Case Report

The axillary artery-popliteal vein extended polytetrafluoroethylene graft: a new technique for the complicated dialysis access patient

Francis R. Calder, Eric S. Chemla, Liz Anderson and Rene W. Chang

Department of Renal Surgery and Transplantation, St George’s Hospital, London, UK

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Introduction

It is essential to increase the level of awareness for the need to preserve the integrity of the venous system in the dialysis patient. Central venous stenosis is a major problem for this population, effectively excluding an affected individual from the safest and most efficacious form of vascular access—a native upper limb fistula. Amongst end-stage renal failure (ESRF) patients central venous stenosis is most common in those who have had subclavian catheterization with an observed incidence of over 40% [1]. Current treatment of central stenosis is by angioplasty and stenting [for early (<3 months) recurrence and elastic lesions]. However, there is an initial failure rate of 30% and recurrence within a year is the norm [2]. Managing the access of such patients is often made more complex by the presence of significant peripheral vascular disease in the lower limbs. This precludes a lower limb fistula based on the femoral vessels because of the significant risk of a ‘steal syndrome’ or frank gangrene.

We report a novel approach to managing the patient who is unable to peritoneal dialyse, has central venous stenosis and peripheral vascular disease.

Case 1

The patient is an obese 68-year-old black lady with autosomal dominant polycystic kidney disease-related ESRF, hypertension and type 2 diabetes. She began dialysis in 1988 on peritoneal dialysis but was converted to haemodialysis in 1989 after multiple episodes of peritonitis and developing a large incisional hernia post nephrectomy. Her vascular access history involved native fistulae and grafts in both upper limbs and many central venous catheters. In 1999, she developed central venous stenosis and underwent repeated angioplasty and stenting but with recurrence and finally occlusion. Blood supply to both lower legs was poor with one diseased vessel below the knee bilaterally. By 2002, the patient was dialysing poorly through femoral catheters and after several serious line infections she underwent a right-sided axillary artery-popliteal vein extended polytetrafluoroethylene (PTFE) graft in November 2002. Two weeks post-operatively, she developed a large seroma with overlying skin necrosis at the lower margin of the wound. This was debrided and skin grafted successfully. Four weeks post-operatively, the right lower leg became swollen and a superficial ulcer developed over the lateral malleolus after a minor trauma. Fistulography revealed stenosis of the common iliac vein which was dilated by angioplasty. The leg swelling has resolved but the ulcer remains unhealed due to poor arterial supply. Dialysis through the graft was initiated 4/52 post-implantation and has been working well for the last 11/12. There have been no infective complications and it is easily cannulated in the thigh (Figure 1). Dialysis requirements show a urea reduction ratio (URR) of 69%, mean pump speed 300 ml/min and venous pressures of 130 mmHg.

Case 2

A 57-year-old Caucasian woman with type 1 diabetes and hypertension developed ESRF in 1999 and began peritoneal dialysis. This was complicated by six episodes of peritonitis and several central venous catheters were inserted whilst her peritoneum was ‘resting’. In 2002, after further infections, peritoneal dialysis was abandoned and dialysis was commenced through a long-term central venous catheter. In July 2002, after developing superior vena cava thrombosis, dialysis was switched to tunnelled femoral venous catheters. In March 2003, with worsening dialysis...
adequacy, a venogram showed bilateral common iliac vein stenosis. At the same time, the patient developed critical ischaemia of the right foot and arteriography demonstrated unreconstructable arteriopathy below the knee bilaterally. With no other options, the left common iliac stenosis was dilated by balloon angioplasty and stented percutaneously. Subsequently, the patient underwent a left axillary artery-popliteal vein extended PTFE graft at the beginning of May 2003. There were no wound problems and the graft was first used 2/52 post surgery. Dialysis requirements show a URR of 70%, mean pump speed 300 ml/min and venous pressures of 120 mmHg. There have been no complications to date.

Discussion

Vascular access is the Achilles heel of managing ESRF patients. It is inevitable that as the dialysis programme ‘matures’ ever more imaginative methods will be required to avoid patients dying simply from lack of access. The axillary artery-popliteal vein extended PTFE graft is a solution to the complex problem of managing patients with central venous obstruction who are excluded from a lower limb fistula due to peripheral vascular disease and who are unable to undergo peritoneal dialysis.

We would offer several recommendations to those contemplating this form of vascular access:

- Careful consideration should be given to forming a fistula based upon the femoral artery. A history of claudication, absence of palpable pulses at the ankle, or an ankle:brachial pressure index below 0.8 mandates further investigation. We would consider multisegmental disease not amenable to angioplasty as unsuitable for a lower limb fistula.

- Surgical technique: the second part of the axillary artery should be exposed below the clavicle (by dividing the pectoralis minor) and the arterial anastomosis is performed proximal to the thoraco-acromial vessels, where the artery is relatively immobile. An 8 mm reinforced standard wall PTFE graft is used. It is tunnelled subcutaneously in two stages along the anterior axillary line, lateral to the breast, and over the lower ribs. This is achieved by delivering the graft from the subclavicular position through a separate skin incision in the flank and then further tunnelling it over the abdomen and onto the anterolateral aspect of the thigh (lateral to the femoral vessels) (Figure 2). In the subclavicular position the graft is allowed some degree of ‘play’ to permit movement of the shoulder. The reinforcing ‘rings’ are removed (to enable cannulation) so that they are present only in the lower abdominalinguinal section of the graft. A long (3 cm) venous anastomosis is made to the superficial femoro-popliteal
vein in the subsartorial canal. By this technique the risk of contamination from the groin at surgery (with an infection rate of 18% [3]) or from cannulation [4] is minimized. In addition, it also avoids disrupting the femoral triangle and popliteal fossa lymphatic plexi which may result in lymphocoele formation and wound complications.

Echocardiography should demonstrate good left ventricular function pre-operatively. Post-operatively expect systolic blood pressure falls by up to 20 mmHg with a reflex tachycardia to accommodate the reduced peripheral vascular resistance. Near pre-operative blood pressure is regained after 2 weeks.

A full compliment of peripheral pulses should be present and Duplex scanning of the carotid, subclavian and axillary arteries in the ipsilateral arm should be performed pre-operatively. This is to minimize the risk of a 'steal syndrome'. If, however, a steal syndrome does evolve, this could be managed by a distal revascularization–interval ligation procedure [5] from the carotid to brachial artery.

Lower limb venography is also recommended since these patients have frequently had temporary femoral venous dialysis catheters with associated silent pelvi venous stenoses. These should be dilated pre-operatively.

Cannulation of the graft is best achieved over the antero-lateral aspect of the thigh, where the graft is more fixed and easier to palpate than over the abdomen (Figure 2). An alternative site is over the lower ribs if the patient is not obese.

All other dialysis options should be explored before resorting to this access since it has not been described before (a Medline search reveals one reference to an axillo-femoral graft in a child but with no adequacy/ follow-up data [6]). However, our experience is that it is an easily cannulated reliable form of access where all other options are closed.

Conflict of interest statement. None declared.

References


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