The Arterial Complications of 500 Renal Transplants

M BEWICK, C S OGG, V PARSONS*, A P TRAFFORD†, M GOGGIN, C RUDGE
Guy's Hospital, *King's College Hospital, London
†Royal Sussex County Hospital, Brighton, ¶Canterbury Hospital, Kent, England

Introduction

Arterial problems occur in 5–20% of patients receiving renal transplants. Haemorrhage from the anastomosis line and thrombosis of the renal artery are the two major complications and both are likely to result in transplant nephrectomy. We have had 16 cases of haemorrhage and 10 of renal artery thrombosis, all resulting in transplant nephrectomy. A further eight patients have developed renal artery stenosis, seven of which were corrected surgically, the eighth necessitating transplant nephrectomy. As approximately 20–25% of all kidneys have more than one renal artery we have analysed our results in order to see whether the use of these kidneys is associated with an increased incidence of arterial problems and to compare the different techniques of arterial anastomoses used.

TECHNIQUES

Between May 1967 and February 1976 500 renal transplants were performed, 421 being cadaver kidneys and 79 from live-related donors. The surgical techniques were conventional, the precise type of anastomosis depending on the anatomy of the donor and recipient vessels. The renal artery was anastomosed end-to-end to the internal iliac artery in 151 cases, end-to-side to the external or common iliac artery in 55 cases, and end-to-side with the renal arteries arising from a carrol patch of aorta in 294 cases. Three hundred and eighty-four kidneys had a single renal artery, 96 had two arteries, 19 had three arteries and one kidney had four arteries. Various techniques were employed when more than one renal artery was present. In 65 cases all arteries present were arising from a

single aortic patch, in 37 the smaller accessory vessels were spatulated onto the side of the main renal artery, in eight the arteries were anastomosed separately to recipient vessels, and in a further six cases the accessory arteries were very small and were ligated. For all arterial sutures 5/0, 6/0 or 7/0 Prolene was used.

TABLE I Incidence of haemorrhage from the graft anastomosis site.

TYPE OF ANASTOMOSIS	TOTAL	1 ARTERY	>1 ARTERY
END-TO-END	3/151 = 1.9%	2/126 = 1.6%	1/25 = 4.0%
END-TO-SIDE	1/55 = 1.9%	0/43 = 0%	1/12 = 8.3%
PATCH	12/294 = 4.1%	8/215 = 3.8%	4/79 = 5.1%

Totals: 1 ARTERY 10/384 = 2.7%
>1 ARTERY 6/116 = 5.2%

RESULTS

Table I shows the incidence of haemorrhage according to the type of anastomosis used and the number of renal arteries present. The use of an aortic patch gave a higher incidence of haemorrhage, as did the use of kidneys with more than one renal artery. Table II shows that conversely the incidence of arterial

TABLE II Incidence of thrombosis in graft anastomosis

TYPE OF ANASTOMOSIS	TOTAL	1 ARTERY	>1 ARTERY
END-TO-END	5/151 = 3.3%	5/126 = 3.9%	0/25 = 0%
END-TO-SIDE	3/55 = 5.6%	1/43 = 2.4%	2/12 = 16.7%
PATCH	2/294 = 0.7%	2/215 = 0.9%	0/79 = 0%

Totals: 1 ARTERY 8/384 = 2.1%
>1 ARTERY 2/116 = 1.8%

thrombosis was lowest when an aortic patch was used, and that multiple renal arteries were not associated with a higher incidence of thrombosis. Combining the results in these two tables, Table III shows that when the kidney has a single renal artery the results are the same regardless of whether or not an aortic patch is used, whereas the presence of multiple renal arteries arising from a patch gives very much better results than when no patch is available.

TABLE III Combined haemorrhage & thrombosis at anastomosis site

1 VESSEL ON A PATCH	10/215 = 4.7%
1 VESSEL NOT ON A PATCH	8/169 = 4.7%
> 1 VESSEL ON A PATCH	1/55 = 1.8%
> 1 VESSEL NOT ON A PATCH	7/61 = 11.5%

Table IV analyses the incidence of renal artery stenosis in all kidneys that functioned for greater than three months. The diagnosis was suspected clinically when there was gradual deterioration of renal function and renal scan perfusion index, shown by biopsy not to be the result of acute or chronic rejection, and was confirmed by arteriography (often needing special views) and renal vein plasma renin level estimations. It is seen that the use of an end-to-end renal artery to internal iliac artery anastomosis was associated with a six-fold increase in renal artery stenosis compared with all other techniques. Seven of our eight cases were successfully corrected surgically, with return to normal renal function and normotension, but the eighth required transplant nephrectomy.

TABLE IV Renal artery stenosis (in kidneys functioning >3/12)

TYPE OF ANASTOMOSIS	TOTAL	1 ARTERY	>1 ARTERY
END-TO-END	6/117 = 5.2%	6/99 = 6.1%	0/18 = 0%
END-TO-END	0/39 = 0.1%	0/32 = 0%	0/7 = 0%
PATCH	0/209 = 0.97%	2/155 = 1.3%	0/52 = 0%

Totals: 1 ARTERY = 2.8%
>1 ARTERY = 0%

DISCUSSION

Major arterial problems have occurred in 34 out of 500 renal transplants, an incidence of 6.8%, and in 27 cases have been the cause of graft failure (5.2%). It would appear from our results that there are two main groups of kidneys in which a change in surgical technique would be likely to reduce this incidence, and in both groups it is the presence or absence of an aortic patch that is critical. Renal artery stenosis developed six times more commonly after end-to-end anastomosis than with any other procedure. If no aortic patch is available (a situation that should ideally only apply where live-related donors are being used) it is recommended that the renal artery should be spatulated end-to-side onto the external or common iliac vessels, or if an adult kidney is being transplanted into a child the lower end of the aorta may be used in order to produce a satisfactory blood flow into the kidney. The second group of kidneys is those

having more than one renal artery (23.2% of our total). Our results show that if all the arteries present arise from a single aortic patch the use of these kidneys is not associated with a raised incidence of complications. In the live-related situation it is usually possible to select the appropriate donor kidney such that a single artery is used, but obviously the surgeon is unlikely to have knowledge of the renal vasculature prior to cadaver donor nephrectomy. As speed in this situation is essential, it is strongly recommended that the monoblock techniques of Ackerman and Snell (1968) or Silber and Martin (1973) should be used. It is then possible to open the aorta, see the orifices of all renal arteries present, perfuse the whole kidney, and fashion a suitable patch for transplantation.

References

Ackerman, J R, and Snell, M E (1968) *British Journal of Urology, 40,* 515-521
Silber, I, and Martin, D C (1973) *Journal of Urology, 109,* 949-951

Open Discussion

MAY (Berlin) This paper was very interesting since our investigations concern a similar patient group. In our 207 patients, we did not have to excise kidney grafts because of haemorrhages. We have not so far investigated the question of stenosis, therefore, I would like to ask you for your criteria regarding the diagnosis of stenosis in your patients.

PARSONS Stenosis is defined radiologically, together with a pressure gradient exceeding 50mm Hg across the stenosis at operation. Clinically, one suspects this by having a patient with uncontrollable hypertension. All seven patients had severe hypertension.

HABERAL (Ankara) How do you diagnose the renal artery thrombosis? How can we save the graft, with this problem?

PARSONS Over ten years, a variety of methods have been used to detect arterial thrombosis; orginally it depended on arteriography, now on radioisotope studies. In the absence of signs of rejection one assumes thrombosis. In the cases here, we found, when the kidney came out, there was no sign of rejection in that kidney. Your question about why did we not then go and remove the clot is one that I will reserve for the surgeons.

KERR (Newcastle) Our surgeons may all be good physicians but they are not all keen statisticians. I wonder whether you could tell us whether there was a significant overall difference in complications between end-to-end and side-to-side anastomosis and whether you would advise us to tell our surgeons which of the two techniques they should use.

PARSONS I think our incidence of renal artery stenosis with end-to-end anastomosis is worrying, and is significantly different from the other types of

anastomosis. As far as haemorrhages and thrombosis are concerned, the differences are not highly significant, but if you want to avoid renal arterial thrombosis the message is, use a patch.

GELIN (Gothenburg) If we are going to discuss the vascular techniques used, we also have to consider what the host vessels are like. The type of arterial anastomosis to be used is determined by the condition of the host arteries. The surgeon has to make his decision on individual grounds based on host and graft artery conditions. That is the art of surgery. I have a question. Did you distinguish long-term and short-term arterial stenosis in your material? The short-term stenosis is an anastomotic complication, the long-term one an arterial disease.

PARSONS We did not include the short-term stenosis in our group because that is a technical problem. These patients had all developed post-stenotic dilatation, with the signs that they had been there a long time.