Late Disruption of a Polyethylene Terephthalate Aortic Graft 30 Years after Initial Graft Placement

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A 71 year old male who had undergone extra-anatomic bypass grafting between the ascending aorta and the thoraco-abdominal aorta at 41 years of age for aortic coarctation was admitted with back pain and dyspnea. A 16 mm Cooley double velour knitted polyethylene terephthalate (PET) graft was used in the initial operation in 1983. Computed tomography showed disruption of the initial PET graft perforating the right atrium, and a pseudoaneurysm at the distal anastomosis. The patient was in acute cardiac failure because of left to right shunting. A two stage operation was performed. The first stage comprised emergency re-grafting and right atrium repair, and the second stage re-grafting for the pseudoaneurysm. The patient is doing well 48 months post-operatively; however, monitoring of the patient will continue for potential PET graft rupture.

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CASE REPORT

A 71 year old male was admitted to the study facility with back pain and dyspnea that had been present for 4 days. The patient had undergone extra-anatomic bypass between the ascending aorta and the thoraco-abdominal aorta plus brachiocephalic artery reconstruction at 41 years of age for aortic coarctation.

Computed tomography showed three problems at various sites: disruption of the PET graft perforating the right atrium, pseudoaneurysm at the abdominal aortic bypass distal anastomosis site, and distal aortic arch true aneurysm (Fig. 1). Echocardiography revealed an aeurysmal initial graft perforating to the right atrium, and pulmonary hypertension. The patient was diagnosed with acute cardiac failure caused by left to right shunting from disruption of the extra-anatomic bypass graft. Emergency staged surgery was conducted. Cardiopulmonary bypass (CPB) was started using the femoral artery and vein as the cannulation site, and the patient was cooled down to 22°C for circulatory arrest before the re-median sternotomy. The ruptured PET graft was approached directly through the re-median sternotomy and right atrium repair with mattress sutures using Teflon felt pledgets (Fig. 2B). First, the new graft was anastomosed with the initial graft at the proximal site, then at the distal site by clamping both the proximal site of the new graft and the distal site of the initial graft while the patient was rewarmed to 36°C. Operative findings revealed that the initial graft was partly dilated and ruptured, although it seemed that the structure had been retained in the proximal and distal parts. The initial graft was used to anastomose the sites because it was hard to perform adhesiolysis for all parts of the initial graft under circulatory arrest. Histological examination of the ruptured initial graft revealed a chronic, foreign body, inflammatory reaction without evidence of infection (Fig. 2D).

The second operation was performed 2 months after the first operation. Re-grafting for the pseudoaneurysm was done via both the re-median sternotomy approach and the trans-diaphragmatic approach under hypothermic circulatory arrest with CPB. Accurate investigation of degradation at the initial distal anastomosis site where the pseudoaneurysm

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INTRODUCTION

All polyethylene terephthalate (PET) grafts dilate because of the nature of the knitting or weaving process, and the rate of dilatation in knitted grafts is higher than that in woven grafts. However, despite this tendency to dilate, aneurysmal changes or failure of PET grafts are rare complications. In particular, spontaneous ruptures have rarely occurred in grafts performed using the Cooley double velour knitted PET graft manufactured from 1977 to 1987.

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Figure 1. Computed tomography showed (A) three problems at different sites (arrows): (B) distal aortic arch true aneurysm, (C) disruption of the original polyethylene terephthalate graft perforating the right atrium, and (D) pseudoaneurysm at the distal anastomosis site of abdominal aortic bypass grafting.

Figure 2. Operative findings. (A) Perforation site in the right atrium (white arrow), and holes in the guide line (black arrows). (B) Re-grafting and right atrium repair, (C) longitudinal rupture of the initial polyethylene terephthalate graft (white arrow), the hole in the guide line (black arrow), and (D) histological examination were performed. An initial graft specimen (C) was taken from the centre of the degradation site, which was just a few cm to the side of the perforation site in the right atrium (circle in A), and histological examination of the graft specimen was performed.
had occurred was not possible, as the pseudoaneurysm ruptured during adhesiolysis. Anastomosis was performed at a distal site using a new graft (J Graft SHIELD NEO) with the initial anastomotic stoma in the thoraco-abdominal aorta including some surrounding tissue under hypothermic circulatory arrest (22°C) with CPB. Then, proximal anastomosis was done using the new graft with the last J Graft SHIELD NEO by clamping both the distal site of new graft and the proximal site of the last graft while the patient was rewarmed up to 36°C.

The patient still has a thoracic aortic aneurysm at the distal arch, and the initial graft still partially remains at the proximal site; however, he has done well during 48 months of follow-up (Fig. 3) which is ongoing.

DISCUSSION

All PET grafts dilate because of the nature of the knitting or weaving process. PET graft failure has been reported in the early phase and the late phase after initial surgery. Spontaneous rupture of the Cooley double velour knitted PET graft has been reported. Hence, the possibility of future PET graft failure must always be considered.

Previous studies reported that the causes of graft dilatation or rupture include the type of graft fiber, weave pattern, and construction or manufacturing process. Moreover, previous studies have reported longitudinal rupture of knitted polyester prostheses resulting from degradation of the polyester filaments along the remeshing and guide lines in the Cooley double velour knitted graft and Micro Double Velour. The guide line is performed by incorporation of a dyed yarn in the knit, and the remeshing line is created by the technique of knitting. Two bands were simultaneously knitted and joined to create a tube in this previous series. In the present case, dissection was performed in front of the aneurysm that was adherent to the back of the sternum (Fig. 2A). The initial graft was then approached, which had no trace of its original form at the aneurysmal site, but had maintained its structure in a small section (Fig. 2C). There were holes in the guide line (Fig. 2A and C), and there was structure extension and disruption around the re-meshing line (Fig. 2C).

The previously reported reasons for initial graft disruption include systemic inflammatory reaction with or without infection, mechanical trauma because of friction between the sternum and the heart with every cardiac pulsation, and accidental trauma at the time of implantation. In the present case, histological examination revealed no evidence of infection. Furthermore, mechanical trauma did not seem to be the main cause of disruption of the initial graft, as disruption occurred at the free site as well as at the cardiac site. However, it is still possible that one or both of these may have been modifying factors that contributed to initial graft disruption in the present case. There may have been accidental trauma at the time of implantation of the initial graft; prostheses must always be handled cautiously.

In summary, all PET grafts dilate because of the nature of the knitting or weaving process. Although aneurysmal changes or prosthesis failure are rare complications, it should always be kept in mind that PET graft rupture might occur.

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CONFLICT OF INTEREST

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