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Technical points for aortic valve replacement through right anterior minithoracotomy

Olivier Bouchot*, Andranik Petrosyan, Marie Catherine Morgant and Ghislain Malapert

Department of Cardiovascular and Thoracic Surgery, Dijon University Hospital, Dijon, France

* Corresponding author. Department of Cardiovascular and Thoracic Surgery, Dijon University Hospital, 14 rue Paul Gaffarel, 21079 Dijon cedex, France. Tel: +33-3-80293352; e-mail: olivier.bouchot@chu-dijon.fr (O. Bouchot).

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Abstract

After 8 years of practice and over 400 operated patients, we present a technique of minimally invasive aortic valve replacement that can be used by all surgeons on many patients. The access to the aorta is via the 2nd or 3rd right anterior intercostal space. Cardiopulmonary bypass is provided using the femoral artery and vein. The aorta is clamped directly. One shot of Custodiol (EUSA Pharma, Limonest, France) is the most commonly used cardioplegia. Aortic valve replacement is performed in the regular way. To reduce the aortic cross-clamping time, sutureless or rapid-deployment valves, as well as the Cor-Knot (LSI Solutions, Inc., Victor, NY, USA) automatic knotting system, are excellent options. Right anterior minithoracotomy for aortic valve replacement is safe and reproducible.

Keywords: Aortic valve replacement • Right anterior minithoracotomy • Rapid-deployment valve • Sutureless valve

INTRODUCTION

After 8 years using right anterior minithoracotomy to perform aortic valve replacement in more than 400 patients, we describe the details of aortic valve replacement through right anterior minithoracotomy.

SURGICAL TECHNIQUE

Selective intubation is preferable but not necessary. Transoesophageal echocardiography is the gold standard. Defibrillation pads are placed in the anterior–posterior position. After supine positioning with a small pillow under the right shoulder, the skin incision is performed on the 2nd or 3rd intercostal space, depending on the ascending aorta position and the type of prosthesis used (sutureless valves: 2nd intercostal space; stented valves: 3rd intercostal space). The ribs are retracted using soft tissue and Cor-Valv retractors (Coroneo, Montreal, Quebec, Canada). The right internal mammary artery and veins are sacrificed systematically. The pericardium is opened in an inverted L-shape and pulled by 2 pericardial traction sutures. Cardiopulmonary bypass is installed (under transoesophageal echocardiography control) through a small cut-down in the femoral vessels.

The ascending aorta is directly clamped using a Chitwood or Glauber divisible clamp underneath the innominate artery. Habitually, we use Custodiol cardioplegia (EUSA Pharma, Limonest, France): 1 shot, anterograde in the ascending aorta. Cold blood cardioplegia is an alternative. Significant aortic regurgitation will require selective injection of the cardioplegia into the coronary ostia. Mild hypothermia (33–34°C) is used during cross-clamping. The vent is inserted through the right superior pulmonary vein.

The location of the aortotomy depends on the type of valve used: for the Perceval valve (LivaNova, Saluggia, Italy), a higher aortotomy is required. If the EDWARDS INTUITY Elite valve (Edwards Lifesciences, Irvine, CA, USA) is used, the ascending aorta is opened by a J-type incision, and if a standard valve is used, a circumferential incision should be performed. After the aortotomy is complete, the aortic valve is exposed by 4 stitches (Fig. 1) (one on the distal edge of the aortotomy and 3 on the upper part of the aortic valve commissures) and pulled in appropriate directions to open the aortic valve. Aortic valve removal and decalcification are performed in the regular way.

A 30° optical angulation arthroscopy (18 cm in length and 5 mm in diameter) may improve visualization, especially of the right coronary ostia for selective cardioplegia injection, or of the position of the valve collar in the aortic annulus and the left ventricle, in the case of sutureless valve implantation.

During our experience, we have used stented, stentless, sutureless and rapid-deployment aortic valves. The standard technique is still to use U-shaped pledgeted sutures. An alternative could be a running suture. Knot pushers can be used (Fig. 2A) or Cor-Knot fasteners (LSI Solutions, Victor, NY, USA), which make it easier to tie and secure the knots (Fig. 2B).

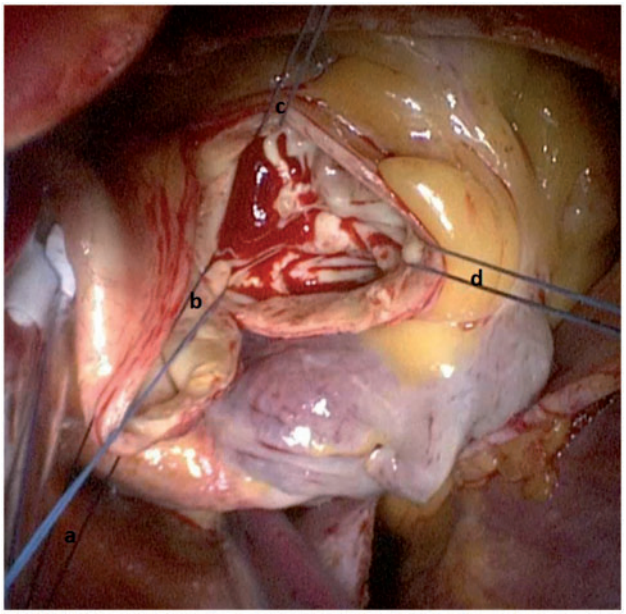

Figure 1: Exposing the aortic valve by 4 stitches: one on the distal edge of aortotomy (a) and 3 on the upper part of the aortic valve commissures (b: left and non-coronary cusp, c: left and right coronary cusp and d: right and non-coronary cusp).

The aortotomy should be carefully closed. If the aortic tissue is very fragile, using a double suture can be beneficial. The pacemaker electrodes must be placed on the anterior face of the right ventricle before cross-clamp removal.

We prevent air embolization by using carbon dioxide (0.5 l/min) and a careful deairing technique. The transoesophageal echocardiography helps by assessing the air condition in the left ventricle.

The pericardium is closed fully, leaving in two 9-Fr drainage tubes: posterior–inferior of the right ventricle and retroaortic. A 24-Fr chest tube is placed into the chest cavity and the thoracic incision is closed using a standard technique.

DISCUSSION

Starting with the Glauber technique [1], we then introduced our own modifications. Now, the right anterior minithoracotomy for aortic valve replacement technique is the first choice in our department. The only exclusion criterion is a calcified ascending aorta. A drawback is the long cross-clamp time (~90 min), but it can be decreased by using sutureless or rapid-deployment valves (~63 min), as described by international expert consensus [2] and, finally, an automatic knotting device: Cor-Knot (~75 min) [3].

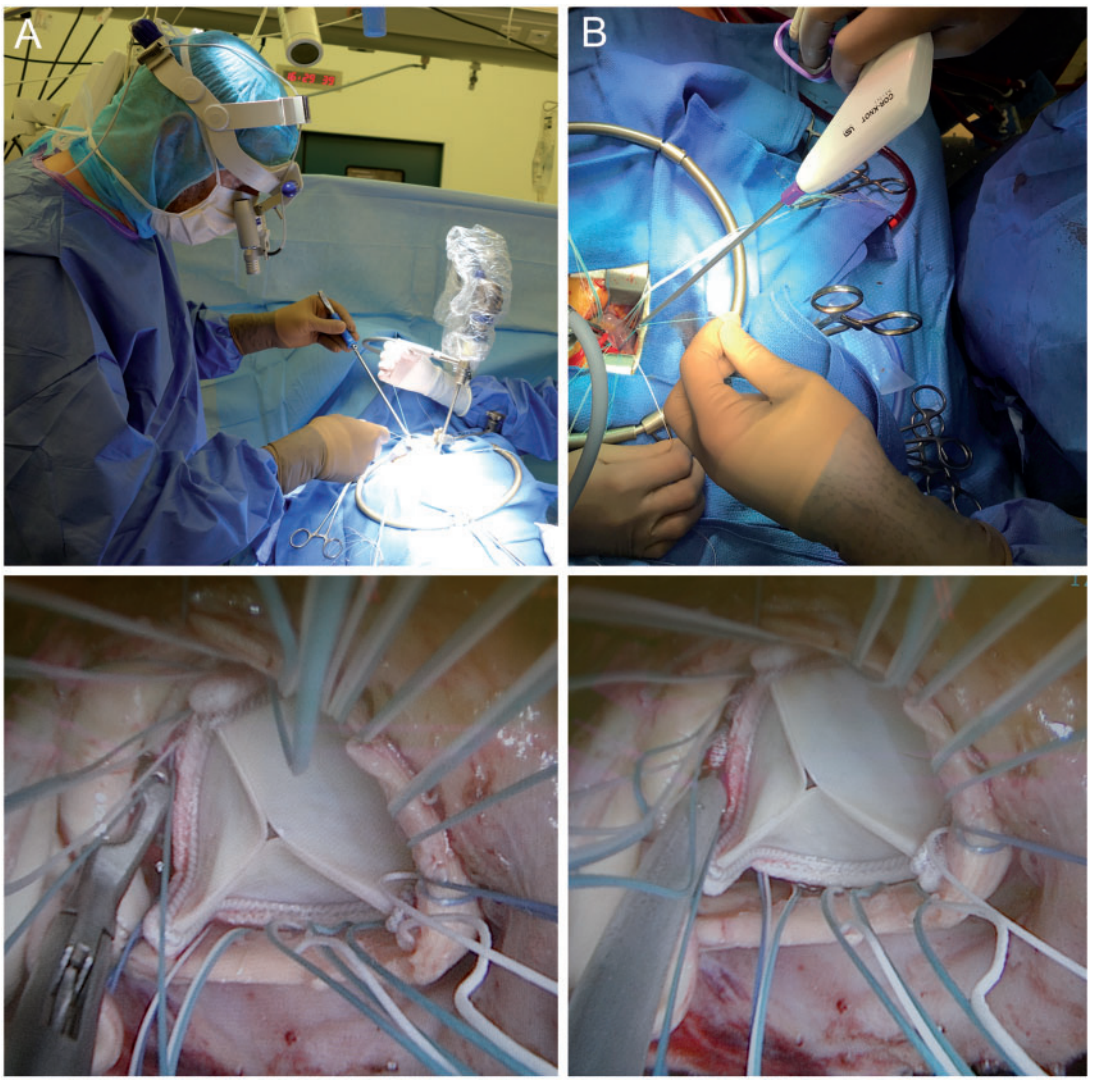

Figure 2: (**A**) Tying knot with knot pusher. (**B**) Tying knot with Cor-Knot.

After a mentoring programme and a learning curve, many experienced surgeons could replace standard sternotomy with this safe and reproducible approach. The benefit is obvious: less pain, faster recovery, less bleeding, shorter hospitalization and a more aesthetic incision.

Conflict of interest: Olivier Bouchot is a consultant for St. Jude Medical, Edwards Lifesciences and LivaNova, and Ghislain Malapert is a consultant for St. Jude Medical and Edwards Lifesciences, where he provides training for right anterior minithoracotomy.

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