Longitudinal rupturing of a knitted Dacron graft 30 years after its implantation

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Abstract

A 79-year old man with a pulsatile mass in his left groin was admitted to our institution in 2012. He had undergone an aortobifemoral bypass using a bifurcated Cooley double velour knitted Dacron graft for aortoiliac occlusive disease in 1982. Computed tomography detected a 34 mm para-anastomotic pseudoaneurysm in the left limb of the graft. Graft replacement was performed to prevent the aneurysm from rupturing, and we found that the old Dacron graft had ruptured longitudinally along its guideline. The disrupted portion of the old Dacron graft was excised and examined by scanning electron microscopy, which revealed the deterioration of the polyester filaments around the guideline.

Keywords: Knitted Dacron graft • Graft rupture • Pseudoaneurysm

BACKGROUND

Knitted Dacron grafts are often selected for abdominal aortic surgery as they are easier to manipulate than other grafts [1], although the rupturing of knitted Dacron grafts has been reported since the late 1970s [2]. Most cases of graft rupturing have involved virgin prostheses (knitted Dacron grafts) manufactured in the 1970s or 1980s [1, 2]. Due to a change in the method used to manufacture the knitted Dacron graft in the late 1990s, the rupturing of these prostheses has become extremely rare. Herein, we report a case in which a knitted Dacron graft ruptured along its guideline in a patient who had undergone an aortobifemoral bypass 30 years previously.

CASE REPORT

A 79-year old man with a pulsatile mass in his left groin was admitted to our institution in 2012. He had undergone an aortobifemoral bypass using a bifurcated Cooley double velour knitted Dacron graft (CDVKD; Meadox Medical, NJ, USA) for aortoiliac occlusive disease in 1982. He had also undergone a second round of abdominal aortic grafting (20 mm, ePTFE tube graft; Gore and Associates, Flagstaff, AZ, USA) for a pseudoaneurysm that developed close to the anastomotic site in 1998. Computed tomography (CT) demonstrated a para-anastomotic pseudoaneurysm measuring 34 mm in diameter in the left limb of the graft, and graft replacement was performed to prevent the pseudoaneurysm from rupturing (Fig. 1).

The surgery was performed under general anaesthesia with the patient in a supine position. To begin with, we exposed the left limb of the bifurcated graft at a site close to the aneurysm via a retroperitoneal approach. The left superficial femoral and deep femoral arteries were also encircled and clamped. After opening the aneurysm wall and removing the thrombus, we found that the Dacron graft had ruptured longitudinally along its guideline (20 mm in length). The anastomotic site produced in the previous surgical procedure was intact. A ringed woven Dacron graft (Gelsoft 10 mm, Terumo, Tokyo, Japan) was inserted between the

Figure 1: Three-dimensional reconstruction of computed tomography scan showing a pseudoaneurysm in the left groin. Pseudoaneurysm was completely separated from the previous anastomotic site.
intact Dacron graft limb proximal to the edge of the rupture and the native deep femoral artery. The part of the native superficial femoral artery in the lateral portion of the Dacron graft was reconstructed. The patient was discharged from our hospital without major complications.

The ruptured portion of the Dacron graft was excised and morphologically examined by objective light microscopy (OLM) and scanning electron microscopy (SEM).

In OLM, a break in the dyed yarn that had been used to construct the guideline was observed.

An SEM image of the ruptured part (the guideline) of the graft is shown in Fig. 2A. The guideline was constructed of a textured yarn, and a flat yarn had been used to connect it to the rest of the graft. The complete breakdown of the filaments in the flat yarn was observed. In high-powered fields, the breakdown of the flat yarn filaments is clearly seen. (Fig. 2B)

**DISCUSSION**

Knitted Dacron grafts rupture in approximately 0.5–3% of post-operative patients. The mean period from implantation to rupturing varied markedly between previous reports; i.e. Nunn et al. [3] reported that it was 77 months, whereas Chakfe et al. [4] reported that it was 16.0 ± 3.3 years, and it was 30 years in the present case, which might be the longest reported implantation to rupturing period.

In the present case, axial CT images did not provide us with sufficient information regarding the aetiology of the pseudoaneurysm. Conversely, preoperative three-dimensional CT imaging was very informative and helped us to make an accurate diagnosis. The orifice of the pseudoaneurysm was completely separated from the anastomotic site (Fig. 1). Thus, longitudinal rupturing at the distal end of the left graft limb was suspected to have caused the aneurysm.

Regarding the aetiology of graft disruption, inappropriate intraoperative handling of the graft, e.g. clamping the graft limb with a non-vascular clamp or handling the graft roughly with forceps, is considered to increase the risk of late Dacron fibre deterioration.

In addition to the intraoperative factors mentioned above, the properties of the graft should also be discussed. Several previous reports have stated the guideline (a piece of dyed yarn that is included in the graft to prevent twisting) and the remeshing line (a line produced by the manufacturing process) as areas of weakness in virgin prostheses because these two lines are composed of fragile polyester fibres [4, 5]. A SEM-based examination of the guideline rupture site demonstrated the degradation of the flat yarn used to connect the textured yarn to the rest of the graft, which is similar to the rupture site findings described in a previous report [4].

An in vivo study by Dieval et al. [5] showed that the longitudinal rupturing of Dacron grafts occurs when the graft dilates to ≥170% of its initial diameter. In our case, we retrospectively measured the size of the graft limb using CT angiography. The diameter of the left graft limb was 10.1 mm (120% of its initial diameter), and the left limb did not exhibit aneurysmal changes or significant dilatation. These findings confirm that in addition to increases in intraluminal pressure, graft rupturing can also be caused by localized external mechanical stress.

To avoid repeated surgical procedures due to the rupturing of virgin prostheses, the complete removal of Cooley double velour knitted Dacron graft (CDVKDG) might be considered. However, in the present case the removal of the (undilated) CDVKDG, which would have required the patient to undergo laparotomy for the third time, was not appropriate due to the patient’s age (79). Also, as the right limb of the graft had been anastomosed to the external iliac artery, endovascular procedures are feasible, even if other ruptures occur in future.

From 1998, all manufactured vascular prostheses must pass a set of durability tests developed by the International Organization for Standardization (ISO7198: 1998 Cardiovascular implants- Tubular vascular prostheses). The durability tests examine the porosity, bursting pressure and tensile strength; i.e. the wall strength, of the grafts, which are also subjected to a pressure durability test. It is considered that these tests have helped to standardize graft quality.
In conclusion, patients who have had Dacron grafts implanted, especially those who received the implants in the early 1980s, require long-term follow-up. Since a previous review of 20 cases of late graft disruption found that the time to graft disruption varied from 108 to 264 months and that approximately 80% of graft disruptions were asymptomatic and involved the graft limb [4], we suggest that annual abdominal CT scans without contrast medium and self-assessments of the groin by patients are sufficient for screening.

Conflict of interest: None declared.

REFERENCES