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How to Do It: The Commando Operation for Reconstruction of the Fibrous Skeleton with Double Valve Replacement

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ABSTRACT

Infiltrative processes that extend into the intervalvular fibrosa, such as infection or calcification, often mandate a complex reconstructive procedure known as the Commando operation. First described less than 20 years ago, this operation is not widely implemented, with experience limited to a few select centers. This report provides a detailed summary of our approach to this intricate procedure.

INTRODUCTION

The intervalvular fibrous body (IFB) is a key structural facet of the fibrous skeleton, serving as part of the scaffold for the aortic and mitral valve annular attachments. Valvular pathology, such as endocarditis or degenerative calcification, can directly infiltrate the IFB. In such instances, double valve replacement alone will not suffice because the structural integrity of the fibrous skeleton remains compromised, and/or residual calcification may not accommodate adequately sized valve prostheses. Owing to its procedural complexity, the Commando operation, or double valve replacement with patch reconstruction of the IFB, is a viable surgical approach for this difficult problem. First introduced by David in 1997, this procedure has become the standard surgical option but is implemented only at select centers with the requisite expertise [David 1997]. Limited application of this operation may be attributable to the paucity of published reports on its outcomes and procedural steps [David 1997; De Oliveira 2005; Kim 2013; Davierwala 2014; Pettersson 2014; Forteza 2015]. Herein, we provide a detailed, step-by-step description of our surgical approach to the Commando procedure.

SURGICAL TECHNIQUE

As part of the standard preoperative workup, all patients undergo transesophageal echocardiography, cardiac catheterization, and computed topography scan of the chest. In reoperative cases, it is essential to review details of prior procedural reports. The standard surgical approach includes median sternotomy with bicaval venous cannulation. Peripheral cannulation via the axillary and/or femoral vessels is undertaken in reoperative cases, where appropriate, to ensure safe sternal reentry. Optimal exposure to the left atrial dome is achieved by routine transection of the superior vena cava (SVC) (Figure 1). A transverse aortotomy 2 cm above the coronary ostia is extended onto the left atrial dome, transecting the noncoronary sinus, aortic annulus, IFB, and anterior mitral annulus. To preserve three-dimensional orientation, the authors have found that placing sutures to mark the divided ends of the noncoronary aortic annulus is key in facilitating reconstruction. Aortic root involvement requires creation of coronary buttons and is not included in the present summary for the sake of simplicity. Depending on the etiologic factor (infection, calcification, or both), the aortic and mitral valve leaflets are excised and the annuli debrided to the extent necessary to eliminate all affected tissue.

Reconstruction (Figure 2) begins with placing subannular horizontal mattress sutures along the posterior annulus of the mitral valve, from trigone to trigone. With these sutures, an appropriately sized mitral valve prosthesis is seated into position. Anteriorly, the prosthesis is seated with a series of interrupted mattress sutures placed through the midline of

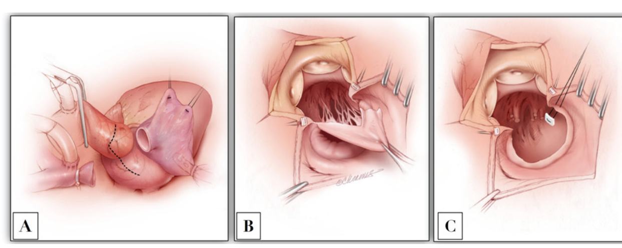

Figure 1. Surgical approach for Commando procedure. A, Venous drainage is via bicaval cannulation. The SVC is transected with the right atrium retracted inferiorly to optimize exposure to the dome of the left atrium. The incision line (dotted) begins with a transverse aortotomy that is extended along the noncoronary sinus, dividing the aortic annulus, intervalvular fibrous body, and anterior mitral annulus onto the dome of the left atrium. B, Retraction sutures mark the midline of the divided (noncoronary) aortic annulus. The anterior mitral valve leaflet is excised. C, The posterior mitral valve leaflet may also be excised in conjunction with aggressive surgical debridement of all infected/nonviable tissue in the setting of endocarditis. Valve sutures are placed along the posterior mitral valve annulus.

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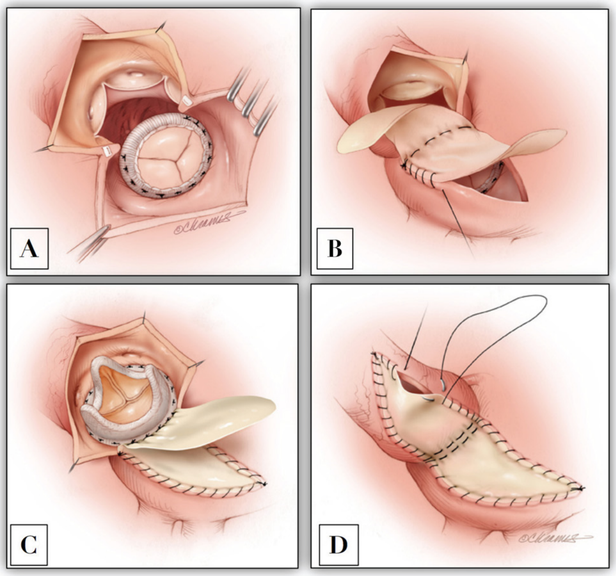

Figure 2. Surgical technique for double valve replacement and reconstruction of the intervalvular fibrosa in the Commando procedure. A, Horizontal mattress, pledgeted valve sutures are placed along the posterior mitral annulus. The appropriately sized mitral valve prosthesis is subsequently seated with these posterior annular sutures. B, The anterior mitral annulus and intervalvular fibrous body is reconstructed with interrupted sutures along a bifurcated patch of bovine pericardium. These sutures also serve to anchor and seal the anterior sewing ring of the mitral valve prosthesis. One limb of the pericardial patch is used for closure of the left atrial dome. C, Mattress sutures are placed along the aortic annulus within the right and left coronary sinus and utilized to seat the aortic valve prosthesis. The noncoronary sewing ring of the prosthesis is sutured along the pericardial patch. D, The second limb of the pericardial patch is used to complete patch closure of the aorta.

an elongated, rectangular pericardial patch (length 10-12 cm and width 2-3 cm; bovine pericardium [Edwards Lifesciences, Irvine, CA]). The extent of IFB removed will dictate the width of the pericardial patch necessary to create a tension-free reapproximation of the continuum defined by the edges of the divided anterior mitral valve annulus, IFB, and noncoronary aortic annulus. The demarcated midline of this patch serves as the border between patch reconstruction zones of the left atrial dome and noncoronary aortic sinus. Before proceeding to aortic valve replacement, the left atrial dome patch closure is completed. An adequately sized aortic valve prosthesis is seated in position with mattress interrupted sutures placed along the left and right coronary annuli. The second half of the pericardial patch is then used to reconstruct the noncoronary sinus. Sutures to seat the noncoronary sewing ring of the aortic valve prosthesis are pledgeted and placed along the patch along the same line used to anchor the mitral annulus (after extensive debridement in endocarditis cases.) The transverse aortotomy is closed in standard fashion, incorporating the pericardial patch where necessary for a tension-free reapproximation. The sewing suture material is 4-0 Prolene in a continuous fashion. The "hinge" points of transition from the aortic and mitral valve annulus to the pericardial patch may bleed occasionally. To prevent bleeding from this area the patch should be tension-free and the sutures placed closely. The SVC is sutured after the cross-clamp is released to allow checking for bleeding and placement of additional sutures for adequate surgical hemostasis.

DISCUSSION

The Commando operation affords an effective surgical strategy for the management of complex, infiltrative processes of the aortic and mitral valves that involve the IFB. Indications for this procedure include double valve endocarditis, extensive annular and IFB calcification, inability to accommodate an adequately sized valve prosthesis, and lack of fibrous tissue secondary to prior valvular operations [David 1997; De Oliveira 2005]. This is a very technically challenging operation that entails a comprehensive knowledge of the three-dimensional annular anatomy of the fibrous skeleton. Not surprisingly, few published series of this procedure have been described [David 1997; De Oliveira 2005; Kim 2013; Davierwala 2014; Pettersson 2014; Forteza 2015]. Among those, operative mortality rates range from 7% to 32%. Moreover, this published experience is primarily derived from a mere 5 centers, encompassing a total of only 222 patients, with each series ranging from 25 to 76 cases. When these outcomes data are pooled, the collective operative mortality of this patient cohort is 18%. Rates of reoperation for bleeding, renal failure, heart block, and stroke also approach 20% in these studies.

In reviewing the authors' experience, the first three cases reflected a learning curve of this procedure. However, this will vary from surgeon to surgeon based on individual expertise and learning speed. After the technique is mastered, the operative time and bleeding become less and the immediate postoperative clinical outcomes excellent. The Commando procedure has evolved to become our standard approach for complex double valve pathology. In our most recent experience with 14 consecutive patients, 2 operative deaths (14%) were encountered, including an emergency procedure in a patient with profound cardiogenic shock and hemodynamic extremis. Rates of postoperative heart block, stroke, dialysis, and reexploration for bleeding were 21%, 14%, 7%, and 14%, respectively. Median length of in-hospital stay was 10 days, comparing favorably to the >20 days documented in other series [Kim 2013; Davierwala 2014; Forteza 2015].

In conclusion, double valve replacement with reconstruction of the IFB can be safely performed in select patients with acceptable rates of morbidity and mortality. As with other technically challenging procedures, it is anticipated that with improved selection and increased experience, outcomes of the Commando procedure will continue to improve.

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