Early experience with a new knitted Dacron prosthesis


SUMMARY.—A new low porosity knitted Dacron Prosthesis (Vascutek Triaxial) has been compared with standard Dacron prostheses and early clinical experience reviewed. Porosity (Wesolowski principle) and diaphragm burst strength were measured under standard conditions. Bypass grafts were implanted in the aorta in mongrel dogs using Triaxial (n=17) or a current Dacron prosthesis (n=17) for periods up to 6 months. Porosity was 750 mls/cm²/min in Triaxial and 1500 mls/cm²/min in controls. Burst strength values were higher in Triaxial (1000 kPa) compared to control grafts (796 kPa). Histology and electron microscopy showed good tissue incorporation and "endothelialisation" with the Triaxial. One hundred-twenty-one consecutive Triaxial grafts were inserted in 89 patients (74%) for critical ischaemia due to aorto-femoral disease. Thirteen patients had aortic endarterectomy. Operative mortality was 5%. Cumulative patency rate at 2 years was 98.6%. These findings suggest that the Triaxial graft with its low porosity and high burst strength is an improvement on current Dacron prostheses with excellent early patency rates.

Key words.—Knitted Dacron - Triaxial - Porosity - Strength.

Introduction

Despite the success of wide bore knitted Dacron vascular prostheses in high flow situations, numerous reports have documented the occurrence of intrinsic graft failure as a result of structural defects, aneurysmal dilatation and late prosthetic structural deterioration. The perfect vascular conduit should have a thrombus resistant flow surface, which allows firm pseudo-intimal attachment and should show good tissue incorporation. Furthermore it must exhibit a high degree of conformability and be easy to suture. It should undergo minimal or no dilatation and there should be no structural deterioration.

An advanced knitted Dacron graft (Vascutek Triaxial) has been developed taking account of the above features. At the Royal Infirmary, Glasgow, Scotland and University Laval Quebec, Canada, this graft has been physically tested and evaluated in the canine model and compared to current Dacron prostheses. We also report our clinical experience with Triaxial in 121 proximal arterial reconstructive procedures performed at the Royal Infirmary, Glasgow.

Material and methods

(a) Physical testing. Porosity was estimated by measuring the permeability to clean micro-filtered water at 120 mg Hg pressure through 1 sq cm of graft material measured over the first minute. Strength was tested by the Wool Industry Research Association using a diaphragm burst test.

(b) Canine model. Infrarenal bypass grafts were inserted in 10 mongrel dogs for a period of three months as described by Pollock. Currently available Dacron prostheses (Vascoulor II) were used in five of the dogs acting as controls. At sacrifice the grafts were excised, and stained with haematoxylin and cosin and more specifically for collagen, fibrin and "endothelial" cells. The degree of "endothelialisation" was measured by the point counting method. Long thoraco-abdominal bypass grafts using Triaxial (n=12) or current knitted Dacron prostheses (n=12) were implanted in mongrel dogs for periods varying from four hours to six months as

*Royal Infirmary, Glasgow.
**Université Laval, Quebec.
***Vascutek Ltd., Scotland.
described by Goeau Brissoniere. At sacrifice the grafts were excised and scanning electron microscopy was used to examine the luminal surface and evaluate encapsulation.

Results

(a) Physical testing. Burst strength values were higher in the Triaxial graft (1000 kPa) than in control grafts (796 kPa). The porosity value for the Triaxial was 750 mls/cm²/min, lower than in controls (1500 mls/cm²/min, Table 1).

(b) Canine model. There was no difference in the gross appearance of the infrarenal bypass grafts between the Triaxial and the control grafts with no abnormal tissue reaction. "Endothelialisation" occurred to a similar degree between the two types of graft (Fig. 1) over a variable area throughout the prosthesis, most evident at anastomotic sites. In thoraco-abdominal implantations the healing sequence of the Triaxial was similar to controls. Initially the luminal surface of the prosthesis was coated with large red surface thrombi with particular accumulation at anastomotic sites. With the development of fibrinolytic activity this thrombogenic matrix was reduced exposing the majority of fibres on the luminal surface of the prosthesis to flowing blood, but enough matrix remained in the interstices of the knitted structure to prevent blood loss. The central part of the graft was still not covered with pseudo-intima at six months.

Clinical investigation

Patients and methods

Between 1982 and 1984, 121 consecutive patients underwent major reconstructive surgery for severe aorto-femoral disease. Male: Female ratio was 2:1 with mean age 63 years (range 40-78 years). Eighty-nine patients (74%) had disabling claudication and 19 (16%) had critical ischaemia (rest pain and/or ischaemic ulceration and/or gangrene). Thirteen patients had elective aortic aneurysmectomy.
possible by improved technology. It is a Raschel warp knit triaxial construction with a low internal pile height (velour) and good external velour. The graft has a low porosity achieved without resource to chemical or high temperature shrinkage processes. It possesses all of the advantages of the knitted construction, such as high conformability and ease of suturing in addition to high strength. Knitted constructions to date have been highly porous allowing greater interstitial bleeding and often lacking in strength. The Triaxial graft is designed to allow tissue ingrowth and encourage healing yet is tight enough to prevent interstitial bleeding after precutting. Pseudo-intimal covering of the flow surface of the graft is important in ultimate graft healing and reduced thrombogenicity of the flow surface.

No intraoperative complications directly attributable to the prosthesis were noted in our clinical experience to date. There was only one patient who developed a graft thrombosis probably associated with pseudo-intimal proliferation. The solitary false aneurysm in another patient was associated with graft infection probably following wound sepsis.

An advanced knitted low porosity Dacron graft has been developed which shows good tissue incorporation, excellent pseudointimal adherence, high degree of conformability together with strength. Within the time constraints of our clinical investigation we believe that the graft is safe, possesses desirable, technical and handling features and performs satisfactorily. Further prolonged follow up is required before true clinical durability and incidence of prosthesis related complications can be fully ascertained.

References


[Authors' address:
J. C. Pollock
Surgeon in Administrative Charge
Peripheral Vascular Unit
Royal Infirmary
St. Alexandra Parade
Glasgow (Scotland).]