Aortic root replacement with a valved conduit containing a stented xenograft

Giuseppe Gatti*, Bernardo Benussi, Aniello Pappalardo, Bartolo Zingone

Department of Cardiovascular Medicine, Division of Cardiac Surgery, Ospedali Riuniti di Trieste, Trieste, Italy

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Abstract

The Bentall operation is a well-established procedure for aortic root replacement, generally contemplating the use of a mechanical valve substitute. We have devised a simple modification by which a stented bioprosthesis is sutured inside, rather than at the extremity, of a vascular tube graft. This facilitates the technique of implantation and may simplify a redo procedure in case of valve failure.

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1. Introduction

The Bentall operation is a popular, well-established procedure for ascending aortic and root replacement contemplating from its very inception the use of a mechanical valve substitute [1]. We have devised a simple modification of the Bentall concept by which a stented bioprosthesis is sutured inside, rather than at the extremity, of a vascular tube graft, carrying with it a number of advantages.

2. Technique

The aortic annulus is sized following excision of the valve, and a stented bioprosthesis (Perimount, Edwards Lifesciences, Irvine, CA, or Mosaic, Medtronic, Minneapolis, MN) is selected accordingly or upsized if so desired. While rinsing the bioprosthesis, Valsalva sinuses are removed leaving a 3—5 mm rim above the annulus and around the coronary ostia. No different from the ordinary Bentall procedure, coronary ostia are extensively mobilized to facilitate reimplantation.

Next, a vascular graft (Hemashield, Boston Scientific Corporation, Natick, MA) 3—5 mm larger than the labelled valve size is selected and everted at one extremity for approximately 3 cm. The bioprosthesis is now placed inside the vascular tube graft and secured to the doubled end of the tube. The everted segment is then pulled down below the valve and bevelled as a mini-skirt sloping from 7—10 mm to 15—20 mm edge depth. Conduit preparation consistently takes from 6 to 9 min (Fig. 1a,b).

The conduit can be implanted by either multiple interrupted 2-0 pledgetted sutures or by an over-and-over 3-0 monofilament continuous suture. The shorter length of the mini-skirt is made to correspond to the left coronary sinus and the intercoronary commissure remnants. Due to its bevelled end the conduit takes off from the root in a more cranial direction than allowed by the usual straight tube grafts. Openings for coronary reimplantation are then made in the appropriate positions in the tube graft between the bioprosthetic valve struts, coronary buttons are connected and the procedure is completed with the distal aortic anastomosis.

From May 2001 to November 2007 we selected a biological conduit for 35 patients due to their advanced age or reluctance to lifetime anticoagulation in younger patients (Table 1).

3. Discussion

Over the last several years, a growing interest for aortic valve replacement with biologic prostheses has been fuelled by increased durability of biologic substitutes, ageing of the surgical population and an appreciation that a two-stage strategy avoiding anticoagulation can be a competitive option for young adults as well. The latter implies that the staged procedure can be technically simple and at low risk, though this is unlikely the case when the entire root has been replaced at the first operation [2,3].

The Bentall operation is generally performed with conduits incorporating a mechanical valve [1,4] due to the
willfulness to avoid a late redo procedure and the off-the-shelf availability of conduits. Alternatively, several ways of replacing the root with bioprostheses-containing conduits have been described [5,6], though none of them can assure freedom from prosthetic degeneration in young patients. The issue is a minor concern in the elderly when homograft or xenograft roots may be an option although not all surgeons keep them in stock.

We, as others [5,7], have thus resorted for many years to simply implanting stented xenografts at the extremity of a vascular graft. The technique we have described was eventually developed to facilitate suturing of the conduit to the annulus and to prevent its bending before reaching the distal aorta. It readily lent to continuous suture implantation, and allowed easily doubling of the suture line if deemed necessary. In addition, it would permit up sizing the valve with almost no limitation. We also speculated that, in case of valve failure, transecting the tube would allow easy access to the valve and simply interrupting the single monofilament suture would facilitate its removal. Subcoronal implantation of a new prosthetic valve into the conduit may be even easier than replacing a prosthesis into the native root, although this has not been necessary yet. We have experienced, however, the ease of implanting a prosthesis in a few cases of intraoperative failure of a valve-sparing procedure.

For young patients unwilling to undertake lifelong anticoagulation this procedure competes with biologic root replacement and the expected difficulties of taking down the previous, usually calcified root before undertaking a new full root reconstruction. The described modification of the Bentall procedure, currently performed according to the button technique developed by Kouchoukos et al. [4], is indeed of minor degree. Actually, Cabrol et al. [8] first described a subvalvular mini-skirt in proposing a procedure which has met some popularity in the past, though its failure modes had little to do with the proximal implantation technique. No surprise, therefore, if it can reproduce the intrinsic safety of the basic operation, albeit in a very small series such as reported herein. Surgeons acquainted with the Kouchoukos/Bentall operation would find it somewhat easier to perform, if anything.

References