

CASE REPORT

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Inverted aortic bioprosthesis for mitral valve replacement with Ross procedure: case report



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Abstract

Background: A 34-year-old gentleman presented with *Staphylococcus salivarius* infective endocarditis 13 years after aortic homograft and mitral valve repair for degenerative bicuspid aortic valve associated with rheumatic heart disease. The homograft had calcified, and the mitral repair had deteriorated with severe regurgitation. Multidisciplinary team decision to restore best quality of life was for re-do Ross procedure with bi-leaflet preserving mitral valve replacement with an inverted RESILIA aortic valve as the patient was fundamentally against lifelong anti-coagulation.

Case presentation: The aortic homograft was excised, and coronary arteries dissected out followed by harvesting of the pulmonary autograft. The mitral valve was accessed via a trans-septal approach. On examination, there was a restricted and thickened posterior mitral valve leaflet. An inverted 27-mm INSPIRIS RESILIA aortic bio-prosthesis was placed with mitral cusps preserved. The pulmonary autograft was implanted in an intra-annular position, and a 26-mm pulmonary homograft was used to replace the pulmonary valve. Echocardiogram at 4 weeks revealed preserved LV function and well-functioning prosthetic, autograft and homograft.

Conclusion: An inverted RESILIA valve, with its anti-structural valve deterioration properties, can be used in the mitral position with preservation of the mitral cusps to avoid anti-coagulation with the hope of reducing need for re-operation in line with patient wishes.

Keywords: Ross, RESILIA, Mitral valve

Background

We present the case report of a dilemma of a patient with an infected homograft for degenerative bicuspid aortic valve and mitral ring for central regurgitation performed 13 years prior. There was debate as to how best to restore life expectancy with both mitral and aortic valve surgery, as the mitral repair had degenerated, and the posterior leaflet was shortened. Additionally, the patient was refusing mechanical replacement and anti-coagulation. Repair would be complex and difficult to test with an incompetent homograft and intended Ross procedure. The decision was for redo Ross procedure with bi-leaflet preserving mitral valve replacement using

an inverted INSPIRIS RESILIA (Edwards Lifesciences Inc., CA) aortic bioprosthesis. The authors declare no conflicts of interest and that no funding was received.

Case presentation

A 34-year-old gentleman with *Staphylococcus salivarius* infective endocarditis, confirmed on peripheral blood culture, presented with heart failure. Computed tomography (CT) showed circumferential calcification of the aortic homograft (Fig. 1). Trans-oesophageal echocardiogram (TOE) displayed thickened aortic valve leaflets and severe transvalvular regurgitation, alongside severe mitral regurgitation (Fig. 2). Left ventricular (LV) function was preserved. The patient was recommended mechanical aortic and mitral valve replacements. However, as a fit patient and mountain climber, he refused mechanical aortic or

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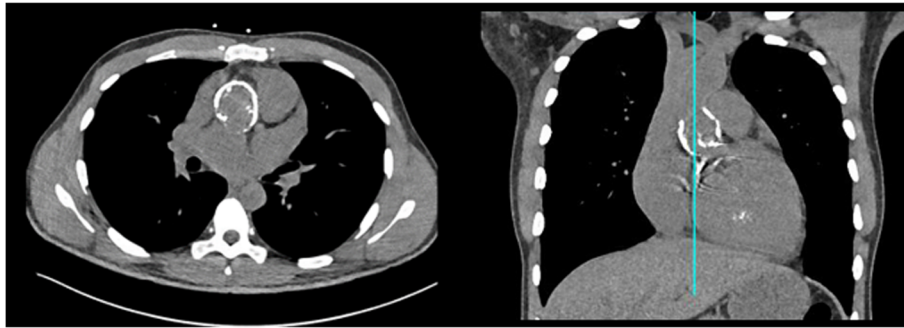


Fig. 1 Computed tomography (CT) angiogram aorta performed on admission for symptoms of infective endocarditis to assess the aortic homograft inserted 13 years prior for evidence of infection, abscess, and degeneration. Axial and coronal sections showed only heavy, circumferential calcification of the aortic homograft with associated heavily calcified leaflets. These findings were contextually interpreted to display infective endocarditis considering blood culture findings after multi-disciplinary team discussion

mitral valve replacements, despite counselling on the inferior longevity of a tissue replacement. The opinion of the multi-disciplinary team considered the Ross procedure as the procedure to give the best quality of life and life expectancy, in this situation where anticoagulation was to be avoided.

Redo sternotomy was uncomplicated and cardiopulmonary bypass was established in a standard fashion. The aortic homograft was excised, coronary arteries dissected out and the pulmonary autograft harvested. The mitral valve was accessed via a trans-septal approach. There was a restricted and thickened posterior mitral valve leaflet but no vegetations. The annuloplasty ring was excised, and an inverted 27-mm RESILIA bio-prosthesis was placed using concertina-style pledgeted sutures. Mitral cusps were preserved, and valve secured using interrupted pledgeted sutures. The pulmonary autograft was implanted as a “free standing” root in an intra-annular position. A 26-mm pulmonary homograft was implanted. Cross clamp time was 294 min and bypass time was 344 min. Intra-operative

TOE showed an insignificant paravalvular leak at the anterior mitral leaflet (vena contracta=3 mm) and no LV outflow tract obstruction. The patient returned to the Intensive Care Unit (ICU) supported with adrenaline, milrinone and noradrenaline. These were weaned over the following 24 h, with the patient extubated on the morning of the first post-operative day. The patient was discharged from ICU on post-operative day 3. The patient had an underlying sinus rhythm post-operatively, with backup dual chamber pacing in place for 4 days before removal of temporary pacing wires. Renal and cardiac function remained good and the patient was discharged on post-operative day 5. Echocardiogram at 4 weeks revealed preserved LV function and well-functioning prosthetic, autograft and homograft.

Conclusions

Mitral valve replacement is mandated in complex disease or re-do surgery. Traditionally, bioprostheses have been used in older patients as the need for re-operation is low

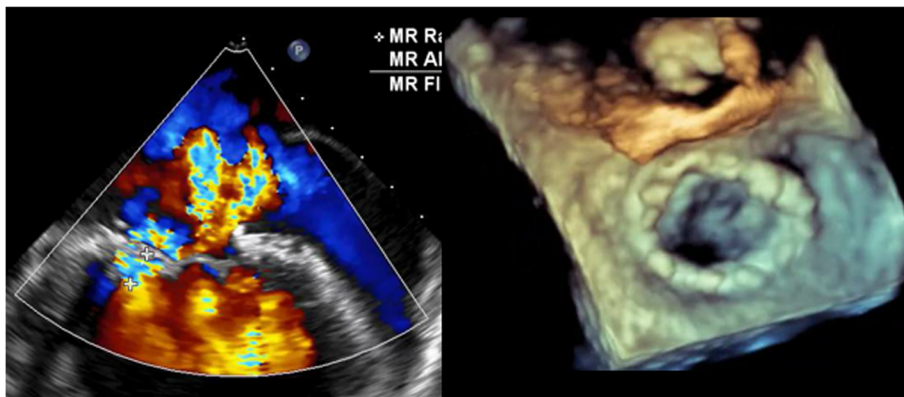


Fig. 2 Pre-operative transoesophageal echocardiogram (TOE) was performed to assess valve function and assess for vegetations. TOE showed the posterior leaflet of the previously repaired mitral valve to significantly shortened and thickened but no clear signs of infective endocarditis. Superimposed Doppler assessment demonstrates severe mitral regurgitation and the 3-dimensional (3D) re-construction demonstrates the restriction of the valve, both secondary to this shortened and thickened posterior leaflet

despite structural valve deterioration (SVD). For patients less than 50 years old with an expected survival of greater than 20 years, life-long mechanical valves with anti-coagulation are used to offset need for re-operation [1]. This involves substantial bleeding risks, close adherence to treatment regimens and lifestyle changes. These cannot be underestimated and are key to the safety of the valve. This patient adamantly refused anti-coagulation.

The RESILIA valve was developed for implantation in the aortic position and possesses several benefits over traditional bioprostheses, primarily expected reduction in calcification, SVD and valve failure. Owing to the recent development of this technology, there is currently no evidence on the long-term calcification of the valve. However, current 4-year up follow-up data demonstrated no SVD in 133 patients implanted with a RESILIA valve. This reflects the long-term reduction in SVD noted in animal models [2]. RESILIA technology may delay or avoid re-operation for SVD induced mitral valve failure which is observed with traditional bioprosthesis in patients less than 50 years old [3].

We were able to implant the RESILIA valve with preservation of the mitral leaflets in an intravalvular fashion, as has been described in other tissue mitral valves. This preserves the sub-valvular apparatus and LV geometry [4], resulting in an improved 5-year survival of 92% at 5 years vs. 80% when the sub-valvular apparatus is interrupted [5]. The Ross procedure has been shown to provide comparable survival compared with the general population and 20-year freedom from re-operation of 83% [6]. However, this and the haemodynamic benefits would be lost if the sub-valvular apparatus were damaged. This case shows that the RESILIA valve can be used in a way that does not detract from the benefits of the Ross procedure.

The use of an inverted aortic INSPIRIS RESILIA valve for mitral valve replacement with Ross procedure has not been described previously. It can be performed successfully with an implantation technique like that of, and with the same benefits as, other tissue mitral valves. The long-term outcomes for SVD and re-operation are not yet known for the RESILIA valve, with the creation of the multicentre INSPIRIS RESILIA Durability Registry (INDURE) [7] designed to address this in patients less than 60 years old. However, if the observed reduction in SVD noted in short to mid-term studies are reflected in long-term outcomes when compared with other tissue valves, in addition to the support of future transcatheter valve implantation, aided by its expanding frame to avoid high pressure sewing ring fractures, the likely required re-operations will hopefully be reduced. A discussion to clarify the patient's wishes is critical to delivering patient centred care. In case the patient refuses mechanical valve replacement

and anticoagulation, this approach provides a viable option to cure disease whilst still providing excellent long-term quality of life, with the benefits of a predicted reduced SVD in the RESILIA valve.

Abbreviations

CT: Computed tomography; TOE: Transoesophageal echocardiogram; LV: Left ventricle; ICU: Intensive care unit; SVD: Structural valve deterioration

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Authors' contributions

IM – Conceptualisation, validation, formal analysis, investigation, writing – original draft, writing – review and editing, project administration. CB – Conceptualisation, validation, investigation, writing – review and editing. TG – Conceptualisation, validation, investigation, writing – review and editing. KB – Conceptualisation, methodology, validation, formal analysis, resources, writing – review and editing, supervision. AH – Conceptualisation, methodology, validation, resources, writing – review and editing, supervision. All authors meet the four ICMJE criteria for authorship. The authors read and approved the final version of the manuscript.

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Availability of data and materials

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Ethics approval and consent to participate

No patient identifiable information or images are included within this case report. Patient consent has been obtained and documented locally.

Consent for publication

Patient written informed consent for publication has been obtained and documented locally.

Competing interests

The authors declare that they have no competing interests.

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