

Starr–Edwards aortic valve: 50+ years and still going strong: a case report

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Abstract

The advent of the Starr–Edwards mechanical valve marked the beginning of the modern era for heart valve replacement. Nowadays, this valve has been supplanted by lower profile bileaflet mechanical prostheses that are considered to have better haemodynamics, lesser risk of thrombo-embolic complications, and longer durability without structural prosthesis failure. These assumptions often lead physicians to face with the question of systematically replacing functional Starr–Edwards valves in patients undergoing redo operations on other valves. We report the case of a 67-year-old patient who recently underwent mitral valve replacement for symptomatic rheumatic valve disease with an excellent outcome. During the operation, the Starr–Edwards valve in the aortic position implanted 51 years earlier was found to still functioning normally hence was left in place, thereby breaking a new longevity record for a valve prosthesis.

Keywords

Case report • Mechanical heart valve prosthesis • Long-term results • Redo surgery

Learning points

- A new longevity record beyond 50 years for valve prostheses has been set by the caged-ball mechanical Starr–Edwards aortic valve. This landmark should contribute to reassure physicians and patients on the excellent performance of this valve.
- Systematic replacement of Starr–Edwards aortic valve when reoperating patients on mitral and/or tricuspid valve is not mandatory.

Introduction

The caged-ball valve created by Albert Starr and Lowell Edwards was implanted for the first time in September 1960 in the mitral

position.¹ It was the first valvular prosthesis produced and marketed on a large scale. Its long-term results up to 40 years have made the Starr–Edwards prosthetic valve a benchmark in the field of valvular surgery.^{2,3} However, if reoperation rates were reported similar to those of other more recent mechanical valves with regard to infection and prosthetic valve dehiscence,⁴ it has been frequently stated that the Starr–Edwards valves had a higher risk of thrombo-embolic events and of valve dysfunction. In fact, freedom from thrombo-embolic events after the implantation of Starr–Edwards valve in the aortic position varied from 74% to 87% at 10 years depending mainly on the time frame of the studies, which likely reflected evolutions in anticoagulation protocols.^{4,5} Furthermore, in the most recent series, haemolysis and valve thrombosis rates were reported as low as 0.10% and 0.06% per patient years, respectively.⁶ We report a case of a 67-year-old patient who was recently reoperated on for rheumatic mitral and tricuspid valve disease and had a Starr–Edwards aortic valve implanted 51 years earlier with no valve dysfunction.

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Timeline

Year	Event
1965	Aortic valve replacement with a Magovern mechanical prosthesis for rheumatic valve disease
1966	Second cardiac procedure: aortic valve replacement with a Starr–Edwards 8A caged-ball prosthesis for Magovern valve dehiscence
1969	Third cardiac procedure: reinsertion of the Starr–Edwards aortic valve for partial prosthesis dehiscence and systematic ball replacement
2009	Atrial fibrillation and ischaemic stroke with aphasia. Complete clinical recovery within 3 months
2016	Hospitalization for pulmonary oedema revealing severe rheumatic mitral valve insufficiency
2017	Fourth cardiac procedure: mitral valve replacement with a Carbomedics mechanical prosthesis associated with tricuspid valve annuloplasty. The 51-year-old Starr–Edwards aortic valve was let intact.

Case report

In 1966, a 17-year-old patient underwent reoperation at Broussais hospital for dehiscence and dysfunction of a Magovern valve prosthesis implanted a year earlier for rheumatic aortic valvular disease. A Starr–Edwards Model 1200 prosthesis Size 8A was then implanted. Two years later, this patient had to be reoperated on for valve reinsertion and the silastic ball of the Starr–Edwards valve was also preventively changed. Over the following 50 years, she was maintained under Coumadin, had regular check-ups, and did not present any noticeable medical problems except for a permanent atrial fibrillation (AF) and an ischaemic stroke event in 2009 although the international normalized ratio (INR) was within the therapeutic window between 2.5 and 3.5. She completely recovered from the latter event within 3 days. Recently, at age 67, she became symptomatic with dyspnoea New York Heart Association (NYHA) Class III. Auscultation revealed a systolic murmur at the mitral area. Transthoracic echocardiography showed severe mitral insufficiency associated with increased left ventricular (LV) dysfunction (LV ejection fraction 42% and LV end-systolic diameter 48 mm). The mitral valve was extremely remodelled; the chordae were short and thickened, responsible for a Type IIIa posterior leaflet dysfunction. The anterior leaflet was severely retracted (height 22 mm) but also prolapsing at the level of A2 by lateral displacement of marginal chordae. On the other hand, the Starr–Edwards aortic valve prosthesis was found to function well with a mean transaortic gradient at 16.8 mmHg, peak velocity of 267 cm/s, effective orifice Area of 1.33 cm², and no significant regurgitation (Figure 1). Moderate tricuspid insufficiency (regurgitant orifice area 25 mm²) and mild pulmonary arterial hypertension (systolic pulmonary arterial pressure 48 mmHg) were also noted. Finally, on preoperative computed tomography scan assessment (Figure 2), an anomalous aortic origin of the circumflex artery originating from the right coronary sinus was detected.

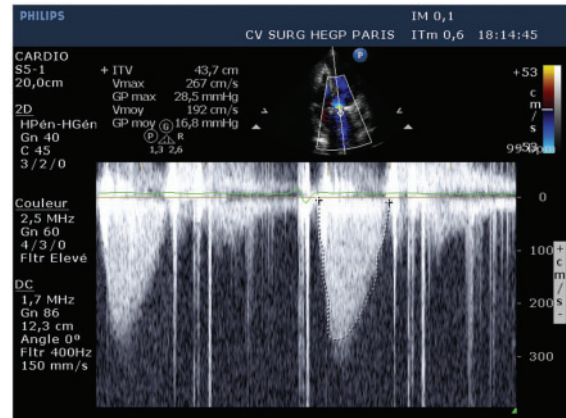


Figure 1 Preoperative Transthoracic Echocardiography: continuous-wave Doppler evaluation of the Starr–Edwards aortic prosthesis.

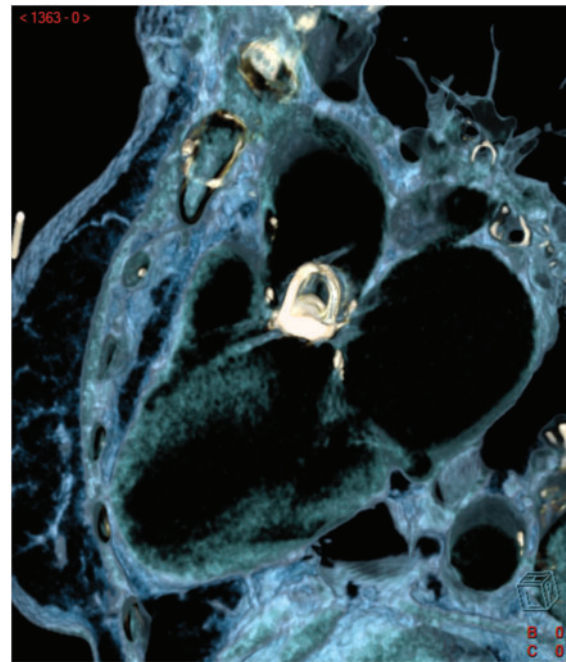


Figure 2 3D Computed Tomography imaging volume rendering reconstruction of a three-chamber view showing the normal functioning of the Starr–Edwards valve in the aortic position.

The decision was made to operate on her mitral valve. Oral anticoagulation was discontinued 5 days before surgery and relayed by non-fractionated heparin when the INR was below 2.5. The intervention was performed by median sternotomy with the complete release of LV adhesions. Transoesophageal echocardiography in the operating room confirmed that the Starr valve was functioning normally and reinforced our idea of preserving this valve (see [Supplementary material online, Video S1 and S2](#)). The extracorporeal circulation was carried out by central cannulation under moderate hypothermia. After aortic clamping and antegrade cold blood

cardioplegia, the mitral valve was approached via the Sondergaard groove. Analysis of the mitral lesions showed that the valve was not amenable to a repair procedure. A mitral valve replacement was then performed with a Carbomedics N°29 mechanical prosthesis combined with a tricuspid annuloplasty by a Carpentier–Edwards Physio prosthetic ring N°30. The duration of the aortic cross-clamping was 90 min. The postoperative care was uneventful, except for an episode of transient oliguria and pulmonary congestion which was favourably treated by diuretics and non-invasive ventilation.

The patient was put back on oral anticoagulation with a new targeted INR between 3 and 4. Postoperative echocardiographic assessment of the Starr–Edwards aortic prosthesis showed no functional modification compared with preoperative evaluation (see [Supplementary material online, Video S3](#)). The patient was able to leave the hospital quickly and is still doing well 5 months after the intervention.

Discussion

Since its introduction in 1960, more than 175 000 patients have received the Starr–Edwards valve in the mitral, aortic, or tricuspid position.⁷ The case of our patient is, to the best of our knowledge, the first reported observation of a Starr–Edwards prosthetic valve still functioning after 50 years. Only two valve-related complications occurred during the follow-up. The first was a reintervention for valve dehiscence 2 years after its implantation. One can assume that this complication was due to a technical cause and not to the Starr–Edwards valve itself, because the native annulus had suffered previous damage from the dehiscence of the initial Magovern prosthesis. The change of the silastic ball had been carried out systematically, but the replaced ball did not present an abnormal infiltration pattern as described for the model 1000.⁸ The second was an ischaemic stroke that occurred 43 years after implantation without any additional image seen on the cardiac echography. Although thrombus from the valve prosthesis cannot be definitively excluded as the cause of stroke, the patient was also in AF. Contrary to a widely disseminated belief, the rate of thrombo-embolic events in patients with Starr–Edwards valves is not higher than that of patients with the latest generation of valves regardless of the position.⁹ Fortunately, this event did not have any long-term neurological consequences for our patient who fully recovered. The excellent haemodynamic stability of this valve reported in the literature¹⁰ as well as the aortic valve echocardiographic parameters led us to adopt a conservative attitude on this aortic valve. Moreover, mitral valve exposure via the Sondergaard groove was not limited by the aortic valve prosthesis protrusion towards the left atrium. This allowed us to limit the surgical time in a patient with an already significant ventricular dysfunction and thus to reduce the risk of excess mortality and complications inherent in double mitral and aortic valve replacements.¹¹ In view of the need for anticoagulation treatment, we chose to implant a bileaflet mechanical valve in the mitral position. Preservation of the posterior subvalvular apparatus during mitral valve replacement was performed in a systematic manner for contributing to late improvement of ventricular function as recommended by many authors and European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) guidelines.^{12,13}

Conclusion

The excellent durability of the Starr valve is further demonstrated by this observation. This might allow having a conservative attitude regarding these valves, which, in this case, has shortened the operative time, thereby contributing to a good operative outcome.

Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

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Consent: The authors confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: A.C. is a scientific advisor at Edwards Lifesciences R&D.

Author Contributions: M.A. compiled data and was involved in writing the article. G.S. helped in editing figures. A.C. was involved in clinical and surgical management and article reviewing. J.J. contributed to clinical and surgical management, article writing, reviewing, and editing.

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