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Vascular Complications of Allograft Nephrectomy

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Objectives. *To identify risk factors that predisposes patients to vascular complications from allograft nephrectomy and to determine the safe management of this group of patients.*
Design. *This is a retrospective review of 1543 renal transplants performed in our institution between January 1990 and January 2002.*
Patients and methods. *During this period, 161 (10.4%) transplant nephrectomies were performed, of which we identified nine patients (5.6%) who sustained significant vascular complications.*
Results. *Seven patients required ligation of external iliac artery for control of haemorrhage. Immediate vascular reconstructions (femoral–femoral cross-over bypass in two cases and one vein patch to an external iliac artery defect) were performed in three patients. Two patients had endovascular stenting of their external iliac artery pseudoaneurysm. No patient suffered limb loss. However, three patients died—two died from overwhelming sepsis and one patient died of an intracerebral haemorrhage.*
Conclusions. *While vascular complications associated with transplant nephrectomy are relatively rare, they are associated with a significantly poor outcome. Immediate attempts to reconstruct the vascular supply to the lower limb are associated with a high complication rate. We advocate that where possible, vascular reconstruction should be deferred and that external iliac artery ligation can be performed safely with surprisingly low limb ischaemia rate.*

Keywords: Allograft nephrectomy; External iliac artery ligation; Pseudoaneurysm.

Introduction

Although vascular complications of allograft nephrectomy are uncommon, they are associated with significant morbidity and occasionally mortality.[1–7] Frequently, transplant nephrectomy may be performed in a seriously immunosuppressed patient who may be uraemic and has co-morbid disease such as arteriosclerosis, diabetes or hypertension. It is, therefore, not surprising that vascular injury in these patients carries such a high morbidity rate. The most important factor in predicting significant vascular injury at the time of transplant nephrectomy is local infection either involving the anastomotic site or the allograft itself.[8–11] Infection at the anastomotic site predisposes to disruption of the anastomotic line with acute haemorrhage or pseudoaneurysm formation. In such circumstances, where it may even be necessary to ligate the iliac vessels to control haemorrhage, the issue of how and when to reconstruct a vascular inflow to the lower limb arises. We reviewed our experience of these extremely difficult clinical cases and report our findings.

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Materials and Methods

Between January 1990 and January 2002, we performed 1543 renal transplants in our institution; of which 1538 were cadaveric and five were living related transplants. The vast majority were primary transplants (1321) and 222 were sequential transplants. During this period we performed 161 transplant nephrectomies (10.39%).

Virtually, all the primary or secondary transplants were performed using an extra-peritoneal approach to the external iliac vessels. The donor renal artery was anastomosed in an end to side fashion to the external iliac artery employing a Carrell patch. The left renal vein was anastomosed end to side to the external iliac vein but for the right renal vein a caval extension was constructed for the anastomosis. Standard triple induction immunosuppression employing cyclosporine, steroids and azathioprine in unsensitised recipients was used. Quadruple induction

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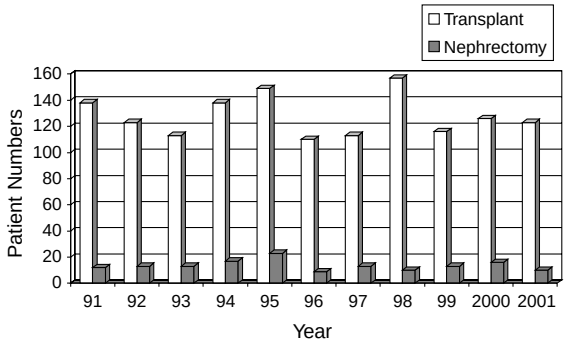

Fig. 1. Annual renal transplants and corresponding transplant nephrectomy (1991–2001).

immunosuppression using ATG (Fresenius®) was employed in highly sensitized recipients with a panel reactive antibody level >50% and in paediatric recipients.

Annually, the incidence of transplant nephrectomy in our institution is 10.39% (range 6.37–14.77%) (Fig. 1). The indications for transplant nephrectomy are shown in Table 1. We adopt a policy of performing transplant nephrectomy for all grafts that fail within the 1st year to reduce the risk of complications related to ongoing immunosuppression, infection, rejection and patient sensitization. Grafts that failed after the 1st year were nephrectomised only if they became symptomatic. A sub-capsular approach to transplant nephrectomy was employed if the nephrectomy was performed more than 3 months post-transplant. Of the 161 transplant nephrectomies performed in this study period, 60 were approached via an intra-capsular method and 101 were via an extra-capsular technique. To avoid iatrogenic injury to the iliac vessels, where possible, the renal vessels were oversewn and ligated close to the renal hilum, leaving the Carrell patch *in situ* on the recipient iliac artery. Standard peri-operative antibiotic using co-amoxiclav or ciproxin was administered at the time of nephrectomy unless specific cultures indicated otherwise. Immunosuppression was tailored following nephrectomy and discontinued after 12 weeks.

Table 1. Indications for transplant nephrectomy

Acute/hyperacute refractory rejection	
Within 1 week	2
More than 1 week, less than 6 weeks	26
Chronic rejection	
6 weeks to 6 months	15
More than 6 months	44
Renal vein or artery thrombosis	38
Primary non-function grafts*	9
Haemorrhage, anastomotic bleed, pseudoaneurysm	9
Recurrence of primary disease (FSGS)	6
Sepsis	5
Chronic symptomatic failed grafts†	3
Others	
Donor lymphoma disease	1
Polyoma virus in graft	1
Bleed post-renal biopsy	1
Malignancy in graft-renal cell carcinoma	1

* Including three primary non-perfused grafts.
† Symptoms included pain, hypertension, haematuria, pyerexia.

Results

Of the 161 transplant nephrectomies in this time period, nine patients suffered significant vascular injury. These patients' details are shown in Table 2. Almost all patients (78%) had proven peri-operative infection at the allograft site. There was no correlation between the laterality of the kidney transplanted and the development of vascular complications at the time of nephrectomy. In the sub-group experiencing vascular complications, four patients suffered pseudo-aneurysm formation (Fig. 2). Of these, two patients developed the pseudoaneurysm at a time interval of 7 weeks and 6 months following transplant nephrectany. Both patients underwent successful endovascular stenting of the iliac vessel excluding the aneurysm. The two remaining patients who developed pseudoaneurysm at the anastomotic site 2 months and 10 days respectively post-transplantation, required emergency surgical exploration for control of haemorrhage and simultaneous allograft nephrectomy. Both of these patients underwent ligation of the external iliac artery and vein to control haemorrhage. One of these patients required an immediate femoral–femoral cross-over bypass to restore inflow into the lower limb. Even though he did not suffer limb loss, he died 50 days post-transplant nephrectomy from overwhelming sepsis and secondary haemorrhage from the infected vascular graft site.

Three further patients sustained traumatic injury to the external iliac artery at the time of transplant nephrectomy necessitating eventual ligation of the external iliac artery for control of bleeding. Of these three patients two had intra-capsular transplant nephrectomy and none had proven infections. In one patient (No. 4), immediate reconstruction of the external iliac artery was performed using a saphenous vein bypass graft. Unfortunately, this patient developed MRSA wound infection and suffered severe haemorrhage from the site of the vein graft on the 21st post-operative day and required ligation of the external iliac artery on re-exploration. The remaining two patients suffered severe haemorrhage post-transplant nephrectomy associated with significant local infection and required surgical re-exploration and

Table 2. Patient's demographics

Pt	Gender	Age	Interval between Tx and Tn	Indications for Tn	Surgical technique	Infection	Vascular injury	Management	Outcome
1.	M	22	67 days	Sepsis and bleeding	Extracapsular	MRSA and *Clostridium difficile* wound infection pre-Tn	EIA pseudoaneurysm post-Tn	EIA ligation femoral–femoral cross-over	Death
2.	M	23	8 months	Chronic rejection	Intracapsular	None	EIA injury at Tn	EIA ligation	Claudicant
3.	M	21	10 days	Sepsis and renal vein thrombosis	Extracapsular	Serratia and CMV septicaemia pre-Tn	EIA psedoaneurysm and bleeding at Tn	EIA ligation	Claudicant
4.	F	23	6 days	Acute rejection and renal vein thrombosis	Extracapsular	MRSA wound infection post-Tn	EIA injury at Tn bleeding post-Tn	Saphenous graft repair, later graft blow out and EIA ligation	Claudicant
5.	F	47	7 days	Acute rejection	Extracapsular	MRSA wound infection post-Tn	EIA bleeding post-Tn	EIA ligation femoral–femoral cross-over	Claudicant
6.	F	38	6 years	Chronic rejection	Intracapsular	*Clostridium* and coagulase negative *Staphylococcus* wound infection post-Tn	EIA injury at Tn	EIA ligation	Death
7.	F	15	43 days	Sepsis and bleeding	Extracapsular	Fungal septicaemia pre-Tn	EIA bleeding at Tn	EIA ligation	Death
8.	M	21	14 days	Acute rejection and sepsis	Extracapsular	MRSA septicaemia pre-Tn post-Tn	EIA pseudoaneurysm	Psedoaneurysm stented	Claudicant
9.	M	41	6 years	Chronis rejection	Intracapsular	None	EIA pseudoaneurysm post-Tn	Pseudoaneurysm stented	Claudicant

Pt, patient; Tx, transplant; Tn, transplant nephrectomy; M, male; F, female; MRSA, methicillin resistance *Staphylococcus aureus*; CMV, cytomegalovirus; EIA, external iliac artery.

ligation of the external iliac vessels. Of these two patients, one died from sepsis 3 days post-transplant nephrectomy, the other underwent a femoral–femoral bypass graft. This graft required thrombectomy, 4 years following its insertion and this patient now experiences intermittent claudication at 200 m. In summary, of the seven patients who underwent ligation of the external iliac vessels, three underwent immediate reconstruction of the vascular supply to the ipsilateral lower limb (two femoral–femoral cross-over, one saphenous vein graft repair).

No patient suffered limb loss. Three patients died—two patients died from systemic sepsis as described earlier 3 and 50 days post-transplant nephrectomy, respectively. The remaining patient died 3 months following his transplant nephrectomy due to cerebrovascular haemorrhage. With the exception of the lady who underwent delayed thrombectomy of her femoral–femoral bypass graft, none of the surviving patients required any further vascular intervention, with a mean follow-up of 88 months.

Discussion

Vascular complications are a relatively rare but potentially life and limb threatening event in a patient undergoing transplant nephrectomy. The overall reported morbidity of transplant nephrectomy ranges from 4.3 to 84.4% with mortality rates quoted between 1.2 and 38%.[1–3,8,12] Significant variations in these results reflect the disparate clinical indications for transplant nephrectomy reported and the variations in timing of nephrectomy post-transplantation in the series published.

The incidence of vascular complications reported ranges between 0.9 and 14%.[8–11] Of the seven published series reporting external iliac artery ligation,[1,4,8–11,13] Blohme *et al.*[9] reported the largest number of cases of external iliac artery ligation with 13 patients undergoing this procedure for control of massive haemorrhage. No patient in this series underwent reconstruction of the blood vessels to the ipsilateral lower limb in the immediate peri-operative

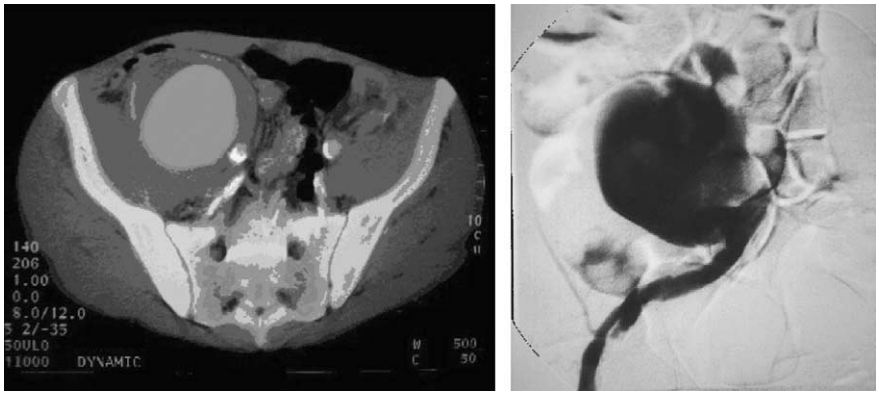

Fig. 2. CT and angiographic appearance of external iliac pseudoaneurysm post-transplant nephrectomy.

period and no patient sustained limb loss. The conclusions of this study correlate to the clinical management of our own series of cases. Seven of nine patients in our series underwent ligation of the external iliac vessels secondary to vascular injury. In two of these cases, vascular inflow to the lower limb was restored at the time of transplant nephrectomy by PTFE® femoral–femoral bypass grafts. In one of these two cases, the bypass graft became infected resulting in secondary haemorrhage and the patient died of sepsis and haemorrhage before further surgical treatment could be conducted. The other patient that underwent femoral–femoral bypass grafting required thrombectomy of her bypass graft and currently experiences moderate symptoms of lower limb ischaemia.

Virtually, all cases in our series of transplant nephrectomy that went on to develop a vascular complication had evidence of systemic or local infection around the time of surgery. Attempting to perform vascular reconstruction in the presence of local infection is associated with an extremely high risk of further infection of the vascular graft. This may in turn lead to secondary haemorrhage. In the situation where no infections were diagnosed, our results showed that intra-capsular technique was associated with higher rate of traumatic injury to iliac vessels, though it is hard to draw any conclusion due to the small number of cases examined here.

Contrary to reports of iliac arterial injury necessitating ligation in military personnel where there was a high incidence of limb loss,[8,9] ligation of the external iliac vessels in patient with renal failure is not uniformly associated with critical limb ischaemia. In our, albeit small series, we report that ligation of the external iliac artery without immediate vascular reconstruction resulted in preservation of the lower limb and surprisingly these patients did not demonstrate significant ischaemic symptoms subsequently. For those patients where the ipsilateral lower limb is deemed critically ischaemic at the time of the transplant nephrectomy, an extra-anatomical bypass such as femoral–femoral bypass graft employing antibiotic impregnated synthetic graft material is the preferred method of reconstruction. This technique allows the vascular graft to be sited as far distant as possible from the potential site of infection. Immediate vascular reconstruction to control bleeding had been shown to have high re-bleeding rate and this is evident both in our experience with the use of a venous graft and from the data in the literature.[2,8,11]

In conclusion, this review of the management of vascular complications of allograft nephrectomy in our institution over a 12-year period showed that external iliac ligation could be performed safely in the initial management of haemorrhage at time of transplant nephrectomy. Our experience with a low rate of ipsilateral limb compromise further supports the findings of previous published series. If vascular inflow needs to be re-instituted immediately, antibiotic impregnated synthetic graft with an extra-anatomical route is preferable. The major risk factor determining high morbidity is pre-existing infection. The importance of good infection control with prophylactic antibiotics and culture proven appropriate antibiotics, as well as strict glycaemic control and nutritional care is, therefore, paramount. Endovascular stenting to exclude pseudoaneurysms may be a novel form of treatment for these patients and will need further evaluation of its efficacy and safety.

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