How-to-do-it

Inverted graft insertion technique for apicoaortic bypass

Yoshitsugu Nakamura*, Osamu Tagusari, Yoshimasa Seike, Satoru Domoto

Department of Cardiovascular Surgery, NTT Medical Center Tokyo, 5-9-22 Higashigotanda, Shinagawa-ku, Tokyo 141-8625, Japan

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Abstract

The proximal anastomosis of the apicoaortic bypass is technically demanding. We describe our novel surgical technique to reinforce the proximal anastomosis of the apicoaortic bypass. After moving circular muscle of the left ventricle (LV) under ventricular fibrillation, an inverted tube graft is inserted into LV through the opening of the apex. Then, end-to-end anastomosis is made with horizontal mattress sutures passing from the inside of the inverted tube graft through the entire thickness of LV muscle and a running suture of the edge of LV muscle and graft. As the tube graft is pulled out from the LV, the anastomosis is completed. This technique permits simple and reliable suture placement without the need for any special device for the proximal anastomosis of the apicoaortic bypass.

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1. Introduction

Apicoaortic bypass is one of the surgical options for aortic valve stenosis with porcelain aorta. Bleeding from the proximal anastomosis is a common complication of this procedure [1,2]. Shallow sutures may cause cutting of the left ventricular (LV) muscle even when an apical ventricular connector system is used. Therefore, the most important point that must be borne in mind during apicoaortic bypass is to secure the proximal anastomosis adequately with sutures passing through the entire thickness of the LV muscle. Here, we describe our novel surgical technique to reinforce the proximal anastomosis. This technique permits simple and reliable suture placement without the need for any special device.

2. Surgical technique

Anaesthesia is induced with a double-lumen endotracheal tube for single-lung ventilation. The patient is placed in the right lateral decubitus position. Through the left 5th intercostal space, the descending aorta and cardiac apex are exposed. Under full heparinisation, a partial clamp is applied on the descending aorta, if possible. Otherwise, a cross-clamp is applied after partial cardiopulmonary bypass is established via the left femoral artery and vein cannulation. End-to-side anastomosis of a 20-mm tube graft is sewn on to the descending aorta using 3/0 polypropylene suture, with reinforcement of the circumferential Teflon felt strip. The pericardium is opened anterior to the phrenic nerve and the LV apex is exposed. After induction of electrical fibrillation, the circular muscle of the LV apex is removed using a coring device. An inverted 20-mm-tube graft measuring 3—4 cm in length is inserted into the LV through the opening of the apex using a 20-mm bougie (Fig. 1(A)). Twelve interrupted horizontal mattress 2/0 synthetic braided pledgeted sutures are placed from the inside of the inverted graft through the endocardial to the epicardial side (ranging the entire thickness of the LV muscle). A circumferential Teflon felt strip is incorporated into the suture line of the epicardium. Then, an over-and-over running suture of the edge of the ventricular muscle and the graft is placed with 4/0 polypropylene suture for reinforcement (Fig. 1(B)). As the inverted tube graft is pulled out from the LV, the anastomosis is completed (Fig. 1(C)). The distal end of the graft is sewn on to a 21-mm stentless porcine valve (Prima Plus aortic root bioprosthesis, Edwards Lifesciences, LLC, Irvine, CA, USA). Finally, the distal end of the stentless porcine valve is sewn on to the graft anastomosed to the descending aorta (Fig. 2). We performed the apicoaortic bypass using this technique in three patients between September 2005 and August 2009. No additional stitch was necessary for haemostasis on the proximal anastomosis in every patient. There was no hospital mortality.
3. Discussion

Proximal anastomosis is a key procedure in apicoaortic bypass. Suture through the entire thickness of the LV muscle is technically demanding, because the LV muscle is thick and friable in cases of aortic stenosis. Shallow sutures may cause cutting of the LV muscle, resulting in bleeding or formation of a pseudo-aneurysm [1,2], even when an apical ventricular connector system is used. Our novel technique provides the integrity of an everted anastomosis, in a face-to-face fashion between the LV muscle section and the graft surface. Insertion of the inverted graft into the LV apical hole establishes a good arrangement between the graft and the LV wall and helps to keep the hole in a circular shape. Consequently, it is easy to perform the anastomosis with both mattress sutures through the entire thickness of LV and an over-and-over running suture under excellent surgical view and working space.

A similar graft-inversion technique has been used in aortic surgery. Ogino and colleagues have reported that they routinely use the graft-inversion technique called ‘stepwise technique’ for open distal aortic anastomosis under circulatory arrest [3]. They have reported that this technique is easy and useful to achieve favourable haemostasis.

There are potentials for developing advanced techniques, such as the use of an attachment device or the occlusion balloon technique, which can simplify the performance of proximal anastomosis [1,4,5]. Although these techniques offer the promise of lesser invasiveness either on- or off-pump, they are not cost-efficient.

Our technique is available in any situation where the LV-conduit anastomosis is necessary. Currently, trans-catheter aortic valve implantation (TAVI) techniques offer new minimally invasive treatment options for high-risk patients with aortic valve stenosis [6]. It will be relevant to apply the trans-apical TAVI in apicoaortic bypass candidates. Accordingly, chances in which our technique is used would become more common in the field of left-ventricular assist devices rather than in apicoaortic bypass.

In conclusion, our technique permits simple and reliable suture placement without the need for any special device for the proximal anastomosis of the apicoaortic bypass.

References


