How to do it

Simple method of hemostasis in implantation and explantation of HeartMate left ventricular assist device

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Abstract

We described a simple method of hemostasis in implantation and explantation of HeartMate left ventricular assist device. Wrapping of the inflow cannula, outflow conduit and outflow graft with Vascutek tube graft can localize the bleeding due to patient’s coagulopathy, imperfect coating and device defect. During explantation, bivalving the tube graft, leaving the graft in place and no-touch of the adhesion between graft and soft tissue can minimize the dissection and prevent the potential bleeding. Published by Elsevier Science B.V.

Keywords: Hemostasis; HeartMate left ventricular assist device

1. Introduction

Heart transplantation is severely limited by donor shortage. A substantial percentage of transplant candidates will die while waiting for a donor heart. Left ventricular assist device (LVAD) have been used as a bridge to heart transplantation. However, bleeding is still the major contributing cause of operative mortality both during implantation and explantation of the LVAD [1–5]. Here, we present a successful case of implantation and explantation of the HeartMate LVAD. Hemostasis was achieved by wrapping of the inflow cannula, outflow conduit and outflow graft using Vascutek tube graft.

2. Materials and methods

The inflow cannula and outflow conduit of the HeartMate LVAD IP1000 were wrapped each by a 40-mm Vascutek (Gelseal, Sulzer Vascutek Ltd., Inchinnan, Renfrewshire, Scotland, UK) tube graft between the proximal and distal connections. Both ends of the Vascutek tube graft were closed over the smooth surface of the device using a simple ligature of 2-0 silk. The outflow graft was further wrapped by a 28-mm Vascutek tube graft (Fig. 1). The proximal end over the outflow conduit was closed using a simple ligature of 2-0 silk. After the LVAD was completely de-aired, the distal end was sewn to the adventitial tissue of the ascending aorta around the Dacron graft.

We used this technique in a 21-year-old male patient to prevent the potential bleeding from the device. This patient had a history of dilated cardiomyopathy and heart failure for 6 months. He was referred to our hospital for cardiogenic shock and lobar pneumonia. He remained febrile with profound shock in spite of antibiotic therapy, maximal catecholamine infusion and intra-aortic balloon support. Blood cultures were negative for bacteria. Because of refractory shock, he had temporary mechanical circulatory support with extracorporeal membrane oxygenation through femoral artery and vein. Nine days later, he received implantation of the HeartMate LVAD for long-term support. He had an uneventful postoperative course and was supported by the pump for 222 days until a suitable donor heart was available. During explanation, severe adhesion and soft tissue bleeding were encountered. After re-sternotomy and establishment of cardiopulmonary bypass, the wrapped Vascutek tube graft was bivalved. The pump was then removed and the Vascutek graft was left in place without further dissection between the graft and the surrounding adhesion tissue. Orthotopic heart transplantation was performed in the usual fashion. The amounts of transfusion and chest tube drainage during the first 24 h after the operation were 420 and 1310 ml. He was discharged one month later and followed at the outpatient clinic for 6 months without any infectious complication.

From April 1998 till now, we have performed four cases of HeartMate LVAD implantation in patients with end-stage
heart failure for long-term circulatory support. They all presented in cardiogenic shock with decreased sensorium and anuria. Before the operation, temporary mechanical support with intra-aortic balloon pump or extracorporeal membrane oxygenation was needed for life support. One patient died of bleeding and right ventricular failure shortly after the operation. One patient died of LVAD endocarditis and sepsis after 194 days’ pump support. The other two patients had successful heart transplantation with LVAD support durations of 222 and 287 days, respectively.

3. Discussion

Despite technical improvement and device refinement, bleeding still occurs in about 40% of patients with the HeartMate 1000 IP LVAD [1–5]. The bleeding may be either patient-related or device-related. Blood leak may originate from inflow cannula, outflow conduit, outflow graft, connectors or needle holes that have been surgically created to evacuate air at the time of implantation [3]. It may result from patient’s coagulopathy, imperfect pre-clotting, or, less commonly, device defect. Re-exploration is devastating and associated with high mortality and morbidity. Thus, hemostasis is an important issue, especially in those centers without a lot of exposure toward implantation and explantation of HeartMate LVAD. Aprotinin, a bovine protease inhibitor, has been reported to be effective in decreasing bleeding and transfusion requirements, and reducing perioperative mortality in LVAD recipients [6]. In our hospital, because of economic burden, we usually put the LVAD in despairing patients with cardiogenic shock and multiple organ failure. Coagulopathy due to low platelet count or hepatic dysfunction is a common problem. In this case, we successfully prevented the bleeding by wrapping the inflow cannula, outflow conduit and outflow graft using Vasculatek tube graft. It can not only localize the bleeding but also prevent the possible air embolism during re-sternotomy and device dissection. During explantation, simply bivalving the Vasculatek tube graft, removing the pump and leaving the graft in place can minimize tissue dissection and prevent the potential bleeding because of severe adhesion [7]. However, it still exists the risk of infection of the remnant Vasculatek in transplant recipients, although there is no evidence of infection in our patient for 6 months.

In summary, bleeding is not uncommon in the clinical experience of HeartMate LVAD. Wrapping of the inflow cannula, outflow conduit and outflow graft may stop the bleeding and prevent the occurrence of air embolism during re-sternotomy. During explantation, bivalving the tube graft and leaving the graft in place may minimize tissue dissection and prevent the potential bleeding due to severe adhesion.

References