



The Ross procedure—the loose jacket technique

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Introduction

The Ross operation is the only operation which guarantees long-term viability of the aortic valve substitute. This translates into enhanced durability, survival, exercise capacity and quality of life and minimal valve related complications (1,2). However, there is continuing concern about progressive autograft dilatation, particularly when used as a freestanding root (3). The incidence and degree of dilatation varies considerably in different series and is dependent on the technique used as well as management during the peri-operative period and importantly patient-specific characteristics (4). Here we present a new method which aims at preventing long-term dilatation, using autologous tissue, while preserving geometry and dynamism of the aortic root.

Clinical vignette

A fifteen-year-old male with bicuspid aortic valve (fusion of the right and non-coronary cusps) with severe aortic stenosis and incompetence, who had undergone balloon aortic valvuloplasty was complaining of dyspnea on moderate exertion. Left ventricular dimensions and function were not impaired (ejection fraction 70%, left ventricular end systolic dimension 38 mm, left ventricular end diastolic dimension 52 mm).

Surgical technique

The procedure is started with complete transection of

the ascending aorta at its middle (about 2 cm above the commissures) after which the proximal aorta is cut down at the non-coronary sinus until just above its nadir. The aortic valve is excised, and the attention is given to mobilization of the pulmonary autograft.

Harvesting the pulmonary autograft is started at its proximal end leaving 2–4 mm of muscle cuff beneath the valve annulus without interfering with the integrity of the right ventricular outflow tract. This is accomplished by following the curvature of the attachment of the pulmonary valve leaflets and avoiding injury to the first septal perforator. The distal end of the pulmonary root is transected leaving only 2–3 mm above the commissures. After harvest is completed the pulmonary valve is checked and the root is trimmed in preparation for implantation.

To implant the neo-root, we use 4-0 or 5-0 polypropylene sutures (depending on the patient age and size) in a simple, interrupted manner starting from the nadir of the right coronary annulus of the aorta and moving anti-clockwise towards the left. When the left annular sutures are completed suturing is restarted in the same manner from the right nadir in a clockwise fashion towards the non-coronary annulus thus finishing the annular suture line. It is important that all suture bites should be just underneath the annulus (on the aortic end) and incorporating the pulmonary annulus (on the pulmonary end) in a way that “buries” the pulmonary root within the aortic annulus. This is designed to prevent late neo-aortic annular dilatation.

The coronary buttons are mobilized leaving the rest of the ascending aortic wall intact. The coronary buttons and

proximal coronary artery are then threaded through the resulting defect in the aortic wall to reach the pulmonary autograft sinus. A cruciate incision could be added to enlarge the hole in the jacket avoiding kink of the coronary artery running through it.

It is important to make the implantation site of the neo-coronary button of adequate size and site usually within or immediately underneath the sinu-tubular junction. This anastomosis is performed using a continuous 6-0 polypropylene suture. To conclude the autograft implantation, both ends of its distal suture line are trimmed to ensure a good size match and the anastomosis is performed using 5-0 polypropylene.

An appropriately sized pulmonary homograft is used to reconstitute the pulmonary outflow. This step could be performed after the cross clamp is removed.

To fashion the “loose jacket” an appropriately sized, tear drop shaped piece of fresh pericardium is used to close, and slightly augment, the non-coronary incision forming a tube of native aortic wall around the autograft with the coronary buttons passing through without tension or kink. The top end of the jacket is lifted cranially to cover the distal aortic anastomosis and is secured in place with four or five interrupted sutures. Covering the distal aortic suture line by fixing the loose jacket superior to it is an essential step in avoiding late dilatation of the native aorta above the autograft.

Comments

This technique has been used routinely for the last seventy Ross procedures apart from redo operations. Follow-up, using multimodality imaging, for periods of up to eight years showed no or minimal dilation of the autograft root with maintained geometry, dynamism and function. The autologous loose jacket has the benefit of supporting the fragile pulmonary root during the period of adaptation (5) without limiting its capacity to grow.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/acs-2020-rp-20>). The authors have no conflicts of interest to declare.

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References

1. El-Hamamsy I, Eryigit Z, Stevens LM, et al. Long-term outcomes after autograft versus homograft aortic root replacement in adults with aortic valve disease: a randomised controlled trial. *Lancet* 2010;376:524-31.
2. Yacoub M. The Ross Operation Comes of Age. *JAMA Cardiol* 2018;3:988.
3. Luciani GB, Casali G, Favaro A, et al. Fate of the aortic root late after Ross operation. *Circulation* 2003;108 Suppl 1:II61-7.
4. Yacoub MH, El-Hamamsy I. Valvular disease: The private life of tissue valves. *Nat Rev Cardiol* 2010;7:424-6.
5. Yacoub MH, Tsang V, Sarathchandra P, et al. Long-term adaptive versus maladaptive remodelling of the pulmonary autograft after the Ross operation. *Eur J Cardiothorac Surg* 2020;57:977-85.