A modified suturing technique for the implantation of the apical cannula of the HeartMate II left ventricular assist device

Efstratios I. Charitos*, Hans-Hinrich Sievers

Cardiac and Thoracic Vascular Surgery Clinic, University Clinic of Schleswig-Holstein, Campus Luebeck, Ratzeburger Allee 160, 23538 Luebeck, Germany

Received 27 May 2010; received in revised form 6 July 2010; accepted 6 July 2010

Abstract

The secure and haemostatic implantation of the left ventricular assist device (LVAD) apex inflow cannula can sometimes be challenging, especially in the setting of an acute myocardial infarction or significant ventricular wall thinning, when the myocardial tissue may be friable and tissue strength may be compromised. In these cases, surgical complications from this site may present a challenge. We describe a modified suturing technique for the implantation of the left ventricular apical inflow cannula of the HeartMate II LVAD that may prevent surgical complications from the inflow cannula site.

© 2010 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Left ventricular assist device; Surgical technique

1. Introduction

In the setting of an acute myocardial infarction or significant ventricular wall thinning, the secure and haemostatic implantation of the apical inflow cannula of a left ventricular assist device (LVAD) may be challenging. In these cases, tissue quality and strength may be compromised and surgical complications from this site can prove troublesome: visualization of the apex is difficult since this area lies left laterally and far away from the surgeon, access to this site after placement of the pump in the pump pocket and the pump start may compromise haemodynamic stability, and after the pump start, and mobilization of the pump system (inflow, pump, outflow) is severely restricted. Eventually, re-establishing cardiopulmonary bypass and outflow graft clamping may be unavoidable in order to identify and manage surgical complication from the inflow site. An alternative would be to perform a lateral rethoracotomy which would provide adequate exposure of the left ventricular (LV) apex in order to identify and control surgical bleeding from this site. Here, we present a modified technique for the implantation of the HeartMate II LVAD (Thoratec Corporation, Pleasanton, CA, USA) apical inflow cannula, which may be beneficial in the setting of compromised myocardial tissue quality. While we have implemented this technique in the implantation of the HeartMate II LVAD, it could be applicable to all devices that require LV apical cannulation.

2. Description of surgical technique

After median sternotomy, pump pocket preparation and establishment of cardiopulmonary bypass, the LV apex is mobilized. We use the core cutting device provided in the HeartMate II LVAD implant kit to perforate the LV apex, in the direction of the mitral valve. Bleeding vessels are coagulated. Seven to 10 large (2 cm × 1 cm) polytetrafluoroethylene (PTFE)-felt pledgets (Bard Peripheral Vascular PTFE Felt, Temp, AZ, USA) are prepared. A 2-0 non-absorbable polyfilament suture (Seracor™, Serag Wiessner, Naila, Germany) is passed through every pledget to form a U-suture, with each end of the suture being 1 cm from each other apart and 0.5 cm away from the pledget edge. The sutures are passed transmurally, through the LV wall so that the pledget sits on the epicardial side of the LV wall and circularly 1 cm away from the apical perforation margin. Thereafter, the sutures are passed through the apical ring, the apical ring is lowered in place and the sutures are tied (Fig. 1a). Care should be made not to knot the suture very tight, as the U-part of the suture can perforate or traumatize the LV wall. After implanting the cannula, and with the plastic shape holder in place, a size 2 non-absorbable polyfilament suture (Terylene®, Serag Wiessner, Naila, Germany) suture is passed around every pledget to form an additional U-suture as a purse string suture (Figs. 1b and 2). The suture passes through the pledget, 0.25 cm from each edge. The shape holder is removed and the metal cannula is inserted in the silicon ring. With the metal cannula in place, the size 2 suture is tied securely against the metal cannula thus sealing all pledgets over the metal cannula (Figs. 1c and 3). Thereafter, the procedure is carried on in the usual manner.

*Corresponding author. Tel.: +49-451-500-2108; fax: +49-451-500-2051. E-mail address: efstratios.charitos@gmail.com (E.I. Charitos).

© 2010 Published by European Association for Cardio-Thoracic Surgery
Fig. 1. Schematic of the procedure: (a) A 2-0 non-absorbable polyfilament suture is passed through every pledget to form a U-suture, the sutures are passed through the LV wall and the apical ring, the apical ring is lowered in place and the sutures are tied. (b) With the plastic shape holder in place, a size 2 non-absorbable polyfilament suture is passed around every pledget to form an additional U-suture as a purse string suture. (c) With the metal cannula in place, the size 2 suture is tied and secured against the metal cannula, thus sealing all pledgets over the metal cannula. LV, left ventricle.

With the use of the large PTFE pledgets, the two ends of the 2-0 U-suture are passed through the pledget at a distance of approximately 1 cm apart, so that the forces when tying the suture on the inflow cannula ring are less traumatic. The large PTFE pledgets are less rigid and follow the curvature of the ventricle. The thick, size 2 suture acts as a purse string suture to externally compress the PTFE pledgets over the metallic inflow cannula, without applying tearing forces on the tissue. Additionally, the large PTFE pledgets, in contrast to the standard felt armed sutures, provide enough suturing material for repair in case of a tissue tear or trauma.

Fig. 2. Passing the thick size 2 suture around the PTFE pledgets to form a purse string suture. PTFE, polytetrafluoroethylene.

Fig. 3. Tying of the suture, sealing the pledgets against the metal cannula.