

# Valve-Sparing Root Reduction Plasty in Aortic Aneurysm: The “Jena” Technique

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Reconstruction of the aortic valve and replacement of the ascending aorta instead of use of a composite graft is the preferred method in patients, who demonstrate an ascending aneurysm accompanied by aortic root enlargement and aortic valve insufficiency with morphologically intact cusps. Two techniques inaugurated by David and Yacoub have gained widespread acceptance. However,

both approaches are technically demanding. We present a simplified alternative technique for aortic valve reconstruction by means of a reduction plasty of the aortic root without the necessity of transection maneuvers.

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For many years, composite graft replacement was the only option for patients with aneurysms of the ascending aorta accompanied by aortic valve insufficiency. In the mid 1990s, however, both Yacoub and David independently developed techniques for a valve-sparing approach in the surgery of ascending aortic aneurysms with the goal of preserving morphologically intact cusps [1, 2]. Excellent intermediate and long-term results of these specific remodeling techniques have been demonstrated since [3, 4]. Recently, valve-sparing tactics have even been shown to be applicable in patients with acute aortic dissections [5, 6]. Insufficient coaptation of the aortic cusps can be caused by dilation of the sinotubular junction, distortion or dilation of the sinuses of Valsalva, or annuloaortic ectasia. The Yacoub technique comprises a replacement of all three sinuses by means of a triple-tongue-shaped Dacron (C.R. Bard, Haverhill, PA) prosthesis. The David technique comprises a complete transection of the entire root yielding a quasi-homograft without sinus walls. The valve is reimplanted inside an appropriately sized Dacron prosthesis, which is attached to the annulus. In both procedures, the coronary ostia are reimplanted into the prosthesis.

These techniques are technically demanding and require advanced surgical skills. The margin of error during preparation is small considering the various steps of transections and reconstruction of the appropriate spatial alignment of commissures, cusps, sinuses, and coronary ostia. As a consequence, few cardiac surgeons liberally decide towards aortic valve reconstruction in patients with an ascending aneurysm. A simplified method of aortic valve reconstruction may therefore be helpful for decision-making.

## Technique

Three patients (all women, aged 69, 73, and 76 years) were each admitted for a large aneurysm of the ascending aorta accompanied by marked aortic insufficiency. The aortic annulus was not dilated, but the sinuses and sinotubular junctions were involved in the aneurysmal dilation. All patients were considered for ascending aortic replacement and aortic valve reconstruction. All procedures were performed under standard extracorporeal circulation (ECC), blood cardioplegia, and a short period of deep hypothermic circulatory arrest to accomplish an open anastomosis of the proximal aortic arch.

After institution of ECC the aorta was cross-clamped and longitudinally incised. Blood cardioplegia was applied via both ostia. The aortic valve cusps exhibited no morphologic alterations, whereas the coronary ostia were moderately malpositioned. The aorta was transected circumferentially 5 mm above the commissures and scalloped above both ostia (Fig 1A). The commissures were suspended with three 4-0 polypropylene sutures. These sutures were aligned on the rim of a 25- or 27-mm valve sizer to verify harmonic coaptation of the cusps within the margins of a 26- or 28-mm prosthesis. In both coronary sinuses, J- or U-shaped 4-0 polypropylene mattress-sutures were placed internally from below both coronary ostia. The suture line extended toward the free edge of the aortic wall (Fig 1B, Fig 2A) to reduce the size of the sinuses and to retract the malpositioned ostia (Fig 1C). In the noncoronary sinus, a straight 4-0 polypropylene mattress suture was placed internally from the base of the sinus toward the free edge of the aortic wall (Fig 1B, 2B). A Dacron prosthesis of appropriate diameter (26 or 28 mm) was chosen. The three commissure-suspension sutures were placed at the rim of the prosthesis in triangular fashion. The three segments of the circumference were adjusted to compensate for differences in the dimensions of the sinuses. Commissural sutures were tied down. All three remodeled sinuses were anastomosed to the prosthesis using the commis-

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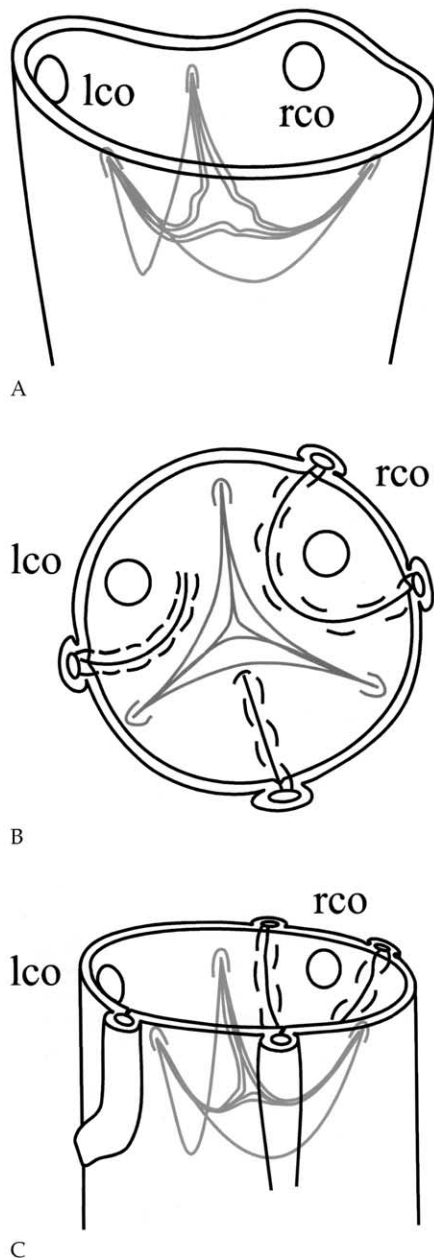


Fig 1. Schematic view of the aortic root after transection of the ascending aneurysm. Left coronary ostium (lco) and right coronary ostium (rco) are indicated. (A) Note the scalloped transection above the cranially malpositioned ostia as well as the incompetent valve due to enlargement of the sinotubular junction involving the commissures. Plication and exclusion of redundant portions of the sinuses are achieved by means of 4-0 Prolene mattress-sutures (B) in J-shape for an asymmetrically shaped sinus or in U-shape for a symmetrically shaped sinus. (C) Completion of the remodeling procedure yields an aortic root with a smaller diameter, sufficient coaptation of the cusps, and normally positioned coronary ostia.

sure sutures in a running suture line. Saline was injected directly into the prosthesis to visualize leaflet coaptation. Cardioplegia solution was then injected into the prosthesis at 80 mm Hg to test for leakage of the anastomosis and competence of the valve.

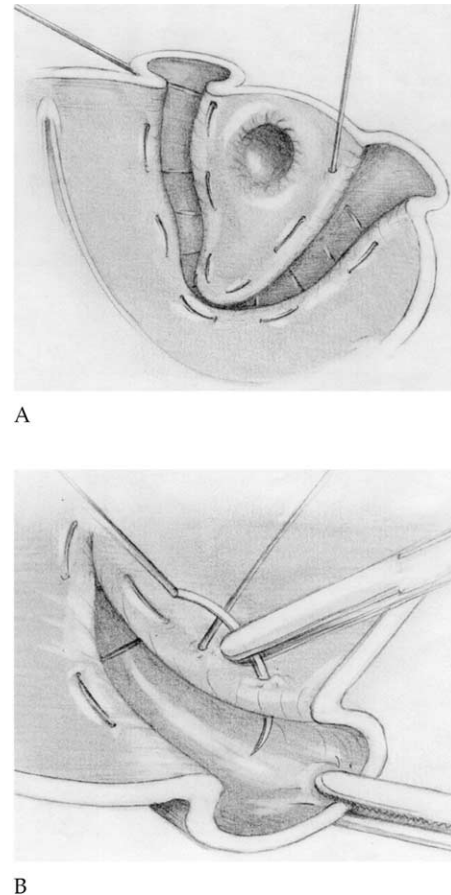


Fig 2. Plication and exclusion technique for remodeling the sinuses. Example shows U-shaped remodeling. (A) Note the placement of the first mattress stitches at the sinus base for a U-shape remodeling. Example shows straight mattress suture. (B) Internal knots in the sinus can be avoided by starting the single mattress suture outside as shown or by beginning a double mattress suture at the base of the sinus (see schematic Fig 1B).

After deep hypothermia was reached, the circulation was arrested and the ascending aorta was transected directly below the innominate artery. The prosthesis was anastomosed to the proximal aortic arch. In all patients, aortic cross-clamping time was less than 70 minutes (55, 65, 68 minutes) and circulatory arrest was less than 20 minutes (9, 13, 17 minutes). After rewarming, the competence of the aortic valve was evaluated by transesophageal echocardiography while the heart was beating. Before discharge and after 3 months of follow-up, all patients had a competent aortic valve and were in excellent condition.

# Comment

Aortic valve reconstruction is a difficult task. In time-consuming steps, the surgeon needs to reconstruct a complex three-dimensional structure when even a slightly misplaced stitch can jeopardize the entire result. In this case, the whole reconstruction must be abandoned

and the ascending aortic prosthesis must be removed and replaced with a composite graft. Our simplified reconstruction completely avoids transection of the aortic root and mobilization of the coronary ostia. Instead, reduction is accomplished by plication and exclusion of parts of the sinus walls. J-shaped unilateral plications are chosen for asymmetrically shaped coronary sinuses. U-shaped plications are chosen for symmetrically shaped sinuses. The aortic prosthesis can then be placed as a supracommissural tubular graft. Shaping of the prosthesis in a complex fashion, resuspension of the valve under difficult conditions, and reimplantation of the coronary ostia are not necessary. The entire procedure can be accomplished in a shorter time than for reconstruction according to Yacoub or David.

Leaving the aortic root of an aneurysmal aorta in place is often considered an incomplete resection, which may eventually produce an aneurysm of the native root [7]. Several studies have demonstrated dangers of subsequently enlarging an untreated aortic root in aortic dissections and Marfan patients [7, 8]. In patients with acquired degenerative aortic aneurysm, however, the risk of enlargement of the native aortic root appears moderate [9]. Thus, congenital degenerative disorders of the aortic wall represent a contraindication for our simplified approach [7], whereas older patients with acquired disease may profit from the simple operative strategy [9]. A decision on an individual basis under direct intraoperative visualization is mandatory. Our

simple technique, however, provides an additional option for the surgeon who wishes to spare a "good-looking" valve.

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