Case Report

Modified (Valsalva Graft) Aortic Root Reimplantation for Successful Repair of Pulmonary Autograft Aneurysm After Ross Procedure

Antonis A. Pitsis, Ioannis G. Bougioukas, Timotheos G. Kelpis, Petros S. Dardas, Nikolaos E. Mezilis, Dimitrios D. Tsikaderis, Despina Deliaslani

Thessaloniki Heart Institute, St. Luke's Hospital, Thessaloniki, Greece

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Dilatation of the pulmonary autograft after the Ross procedure is a possible complication, necessitating aortic valve replacement. We present a case of a patient who developed pulmonary autograft dilatation and was treated successfully with valve-sparing aortic root reimplantation with a Valsalva graft.

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Address:
Antonis A. Pitsis

9 Nimfon St., Panorama
55236 Thessaloniki
e-mail:
apitsis@otenet.gr

In 1967, Ross implanted a pulmonary autograft as an alternative substitute for aortic valve replacement.[1-3] This procedure seems to hold great promise in young patients, offering excellent haemodynamic performance. However, dilatation of the pulmonary autograft is a possible complication, necessitating aortic valve replacement.[4] We present a case of a patient who developed pulmonary autograft dilatation and was treated with valve-sparing aortic root reimplantation with a Valsalva graft (Figure 1). To our knowledge this is the first report in the literature where an aortic root reimplantation technique with a Valsalva graft (Sulzer Vascutek, Renfrewshire, UK) was used to repair neoaortic (pulmonary autograft) root dilatation.

We also take the opportunity to present a brief review of the relevant literature.

Case presentation

A 16-year-old man with severe stenosis of a bicuspid aortic valve underwent total root replacement with a pulmonary autograft on December 6th, 1999. The right ventricular outflow tract was reconstructed with a 26 mm cryopreserved pulmonary homograft. The postoperative course was uneventful and the patient was discharged home one week later.

One year after the operation, echocardiographic examination showed an aortic root diameter of 31 mm, a left ventricular diastolic diameter of 41 mm and a left ventricular systolic diameter of 23 mm (Table 1). No regurgitation of the aortic valve was observed, while the pulmonary homograft gradient was 9 mmHg. Three years later, routine echocardiographic examination revealed a dilatation of the aortic root (50 mm), a left ventricular diastolic diameter of 54 mm, a left ventricular systolic diameter of 30 mm, a mild regurgitation of the aortic valve (grade I) with a pulmonary homograft gradient of 10 mmHg. In view of the gradual increase of the aortic root diameter, a decision was made to proceed to reoperation in order to maximise the possibility of preserving the neoaortic valve, despite the fact that the patient remained asymptomatic (New York Heart Association class I).

The reoperation took place on March 15, 2004. The valve of the pulmonary autograft was spared and a 28 mm Valsalva graft[5] was reimplanted according to the David I technique.[6-8] Postoperative recovery was

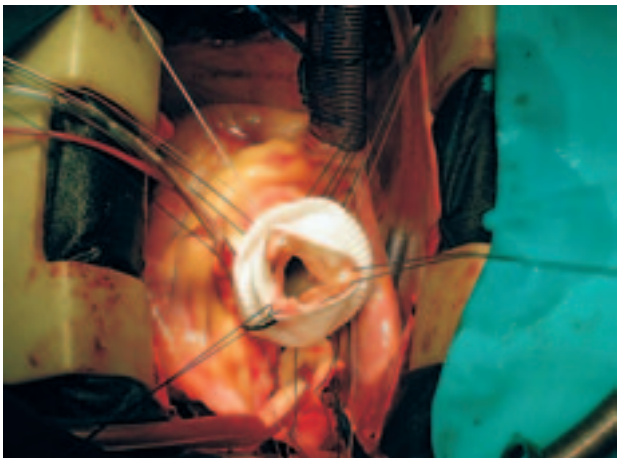

Figure 1. David I procedure with the use of a Valsalva graft (from another operation).

uneventful and patient was discharged home one week later. The neoaortic valve remains free of regurgitation two and a half years later.

Discussion

In the Ross procedure (total root replacement) the aortic valve and aortic root are replaced with a pulmonary autograft and the right ventricular outflow tract is reconstructed with a pulmonary homograft. The haemodynamic performance of the heart seems to be more than satisfactory, while the lack of a need for continuous anticoagulant treatment is a great advantage that might render this procedure as an operation of choice, especially for patients less than 55 years old.

Dilatation of the pulmonary autograft after a total root replacement is a potential complication that may lead to aneurysm formation and severe valve insufficiency. Concern exists about the pulmonary autograft's ability to sustain the increased systemic pressure. Clearly, a normal pulmonary valve is required for the aortic valve reconstruction.

The most common technique for the repair of the dilated neoaortic root following the Ross procedure is the Bentall operation with valved conduits. However, the finding that in many patients the autograft valve leaflets were normal led to the selective preference of valve-sparing operations (Table 2).

Luciani et al[9] reported the case of a 29-year-old male patient treated with a Ross operation for aortic valve regurgitation on a bicuspid valve. Two years after the operation a moderate dilatation of the aortic root was detected, which progressively developed aneurysmal dimensions six years later. The aortic root remodelling was successfully performed with the Yacoub technique, utilising a size 30 Dacron graft. Leyh and colleagues[10] reported the case of a 37-year-old man with severe aortic valve regurgitation who underwent total aortic root replacement with pulmonary autograft valve implantation. Dilatation of the autograft and severe autograft valve insufficiency were found twenty-eight months after the initial procedure. The patient underwent reoperation using a valve-sparing technique, with implantation of a non-tailored Dacron graft. Masetti and colleagues[11] reoperated on a 46-year-old patient who had undergone a Ross procedure at the age of 34 for an aortic valve stenosis. They performed a Yacoub operation in order to correct the dilatation of the aortic root and ascending aorta after the initial procedure. Schmidtke et al[12] reported the case of a 42-year-old patient who underwent a valve-sparing procedure because of aneurysm formation at the neoaortic root ten years after a Ross operation (free-standing root technique).

In our case, we preferred to use a Valsalva graft, as we believe it offers a better anatomical restoration

Table 1. Aortic root and ventricular dimensions after the Ross procedure.

	AR	LVDd	LVDs	Aortic Root	EF	PV gradient
Pre operation	0	41 mm	23 mm	34 mm	60%	
After 1 year	0	41 mm	23 mm	31 mm	60%	9 mmHg
After 2 years	0	53 mm	28 mm	42 mm	60%	10 mmHg
After 3 years	0-I	54 mm	30 mm	45 mm	60%	12 mmHg
After 4 years	0-I	54 mm	30 mm	50 mm	60%	10 mmHg

AR – aortic regurgitation; EF – ejection fraction; LVDd – left ventricular diastolic diameter; LVDs – left ventricular systolic diameter; PV pulmonary homograft.

Table 2. Summary of the literature (remodelling-reimplantation procedures following the Ross procedure).

Authors	Age*/Sex	Original disease	1st operation	2nd operation	Time interval
Leyh R, et al	37/M		Ross procedure	David operation	28 months
Schmidtke C, et al	42/M	Aortic valve insufficiency	Ross procedure	Yacoub procedure	10 years
Luciani G, et al	29/M	Aortic valve regurgitation	Ross procedure	Yacoub procedure	8 years
Masetti P, et al	34/M	Aortic valve stenosis	Ross procedure	Yacoub procedure	12 years
Pitsis AA, et al	16/M	Aortic valve stenosis	Ross procedure	David operation	4 years

* Age at original Ross operation.

of the aortic sinuses, producing a leaflet motion similar to that of normal subjects. This might result in a benefit in terms of valve longevity.

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