneurysmal sac in the upper portion of the right kidney.

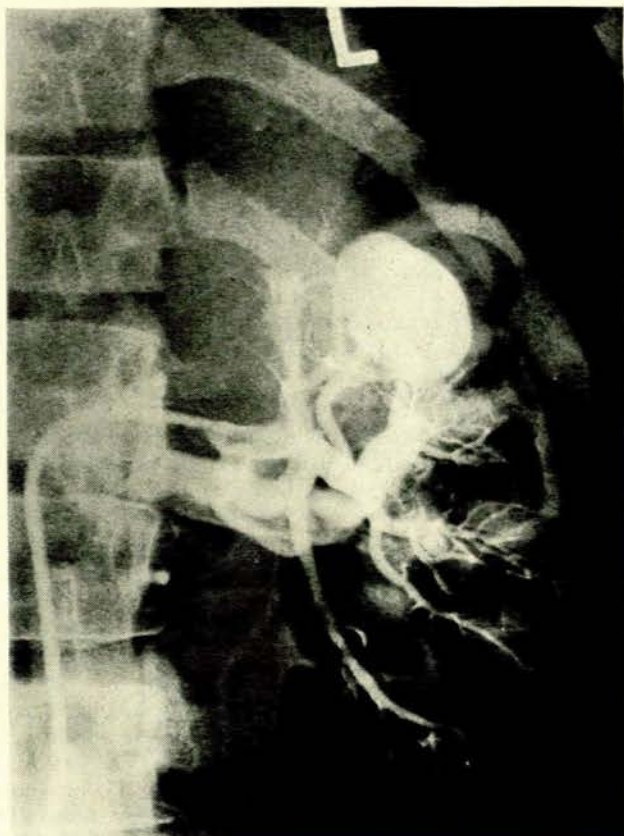
#### Case 2

The second man, aged 20 years, was stabbed in the back over his left lower ribs, during a brawl. He had a small left pneumothorax which caused no trouble, and his skin wound was sutured and healed without difficulty. It was only a week later that there was any urinary complaint, and on that occasion he was seen with severe haematuria and clot retention. The bladder was evacuated and an IVP done, which seemed surprisingly normal. The bleeding cleared rapidly and the patient was discharged on ampicillin and with a clear, sterile urine. Within 4 days he was back again with the same complaint, together with a certain amount of tenderness in the left loin, and a bruit could be clearly heard over the renal area posteriorly. A 'phonofistulogram' confirmed this physical sign.

A selective arteriogram showed the presence of an arteriovenous fistula in the upper portion of the left kidney (Fig. 2), and an isotope renogram revealed very depressed function on the affected side. Blood urea and creatinine were normal, but the creatinine clearance was a little depressed at 72 ml./min.

At operation, an infarcted area of kidney about 5 cm. across was found near the upper pole of the kidney on the anterior surface. The apical branch of the anterior division of the left renal artery came off early, allowing the upper branch of the anterior division to be ligated

and divided without difficulty. The infarct was then incised and the clot evacuated, enabling the internal ostia to be identified (Fig. 3) and oversewn, and finally the cavity was obliterated. Histological examination revealed infarcted renal tissue.



*Fig. 2.* Case 2. The selective arteriogram, showing a dye-filled arteriovenous fistula. The renal vein can be seen below the artery.



*Fig. 3.* Case 2. Photograph at operation of the deroofed infarct at the upper pole of the left kidney. The arterial ostium which was under-run with silk is shown at A, and the opening into the renal pelvis, closed with catgut, is at B. The kidney was exposed through a loin incision and the upper pole is directed towards the camera.

Recovery was uninterrupted and the patient remains well. His follow-up IVP and isotope renogram both indicate that some renal function has been preserved, with a virtually normal pelvicalyceal anatomy.

#### DISCUSSION

Renal infarction may be due to arterial or venous insufficiency; neither is particularly common, but the former is the less unusual type. Most cases are embolic,<sup>1,2</sup> and a predisposing source of embolization has been shown to be present in 76%<sup>3</sup> to 95%<sup>4</sup> of patients in different series; usually this is infective endocarditis or recent myocardial infarction with mural thrombi and associated atrial fibrillation. Atheroma of the aorta or renal vessels also accounts for some cases,<sup>5</sup> but others have been described where no apparent underlying factor has been demonstrated.<sup>6</sup> Loin pain, fever, haematuria to a greater or lesser extent, and a poorly visualized pelvicalyceal system on the IVP, associated with a normal ascending pyelogram, are the usual features described.

Ascending pyelograms were not done in either of the cases that I have cited, as the arteriograms seemed to provide all the information that was required. The serum alkaline phosphatase level is also said to be elevated<sup>7</sup> in this condition, but this investigation was not undertaken in these instances.

The first patient suffered from infective endocarditis, and this disease can involve the kidney in several ways: by embolic occlusion of a small vessel, usually resulting in a small haemorrhagic infarct, and, when multiple, producing the classical 'flea-bitten' appearance; or a slightly larger dry infarct of the characteristic triangular shape and surrounded by a zone of congestion. Flea-bites were a feature of the first case described. In one series<sup>3</sup> of 242 autopsy cases of infective endocarditis, 55, or about 23%, were found to have embolic infarction of the kidneys. A more subtle vascular lesion of the kidney is, of course, the glomerulitis which has a hypersensitivity basis similar to the commoner post-streptococcal glomerulonephritis, and a histological appearance very similar to the latter. Focal embolic glomerulonephritis, with a focal and local intraglomerular distribution, also occurs, but it could be that this is also the manifestation of a hypersensitivity reaction, as organisms are seldom demonstrated in the lesions.

The lesion in case 1 could have been the result of disruption of a rather large infarct due to necrosis of a vessel wall, but a more likely explanation would appear to be that it was the consequence of a rupture of a mycotic aneurysm, yet another of the vascular lesions of infective endocarditis that affect the kidney. Certainly, the latter chain of events seems to be a more likely cause of such massive bleeding than breakdown of a dry, non-septic infarct.

I am not aware of any other reported case of infarction in infective endocarditis that has had such severe haemorrhage into the renal pelvis, although massive perirenal haematoma<sup>8</sup> has been described in association with this condition, nor have I encountered any description of conservative renal surgery having been undertaken in this disease before.

In the second patient, the necrosis of the tissue was secondary to direct traumatic interruption of the segmental arterial supply. Furthermore, the remainder of the renal tissue was definitely ischaemic as the result of shunting away, rather like a miniature 'renal steal'. Although this man has not yet developed hypertension, the circumstances are such that this complication is quite feasible, in that there is viable renal tissue present which has been ischaemic. One would not expect to see the development of hypertension due to infarction in the presence of normal perfusion of the remainder of the renal parenchyma, as the dead tissue should not be capable of producing any renin. It would have been fascinating to know the renin content of the blood in the renal vein, but unfortunately we do not at the moment have facilities for measuring this. A sample of blood has, however, been placed in cold storage against the day when we are in a position to undertake this investigation.

Arteriovenous fistula of the kidney is not a condition that is encountered with any degree of frequency, and the majority of cases have been either congenital<sup>9</sup> in origin, or associated with the pathological circulation of



Fig. 4. A bisected kidney with an arteriovenous fistula near the lower pole. Blood clot fills the pelvis on the left. Superficial to the aneurysmal sac is an area of infarcted tissue somewhat paler than the adjacent normal cortex. With the pedicle controlled, this can be incised easily, the clot evacuated, and the internal ostia dealt with appropriately.

a highly vascular tumour.<sup>9</sup> The post-traumatic examples that do occur are often the result of closed renal biopsy, and it is much less common to diagnose one that is the consequence of accidental injury.<sup>10</sup> Perhaps the use of routine angiography in those patients who have sustained accidental trauma to their kidneys would bring more examples of arteriovenous fistulae to light, and to see whether this is the case we are currently doing this investigation as a routine. Six patients with stab injuries of this kind were admitted to our wards in the first 6 months of 1968, and we have discovered 2 arteriovenous fistulae. Furthermore, we have had one arteriovenous fistula consequent upon blunt trauma to the kidney.

Infarction is not a feature of congenital or malignant arteriovenous fistulae, but because of the more sudden deprivation of the distal blood supply, it seems likely to occur in those instances of trauma where a large enough vessel is interrupted. Systemic effects, such as hypertension and a high-output state, can occur if the shunt is big enough, but the only characteristic physical sign of the condition is a bruit of the kind that was present in the second case. A more recent case, in which the kidney could unfortunately not be saved, had a very loud bruit indeed.

Hitherto, few renal arteriovenous fistulae have been treated by conservative surgery,<sup>11</sup> and, indeed, partial nephrectomy would appear to be the operation that has most frequently been undertaken.<sup>8</sup> Few patients have had

the benefit of simple ligation of the segmental feeding vessel—not a difficult procedure, and one based upon sound anatomical principles. Should the exact vascular anatomy not be easy to demonstrate, use of the technique of local renal hypothermia<sup>12</sup> would provide ideal conditions for unhurried dissection; but if the lesion does not respect the segmental anatomy, simple oversewing of the ostium of the vessel after controlling the renal artery, approached by opening directly into the blood-filled aneurysmal sac, seems an appropriate procedure to adopt. In each case seen by us so far, there has been a definitely established, avascular infarcted area between the sac and the surface of the kidney, through which a bloodless approach could be made (Figs. 4 and 5).

#### CONCLUSION

The important part that renal angiography plays in the management of patients with severe bleeding from the kidney such as occurred in the two cases described should be emphasized, for it enables a precise diagnosis to be made, and, equally important, it enables a definite plan for a surgical approach to be evolved before the procedure is actually commenced, which will preserve the maximum amount of functioning renal tissue.

The sooner the lesion is diagnosed and treated, the better, not only because severe blood loss is prevented, but also because permanent ischaemic damage to the nephron mass is more likely to occur if blood is shunted away from the remaining renal cortex for any length of time.

#### SUMMARY

Two cases are described, one with an intrarenal aneurysmal sac consequent upon rupture of a mycotic aneurysm of a branch of the renal artery in a patient with infective endocarditis, and the other with a post-traumatic intrarenal arteriovenous fistula. Both patients suffered very severe haematuria. The importance of selective renal angiography in the management of such a clinical situation is emphasized and an easy operative approach is suggested.

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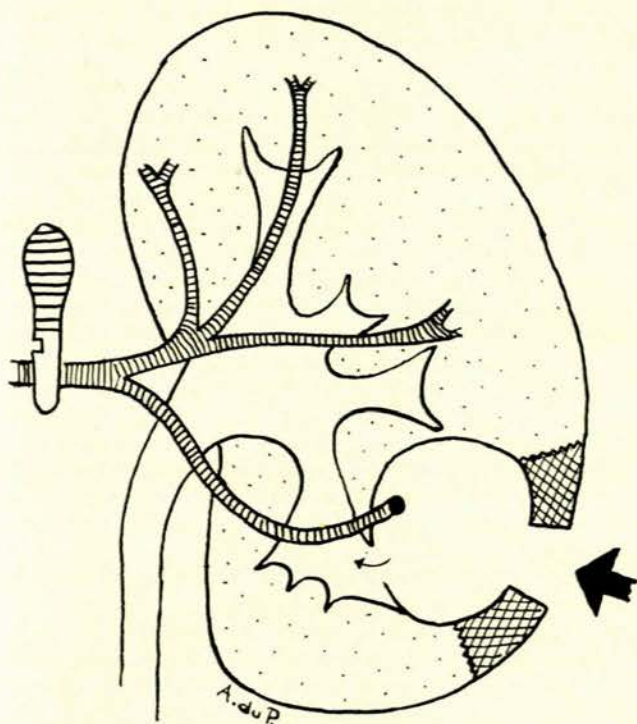


Fig. 5. Diagram to show the operative approach to the blood-filled sac. The pedicle is controlled with a bulldog clamp and the avascular infarcted area is incised, and the clot evacuated, allowing the vascular ostia to be visualized and ligated. Any communication with the renal pelvis can also be closed.