How to Do It

An Approach to Mitral Valve Surgery by a T-shaped Mini-sternotomy with Functioning Bilateral Internal Thoracic Artery Grafts

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Abstract

We herein report successful surgical treatment of mitral valve regurgitation in a 49-year-old man. He was admitted to our hospital due to acute aggravation of dyspnea on effort. He had a surgical history of coronary artery bypass grafting with bilateral internal thoracic artery grafts. A transthoracic echocardiogram showed severely decreased cardiac function and severe mitral regurgitation due to anterolateral mitral valve leaflet prolapse. Computed tomography showed the right internal thoracic artery running over the front of the aorta to the left circumflex artery. To avoid injury to the functioning grafts during median sternotomy, we chose to perform an inferior T-shaped mini-sternotomy. The surgical field was sufficient to perform mitral valve replacement with a mechanical prosthetic valve under fibrillatory arrest. The grafts were neither dissected nor clamped, and access to the aorta and mitral valve was excellent.

Key words  Minimally invasive surgery · Coronary artery bypass grafting · Arterial graft · Mitral valve replacement

Introduction

One of the factors affecting postoperative morbidity and mortality in isolated coronary artery bypass grafting (CABG) is the absence of an internal thoracic artery (ITA) graft. Therefore, cardiovascular surgery in patients with a surgical history of CABG and ITA grafting has been increasing over the past ten years. Surgery in patients with a functioning right internal thoracic artery (RITA) passing over the ascending aorta has been very rare. An injury to ITA grafts during redo sternotomy may be fatal. Therefore, an alternative measure other than redo sternotomy is required to minimize the risk of graft injury. In the present report, we describe the technique of an inferior T-shaped mini-sternotomy and discuss its advantages in avoiding injury to such grafts.

Case Report

A 49-year-old man was admitted to our hospital due to an acute aggravation of dyspnea on effort. He had complications associated with an old myocardial infarction in the left anterior descending artery (LAD) and he had a surgical history of CABG using bilateral ITA 3 years before admission. The RITA was anastomosed to the left circumflex artery and the left internal thoracic artery (LITA) was anastomosed to the LAD. On admission, a transthoracic echocardiogram showed a severely decreased left ventricular ejection fraction (30%) and severe mitral regurgitation due to anterior mitral valve leaflet prolapse. The left ventricular diastolic and systolic dimensions were 57 mm and 41 mm. Enhanced computed tomography showed that the RITA passed over the aorta in the first intercostal space and the LITA also ran along the left side of the sternum (Fig. 1). Due to the fact that a full median sternotomy may result in RITA graft injury, we therefore decided to perform an inferior T-shaped mini-sternotomy in the second intercostal space.

Surgical Procedure and Techniques

External defibrillating pads were pasted before surgery. External defibrillating pads were pasted before surgery. After the removal of two sternal wires, an inferior mini-sternotomy was performed and the sternum was transected at the second intercostal space to avoid any injury to the RITA that passed over the aorta just below the first intercostal space (Fig. 2). The heart was dissected...
free from epicardial adhesions to access the aortic root and the anterior wall of the right ventricle. Cardiopulmonary bypass (CPB) was established with an arterial cannulation of the femoral artery and venous cannulation of both the superior and inferior vena cavae. The left ventricular vent tube was inserted from the right upper pulmonary vein. Because this patient had the complication of a severely decreased cardiac function, we selected surgery under ventricular fibrillation and deep hypothermia with the functioning bilateral ITA grafts. The grafts were neither controlled nor clamped. The mitral valve was exposed through the trans-septal approach under deep hypothermia at 26°C and ventricular fibrillation. We obtained a good surgical field without back bleeding through the aortic valve by retracting the left atrium. The lateral side of anterior mitral valve leaflet was severely prolapsed. Because of redo surgery and the patient’s severely decreased cardiac function, we considered that a short duration of fibrillatory arrest was desirable for this patient. Therefore, the mitral valve was replaced with a 29-mm St. Jude Medical mechanical valve. During the periods of rewarming, all air was removed through a left ventricular vent tube and the aortic root cannula. The patient was easily weaned off of CPB. The mediastinal and pericardial drains were inserted, and the sternum was closed using transverse and vertical steel wires. The operation time was 345 min and the fibrillatory arrest time was 71 min. The postoperative course was uneventful with neither postoperative myocardial infarction nor mechanical valve dysfunction.

**Discussion**

A mini-sternotomy is a well-known procedure, which has been developed in the past ten years and is advantageous for cosmetic aspects and redo surgery. Redo surgery is sometimes difficult when an in situ RITA passes over the ascending aorta. Byrne et al. reported that the recommended approach to mitral valve surgery avoiding sternotomy was a right thoracotomy. This approach was advantageous for preventing graft injuries. However, there is the possibility that several clinical problems, such as potential air bubbles that can cause cerebral emboli, an inadequate view of the surgical field, and respiratory dysfunction, will remain. Therefore, an inferior mini-sternotomy has been devel-