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

Mohamed H. Kamel, Anil A. Thomas, Ponnusamy Mohan and David P. Hickey

Department of Transplantation Surgery, Beaumont Hospital, Beaumont road, Dublin, Ireland

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...
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 atheromatus 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 subcutaneously every 24 h. The kidney suffered DGF for 1 week, during which he was maintained on haemodialysis. 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 treatment 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 transplanted 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 operation, 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 vessels 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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