Renal vessel reconstruction in kidney transplantation using a polytetrafluoroethylene (PTFE) vascular graft

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Abstract

Background. We report a rare experience in reconstructing short renal vessels in kidney transplantation using polytetrafluoroethylene (PTFE) vascular grafts.

Methods. The short renal vessels in three kidney grafts were managed by the interposition of PTFE vascular grafts. Two grafts were from deceased donors and the third was a renal auto-transplant graft.

Results. PTFE grafts were used to lengthen short renal veins in two kidney grafts and a short renal artery in one. The warm ischaemia time was under 1 h and all kidneys functioned well post-operatively. Excellent blood perfusion in the three renal grafts was present on postoperative MAG 3 renal scan. No intra-operative or post-operative complications were encountered.

Conclusions. In the three described patients, the use of PTFE vascular graft presented no additional morbidity to the kidney transplant operation and no post-operative complication was related to its use. However, more data are necessary to conclude that PTFE graft can be used safely in kidney transplantation.

Keywords: kidney transplantation; PTFE graft; vascular injury

Introduction

Damaged or short donor renal vessels during deceased or live donor nephrectomy represent a technical challenge to the transplant surgeon. Donor kidneys with damaged vessels are often declined when offered for transplantation because of increased risk of thrombosis, bleeding, or compromised renal function. Also, the introduction of laparoscopic donor nephrectomy, especially from the right kidney, has led to an increase of compromised organs [1].

Among the various described techniques to repair a short or damaged donor renal artery are end-to-end anastomosis of the graft artery, side-to-side anastomosis of the branch artery and the use of the iliac arterial graft. A short donor renal vein may be managed by transposition of the recipient’s external iliac vein following ligation of the internal iliac vein, lengthening of the donor vein by dissection at the renal hilum and use of the venous grafts [2].

We describe the case of three kidney transplants in which a polytetrafluoroethylene (PTFE) vascular graft (Hybrid PTFE®, Atrium Medical Cooperation, Hudson, NH, USA) was interposed between a short renal and recipient vessel. Two of the described kidneys were allografts procured from deceased donors and the third was a renal auto-transplant. In the case of the two deceased donor grafts, donor iliac vascular grafts were procured by the liver transplant team and we do not store donor iliac vessel grafts. Also, the use of saphenous vein graft was not favoured because of its potential need for coronary artery bypass graft surgery (CABG) in these two transplant recipients. In the renal auto-transplant case, the patient did not consent to the use of a saphenous vein graft.

Technical considerations

Initially, end-to-side anastomosis of the PTFE graft to the recipient vessel was done using 6-0 proline suture on a 13mm needle. This was followed by cross clamping of the PTFE graft and an end-to-end anastomosis between the PTFE graft and the renal vessel, using the same suture material and needle size. Topical fibrin glue was placed at the PTFE-recipient/renal vascular anastomosis in case of needle hole bleeding.

The grafts were not soaked in antibiotic solution before implantation. However, all patients received preoperative antibiotic prophylaxis (amoxicillin and clavulanic acid); this was continued...
for 24 h post-operatively. Systemic heparin was not
given. The lumen of the PTFE graft was flushed using
heparinized saline (5000 IU of heparin in 1 litre of
normal saline). All kidneys perfused homogenously
with no evidence of graft ischaemia. No intra-operative
complications were encountered. The warm ischaemia
time was <1 h. A follow up MAG 3 scan in the
post-operative period showed good perfusion in the
three grafts. Anti-coagulation therapy was not given
post-operatively except in one patient, who was
ventilated in the intensive care unit (ICU) to reduce
the risk of deep venous thrombosis. In the two
deceased donor kidney grafts, post-operative immuno-
suppression was maintained by tacrolimus, mycophene-
nolate mofetil and prednisolone. All three patients had
a rigorous check of blood pressure every 3 months with
Doppler ultrasonography every 6 months following
kidney transplant to check for patency of PTFE grafts,
which have remained patent to date. Further details of
the three patients are described.

**Case histories**

**Case 1**

T.D. is a blind obese 40-year-old male patient, with type
1 diabetes mellitus (DM) and end-stage renal failure
(ESRF) secondary to diabetic nephropathy. He underwent
simultaneous pancreas and kidney transplant (in
right and left iliac fossa, respectively) in 1994. The
kidney suffered chronic allograft nephropathy and failed
4 years later; the pancreas failed in the year 2002.
Neither transplanted pancreas nor kidney were removed.

He subsequently received a 0-0-0 antigen mismatch
left kidney from a deceased donor in the same year his
first kidney transplant failed. Because of the severely
calciﬁed aorta and iliac vessels, known to the
transplant team from his previous simultaneous
pancreas and kidney transplant operation, the
transplant surgeon decided to transplant the new kidney in
the place of the native left kidney (orthotopic
transplant) with vascular anastomosis to recipient’s
native renal vessels stumps.

Following the left native nephrectomy, the native
left renal artery was found to be calcified with poor
back ﬂow. The surgeon decided to anastomose the
donor renal artery to the recipient’s aorta with
dissection of the infra-renal aorta. The donor renal
artery was too short to bridge the gap to the infra-renal
aorta. A thin wall PTFE vascular graft, 7 cm in length
and 6 mm in diameter, was used to extend the donor
renal artery. The patient had an uneventful post-
operative recovery. Four years following the transplant
operation, the kidney is functioning well with a current
serum creatinine of 129 mmol/l.

**Case 2**

N.K. is a blind obese 37-year-old male patient with
ESRF secondary to type 1 DM. The patient had severe
diabetic vasculopathy with bilateral above the knee
amputation. He also has a known history of difﬁcult
endotracheal intubation.

The patient was admitted for a deceased donor
kidney transplant 2 years ago. A 1:1:1 antigen
mismatch right deceased donor kidney with caval
venous extension was used. Following a difﬁcult intra-
operative dissection, the iliac vessels were found
atheromatous and not suitable for vascular anastomosis.
Anastomosis between the donor renal vein and vena cava was performed. The donor artery was
too short to be anastomosed to the patient’s
aorta. A thin wall PTFE graft, 6 cm in length and
6 mm in diameter was interposed between the
donor renal artery and aorta. Due to the
patient’s history of difﬁcult endotracheal intubation
and the risk of delayed graft function (DGF), the
patient was admitted to ICU and remained intubated
for 7 days post-operatively. During his stay in ICU,
the patient received anticoagulation using Enoxaparine
sodium at a dose of 40 mg administered subcutane-
ously every 24 h. The kidney suffered DGF for
1 week, during which he was maintained on haemo-
dialysis. A MAG 3 scan performed during this
period showed good blood perfusion in the transplant
kidney.

During this time, urine output started to improve
and the creatinine started to clear slowly. The patient
was discharged from ICU on the 12th post-operative
day and had uneventful recovery. Two years following
his transplant operation, the transplant kidney is
functioning well with a current serum creatinine of
135 mmol/l.

**Case 3**

A.R. is a 44-year-old female patient with severe
bilateral, loin pain-haematuria syndrome. As a treat-
ment for this syndrome, she underwent a nephrectomy
for a poor functioning left kidney and denervation
for the right kidney. The patient continued to
complain of loin pain-haematuria syndrome in
the remaining right kidney. A right renal auto-
transplantation was performed as a treatment option
for this syndrome [3]. A standard right side
nephrectomy was done with the auto-graft trans-
planted to the right iliac fossa. The right renal vein
was only few millimetres in length. A thin wall PTFE
vascular graft, 2.5 cm in length and 6 mm in diameter
was used to lengthen the renal vein and was
anastomosed end-to-side to the external iliac vein.
The patient had an uneventful post-operative recovery
and was discharged with a serum creatinine of
130 mmol/l. One year following the transplant opera-
tion, recurrence of the loin pain-haematuria syndrome
occurred in the auto-transplant kidney and was
managed by graft nephrectomy; however, the PTFE
vascular graft was patent.
Discussion

There are few reported cases describing the use of PTFE grafts in reconstructing short or damaged renal vessels in kidney transplantation. Delphin [4] described two cases in which PTFE grafts were successfully used to lengthen short donor renal veins in two deceased donor kidney grafts. In Delphin’s report, the PTFE grafts remained patent for at least 10 and 2 years. In another case report, Blacklock [5] described donor renal artery reconstruction in a renal auto transplant using a PTFE graft. However, in the previous report, the reason for the use of PTFE graft use was the hypothesis of preventing the recurrence of the loin pain-haematuria syndrome by preventing sympathetic reinnervation along the renal artery. In Blacklock’s report, recurrence of the loin pain-haematuria syndrome occurred and auto transplant graft nephrectomy was performed 2 years later but with a patent PTFE graft.

Our report adds an additional three cases to what has been previously described on the use of PTFE grafts in reconstructing donor renal vessels, with an emphasis on the technical details involved in the procedure. In the three cases we performed, cadaveric iliac vascular grafts were not available at the time of transplant and the use of saphenous vein graft was not feasible.

The technique of initial anastomosis of the PTFE graft to the recipient vessel, followed by PTFE vascular graft cross clamping and anastomosis of the PTFE graft to the renal vessel, resulted in a warm ischaemia time of <1 hour, leading to a better functioning graft. We preferred anastomosing PTFE graft to recipient iliac vessel during the transplant operation rather than performing the anastomosis to the kidney graft vessel at the bench with a cooled kidney, since we believe this leads to an easier intra-operative vascular anastomosis between renal and recipient vessel. This also gives the advantage of shorter lower limb ischaemia time.

We did not use systemic heparin, due to the reported increased risk of bleeding and the greater need for blood transfusion in transplant surgery associated with heparin use [6].

We did not experience any technical problem or complication in the described cases. However, there is little in the literature pertaining to the long-term outcome of PTFE vascular grafts in kidney transplantation. Most of the long-term data on the use of PTFE vascular grafts originated from its use in lower limb revascularization [7,8]. These grafts tend be long and with slow blood flow. PTFE vascular grafts used during kidney transplantation are short in length and with high blood flow and consequently may have better long-term results than PTFE grafts used in treating lower limb ischaemia. Also, we are unaware of studies comparing long-term results of biologic vs prosthetic vascular grafts in kidney transplantation.

Conclusions

In our report, the use of PTFE vascular grafts in the three patients described provided a solution that is simple, technically easy and with no graft site complications. Our results with the use of PTFE vascular grafts for reconstructing short or damaged renal vessel in kidney transplantation need to be tested in bigger series and in comparison with biologic vascular grafts.

Conflict of interest statement. None declared.

References


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