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VASCULAR COMPLICATIONS IN 417 CONSECUTIVE RENAL TRANSPLANTS

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ABSTRACT

The vascular complications, their management and results of treatment in 417 consecutive renal transplantations performed at Taleghani Hospital from September 1989 to December 1997, are presented. There were 7 (1.6%) vascular complications. Among them renal artery stenosis occurred in 2 cases (0.4%), renal artery thrombosis in 2 cases (0.4%), renal vein thrombosis in one case (0.2%), bleeding from the venous suture line in the immediate perioperative period in one case and renal pelvic necrosis in another one. Arterial reconstruction was performed in 2 patients and allograft removal took place in 3 patients. There was no death due to vascular complication.
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INTRODUCTION

Vascular complications are of major importance in renal transplantation since they may be dramatic and accompanied by significant morbidity and mortality. The usual risks associated with vascular surgery are exaggerated in the patient with renal failure because of the anemia, diminished host responses to infection, impaired hemostasis, and metabolic abnormalities that occur in these patients. These risks are further exacerbated by the effects of immunosuppressive drugs and the potential of urinary extravasation and sepsis.[1] However, they are generally the result of technical errors and in an exceeding number of them, salvage of the kidney is unlikely. The incidence has declined significantly in recent years due to meticulous vascular surgery techniques and better management of predisposing factors. However, the associated morbidity and mortality mandate major efforts to avoid these complications. In our review of 417 renal transplantations, the vascular surgery techniques used and the complications attributed to them are surveyed.

PATIENTS AND METHODS

Between September 19, 1989 and December 28, 1997, 417 renal transplants were performed. In 86 patients transplanted kidneys were obtained from related living donors, and in 331 from unrelated living donors. 255 patients were male and 162 female with age ranging from 4 to 62 years (mean age 31.6 years). The records of these patients were reviewed.

All patients underwent baseline radioisotope renography and renal ultrasonography within 48 hours of transplantation and as clinically indicated. Further studies such as Doppler sonography and arteriography were performed when necessary.

The complications related to the vascular aspect of renal transplantation were reviewed.

Surgical procedure

The iliac vessels are exposed retroperitoneally through a hockey stick incision, above the inguinal ligament extending cephalad medial to the anterior superior iliac spine. The renal vein is traditionally anastomosed end to side to the external iliac vein. The renal artery is usually anastomosed end to end to the internal iliac artery.

In cases with multiple renal arteries, the preferred surgical technique for anastomosis is based on the size of the arteries. If two renal arteries are of equal size, they are managed by making a "pair of pants" and by

anastomosing the waist to the recipient's artery. If a polar artery is significantly smaller than the main renal artery, better results can be obtained by anastomosing the end of the smaller vessel to the side of the main renal artery prior to implanting the kidney. The kidney is kept cool during the procedure, which allows adequate time for careful approximation of the vessels.

Children weighing less than 20 kg who receive an adult kidney, usually have the renal artery and vein anastomosed end to side to the common iliac artery and inferior vena cava, respectively.

Routinely, we use 2 closed-suction drains placed adjacent to the allograft and remove them when drainage is under 30 cc per day.

RESULTS

A total of 7 vascular complications (1.6%) occurred in our series. Of these complications 2 (0.4%) were due to arterial thrombosis, both recognized in the early postoperative period (one on the first and the other on the 8th postoperative day). In both cases abrupt cessation of urine output in a primarily functioning kidney was noted and radionuclide scanning and arteriography were performed to document the diagnosis. Both underwent allograft nephrectomy. In one of these cases the donor kidney had 2 arteries.

Renal vein thrombosis was noted in one patient who developed cessation of urine output postoperatively. The diagnosis was confirmed by angiography and nephrectomy performed on the 4th postoperative day. It was associated with severe acute rejection.

Renal artery stenosis occurred in 2 patients. Both had hypertension not controlled with reasonable medical regimens and a rise in serum creatinine. The diagnosis was documented by angiography performed 7 months and 25 days after the transplantations, respectively. One patient had atherosclerotic involvement of the iliac arteries proximal to the renal artery anastomosis. After endarterectomy and saphenous vein patch graft, no stenosis was detected at repeated angiography. One patient with arterial stenosis diagnosed on the 25th postoperative day did well after saphenous vein patch graft of the renal artery at the anastomosis site. The renal artery was anastomosed end to side to the common iliac artery at the time of transplantation because of the very low position of the iliac artery bifurcation, deep in the pelvis.

Acute hemorrhage in the immediate postoperative period was diagnosed in one case and urgent re-exploration performed. Extravasation of blood at the renal vein suture line was noted and corrected.

There was one case of renal pelvic necrosis, which presented as urinary leakage without a clear etiology, in a patient with 2 renal arteries. It was attributed to segmental arterial injury and pyeloureterostomy relieved the problem (Table I).

Of the 7 vascular complications, 3 patients (43%) underwent nephrectomy of the transplanted kidney. No patient death occurred secondary to a vascular complication.

DISCUSSION

Vascular complication rates are reported in the recent literature to range from 5-14%.[2-7] We noted a significantly lower rate of complications in our series. The major difference between our study and the previously reported series is that all of our kidneys were obtained from living donors and we had the opportunity to select our kidney donors based on their renal vascular status demonstrated by angiography. We tried to choose single renal artery kidneys with appropriate length, in a young healthy donor (mean age of donors 29.2 years). We had to perform a number of vascular procedures such as "anastomosing an aortic island patch containing the donor's renal arteries", to manage multiple donor's renal arteries. Moreover, an increased incidence of ureteral and vascular complications have been reported in connection with multiple renal arteries.[7,8,9] In our series, 24 (5.8%) transplanted kidneys had 2 arteries, from whom 2 (8.3%) developed a vascular complication. The vascular complication rate in transplants with a single renal artery was 1.2%.

In the case of vascular thrombosis, rescue of the allograft is unlikely. In our series all patients with arterial and venous thrombosis lost their allograft. Although renal artery and vein thrombosis are quite uncommon following transplantation (0.4 and 0.2% respectively), the associated morbidity mandates major efforts to avoid these complications.

We encountered 2 cases (0.4%) of renal artery stenosis detected by angiography performed because of refractory hypertension. One was located at the anastomosis site and the other in the iliac artery proximal to the anastomosis. Both cases were repaired with patch graft using a segment of saphenous vein. There was no case of renal artery stenosis located distal to the anastomosis, the most common site of stenosis.[1,10] Renal arteriography was not a routine investigation performed in transplanted patients in our center and not all of our patients underwent a regular follow-up examination at repeated intervals. Therefore, the actual rate of arterial stenosis in our center might be more than estimated.

The major misadventure was the unusual complication of bleeding from the venous suture line, which was easily recognized and managed in the immediate perioperative period.

Renal pelvic necrosis is frequently due to technical

Table I. Clinical features of 7 patients with vascular complications after renal transplantation.

Pt. No.	Age	Sex	Donor status	Complication	Treatment
1	13	m.	unrelated	arterial thrombosis	allograft removal
2	39	f.	unrelated	arterial thrombosis	allograft removal
3	27	m.	unrelated	arterial stenosis	venous patch graft & endarterectomy
4	27	m.	unrelated	arterial stenosis	venous patch graft
5	25	f.	unrelated	venous thrombosis	allograft removal
6	24	f.	unrelated	bleeding from venous suture line	7-0 polypropylene suturing of bleeding site
7	47	m.	unrelated	renal pelvic necrosis	pyeloureterostomy

error during the donor nephrectomy.[11] Extensive resection around the hilus of the kidney as well as injury to the lower segmental arteries should be avoided.[12] Salvage of the kidney with pelvic or ureteral necrosis is usually possible by early diagnosis and by using techniques for managing urine leaks.

Aneurysm formation at the renal artery anastomosis site, acute hemorrhage due to disruption of the arterial suture line in association with perinephric abscess, and allograft rupture were not encountered in our series.

In conclusion, vascular complications are generally the result of technical errors. The great majority of patients suffering from vascular complications of renal transplantation loose their allograft. Therefore, to avoid complications, careful harvesting of the donor organ without incision of the renal hilum and special attention to arterial anatomy in selection of donor and recipient are important. Meticulous operative hemostasis and close postoperative surveillance for early detection of complications are mandatory for a favorable result. We attribute our low vascular complication rate to living donors carefully selected.

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