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An evaluation of expanded polytetrafluoroethylene (PTFE) loop grafts in the thigh as vascular access for haemodialysis in patients with access problems

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Summary

A total of 21 patients with vascular access problems received 22 PTFE loop grafts in the thigh as vascular access for haemodialysis. Eighteen of 22 grafts supported haemodialysis during the patients' lifetime. Actuarial patient survival was 50% at 2 years with a cumulative graft patency in the survivors of 80.5%. Although early thrombosis has been a problem, no graft has been lost from infection. We feel that these results are encouraging enough to recommend the use of PTFE grafts in the thigh of patients with vascular access problems.

Introduction

A prerequisite of successful long-term haemodialysis is the ability to provide adequate long-term vascular access. The peripheral arteriovenous fistula, created between the radial artery and cephalic vein at the wrist, originally described by Brescia *et al. (1)*, is the vascular access of choice for patients on chronic haemodialysis. However, with increased longevity of patients in chronic renal failure, greater numbers of patients are being seen with difficult access problems relating to such factors as thrombosis or infection in the fistula. For some individuals the lack of a suitable vein or artery precludes an initial attempt at creating a fistula at the wrist and an alternative is necessary. For such patients the autogenous saphenous vein graft arteriovenous fistula was introduced *(2)*. However, the long saphenous veins may be of too small a length or calibre. Encouraging claims have been made for bovine carotid heterografts *(3)* but they suffer from high cost, lack of availability in various sizes and susceptibility to infection. More recently there have been encouraging reports of the use of expanded polytetrafluoroethylene (PTFE) grafts with a cumulative graft patency of 69% at 2 years when used in the forearm *(4)*. While there have been numerous papers from the USA reporting good results with PTFE, there have been few studies from the United Kingdom and some have reported disappointing results *(5)* and a high incidence of complications *(6)*. This paper reports our experience in 21 patients where a loop graft of PTFE was used to create vascular access in the thigh.

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Patients and methods

A total of 21 patients received 22 grafts in the thigh. The mean age of the patients was 50 years (range 18–74 years). Eleven patients had received numerous access procedures over a number of years and suitable autogenous veins had been exhausted. Nine patients had either poor arm veins or no suitable veins could be located. In particular, a number of older patients had 'spidery' veins in the arms which bruised easily, even after simple venepuncture, and were considered unsuitable for a simple Brescia–Cimino arteriovenous fistula.

One patient had an inadequate fistula in the left forearm and had thrombosed her right forearm fistula following a period of hypotension as a result of shock related to a spontaneous rupture of the oesophagus. An attempt to recreate the fistula in the right forearm some months later resulted in gross oedema of the arm, a result of unsuspected subclavian vein stenosis consequent upon previous subclavian line cannulation for dialysis. This fistula was ligated, resulting in resolution of the oedema and a PTFE loop was fashioned in the left thigh.

Reinforced expanded PTFE grafts (FEP Ringed Vascular Graft, Gore-tex®) 6 mm in diameter and 45 cm long, were implanted in the thigh. An incision was made in the skin crease of the groin and all tributaries of the long saphenous vein ligated. A Satinsky clamp was applied to the femoral vein and the long saphenous vein excised flush with the femoral vein and ligated. A 6 mm PTFE graft was cut obliquely at 45° and anastomosed

FIG. 1 The Gore-tex® graft is shown tunnelled through small incisions on the anterior aspect of the thigh, the incisions subsequently being closed with interrupted 3/0 silk sutures. Needling is carried out on the straight parts of the graft avoiding the ringed 'apex' of the loop.

end to side to the femoral vein at the site of excision of the long saphenous vein using continuous 6/0 Prolene. A subcutaneous tunnel was then created on the anterior aspect of the thigh (Fig. 1) so that the ringed part of the graft was at the apex of the loop. The other end of the graft was then cut obliquely at 45° and anastomosed end to side to the superficial femoral artery using a continuous 6/0 Prolene suture. Grafts were needled as indicated by the clinical need for dialysis, two grafts being needled within 24 h of insertion with no problems.

Results

Eighteen of 22 grafts supported haemodialysis during the patients' lifetime. Six patients died with patent grafts from 3 days to 15 months postoperatively. Twelve grafts remain patent between 1 and 24 months postoperatively. Actuarial patient survival was 50% at 2 years with a cumulative graft patency at 2 years in the survivors of 80.5% (Fig. 2).

Of the four grafts that failed, one graft would not perfuse in theatre due to technical difficulties with the arterial anastomosis and was removed, two underwent thrombosis within 24 h and could not be salvaged and one developed a false aneurysm at the arterial anastomosis 1 month postoperatively. This patient had amyloid in his vessels and at exploration there was no sign of healing at the anastomoses and the graft was removed.

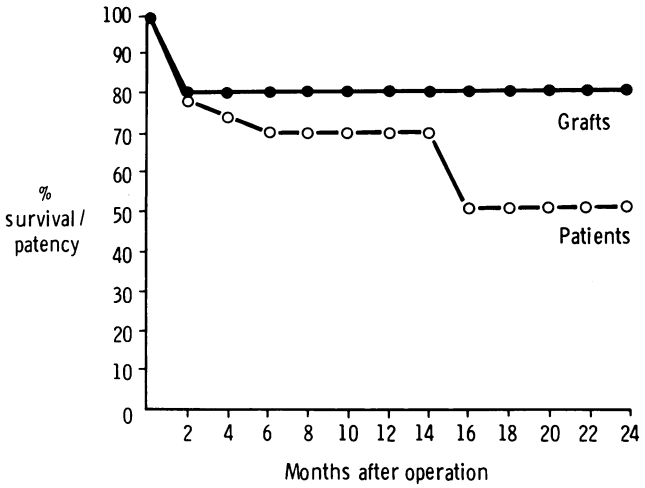

FIG. 2 Cumulative graft patency and actuarial patient survival in patients with PTFE loop grafts in the thigh.

Two patients developed infection at a localised site along the graft at 10 months and 15 months respectively. These failed to settle on antibiotics and in both cases the infected segment of the graft was excised and a new segment interposed, bypassing the area of infection. Both grafts remain patent at 15 and 20 months respectively. One patient developed streptococcal cellulitis along the whole course of the graft at 12 months, associated with streptococcal septicaemia. This settled rapidly on benzylpenicillin. The same patient thrombosed her graft at 18 months but this was successfully treated by disobliteration with an embolectomy catheter and the graft remains patent at 24 months.

Discussion

The overall PTFE graft cumulative patency of 80.5% at 2 years compares favourably with that of other larger reported series *(7,8,9)*. In our series, all grafts were placed in a loop configuration in the thigh as veins were either absent or considered inadequate in the upper limb. In the 50 patients reported by May *et al. (8)*, 20 grafts were in the upper limb and 30 in the thigh. Seven of the grafts underwent thrombosis and it is of interest to note that six of the seven occurred in the upper limb. This was presumably due to the better venous run-off from the femoral vein compared with veins in the antecubital fossa. Three grafts in our series thrombosed within 24 h of surgery and in each case there were problems with the arterial anastomosis and thrombosis can be attributed to technical problems. There was only one late thrombosis and this was easily corrected by disobliteration with an embolectomy catheter. At the time of this report no graft has been lost from infection. Two grafts developed infection at localised sites along the course of the graft which failed to respond to antibiotics. Both these infections were successfully treated by excising the infected segment of graft and interposing a new segment bypassing the area of infection, a technique reported by Sloof *et al. (10)*. One patient with streptococcal cellulitis extending the whole length of the graft tunnel responded quickly to antibiotic therapy.

An advantage of the PTFE graft is that it can be needled shortly after insertion, whereas with the autogenous saphenous vein a period is needed for the vein to mature to a suitable size for needling. Also, the operation can be performed rapidly, the average operating time being approximately 60 min. Our impression is that PTFE grafts have an important role in the management of patients with difficult access problems. Although early thrombosis has been a problem, no graft has been lost from infection. These observations, however, are based upon a limited follow-up period and further experience is needed to properly assess ultimate results. However, we feel these results are encouraging enough to recommend the use of PTFE grafts in the thigh of patients with vascular access problems.

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Notes on books

Pocket Manual of Basic Surgical Skills by C W Van Way III and C A Buerk. 228 pages, paperback, illustrated. C V Mosby, St Louis. £12.

A pocket book in a ring-binder aimed at medical students and house officers. It describes basic surgical techniques such as suturing, knot tying, biopsy methods, catheterisation and principles of trauma care.

Introduction to Surgery by David H Levien. 298 pages, illustrated, paperback. W B Saunders, Philadelphia. £16.95.

A synopsis of general surgery designed for the medical student. The author recommends that it should be read from start to finish over the course of a few days so as to gain a perspective of the totality of general surgery. Pocket book sized in a ring-binder, it reads easily and the text is broken up with numerous line diagrams.

Physiological and Pharmacological Aspects of the Reticulo-Rumen edited by L A A Ooms, A D Degryse and A S J P A M Van Miert. 318 pages, illustrated. Martinus Nijhoff, Dordrecht. £70.95.

Ruminants have been domesticated for many centuries and have served mankind as a source of dairy products, meat, wool and power. The ruminant's stomach has long been of interest to physiologists, pathologists and veterinarians. This book is based on papers presented at a workshop sponsored by the European Association for Veterinary Pharmacology and Toxicology and discusses all aspects of this fascinating field.

Computer Tomographic Imaging and Anatomic Correlation of the Human Brain by C Plets, A L Baert, G L Nijs and G Wilms. 111 pages, illustrated. Martinus Nijhoff, Dordrecht. £51.25.

This is a comparative atlas of thin CT-scan sections correlated with anatomical preparations. A useful reference atlas for radiologists and neurosurgeons.

1987 Yearbook of Vascular Surgery edited by John J Bergan and James S T Yao. 387 pages, illustrated. Yearbook Medical Publishers, Chicago. £37.

Over 3500 articles on vascular surgery were reviewed by a team of editors to choose those that should be summarised in this, the latest issue, of a well-known series. Most of the summaries have an editorial comment, sometimes long, sometimes short. Required reading for all those who practise vascular surgery and wish to remain in touch with current thinking in this subject.

Anesthesia and Organ Transplantation edited by Simon Gelman. 254 pages, illustrated. W B Saunders, Philadelphia. £45.

Beginning with chapters on the immunological aspects of tissue transplantation, ethics and organ preservation the book goes on to consider the anaesthetic problems in transplantation of kidneys, heart and heart-lung, liver and replantation of severed limbs. There is also a chapter on burns entitled 'Skin Transplantation'. Anaesthetists who work in transplantation centres should certainly find this book of interest.