How to achieve an aortic root remodelling by performing an aortic root reimplantation

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Abstract

The aortic root remodelling procedure, introduced by Yacoub in the early 1980s, is the valve-sparing aortic root replacement procedure that better reproduces the anatomical and functional properties of the native aortic root. Long-term durability of the repair, in terms of freedom from recurrent aortic regurgitation, has been questioned and can probably be improved by appropriate patient selection. Reproducibility of the operation, however, depends on subjective evaluations and surgical skill. We report a simplification of the technique designed to possibly increase the reproducibility of the aortic root remodelling operation while retaining its functional advantages.

Keywords: Aortic root • Remodelling • Reimplantation • Valve sparing

INTRODUCTION

The aortic root remodelling procedure [1] designed to replace the aortic root while preserving the native aortic valve consists of tailoring the graft used to replace the ascending aorta in three ‘tongues’ that are used to replace the sinuses of Valsalva. Even if mathematical methods have been developed to correctly size and tailor the graft [2], experience and surgical skill are required to achieve a correct matching of the graft with native tissues and a proper alignment of the commissures.

In the aortic valve reimplantation procedure [3], valve-sparing aortic root replacement is achieved by suturing aortic valve annulus and valve remnants inside an untailored graft. Even if it has been shown [4] that the remodelling procedures better approach the natural dynamics of the aortic root, re-implantation has a more widespread adoption. This is mainly due to the fact that stabilization of the annulus prevents further dilatation and the consequent recurrence of aortic regurgitation. However, another reason is that the reimplantation procedure is much easier and reproducible, since once commissures are suspended inside the graft, it is immediately possible to evaluate the valve geometry and easier to anticipate the final shape of the root.

The proposed method exploits the technical advantages of the re-implantation procedure to achieve the functional advantages of the remodelling procedure.

Technique

After resecting the ascending aorta and detaching the coronary buttons, sinuses of Valsalva were resected and valve remnants trimmed to a minimum of 2–3 mm. A Valsalva graft (Vascutek, Renfrewshire, UK) of appropriate size was selected based on our usual principle of adding 5 mm to the internal aortic annular size measured on the arrested heart. The collar of the graft was...
trammed to a minimum and valve remnants included in the graft without placing any annular sutures.

The three commissures were first positioned, 120° apart, inside the graft at the level of the neo-sinotubular junction with a U-shaped 4/0 polypropylene suture. The final valve geometry was immediately assessed and evaluated.

The aortic valve was then reimplanted inside the graft just like any stentless valve, starting at the nadir of the sinuses and running to the top of the commissures, with three 5/0 polypropylene sutures, passing needles inside-out the graft and then outside-in.

Since the nadir of each native sinus was fixed to the facing portion of the corresponding graft sinus, the height of the neo-sinuses was predetermined by native aortic root anatomy, while their depth was determined by radial expansion of the skirt of the graft and there was no need for complex calculations to trim the graft.

Before suturing the coronary buttons, a longitudinal cut was made in the skirt of the graft from its base to the top of each commissure to allow independent expansion of the sinuses and unrestricted motion of the annulus (Fig. 1). Coronary buttons and distal anastomoses were then performed in an usual fashion with a 6/0 and a 4/0 continuous polypropylene suture, respectively.

In our preliminary experience, the technique was applied in 4 non-Marfan patients, mean age 68 ± 5 years, all of them with a tricuspid valve and with no need for additional procedures on leaflets. Intraoperative transesophageal echocardiography showed a good result: a mean coaptation length of aortic leaflets of 9 ± 2 mm and no or trace aortic regurgitation were observed (Fig. 2). The post-operative course was uneventful, and pre-discharge echo confirmed the absence of aortic regurgitation.

DISCUSSION

Choosing between functional advantages and shorter cross-clamp time of the remodelling technique, and better long-term performance of the re-implantation procedure remains a surgical dilemma. It is well accepted that Marfan patients or patients with a dilated annulus are better treated by a re-implantation procedure [5, 6]. Recent reports suggest that pre-operative anatomy more than surgical techniques can determine long-term results of the valve-sparing aortic root repair [7]. This consideration may shed a new light on the controversy and drive a revival of the remodelling principle, particularly in older patients whose leaflets behave poorly in the rigid ‘reimplanted’ root [8].

The idea of performing a reimplantation of the aortic valve and subsequently switching to a remodelling configuration with three simple cuts in the graft is appealing. It is readily performed with an evident reduction in the risk of bleeding. Suturing the remnants of the aortic root into neo-sinuses after a correct matching has been obtained allows for a better accuracy and for a smooth adaptation that probably helps to minimize bleeding. The technique is obviously intended for patients suitable for an ideal remodelling presenting with a normal aortic annulus and good non-enlarged leaflets. It worked well in our experience and may be tested in future studies as a simplified and reproducible approach to the remodelling principle.

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Conflict of interest: Ruggero De Paulis discloses that he has a patent licensing agreement with Vascutek Terumo.

REFERENCES