



Quadruple valve replacement for patient with infective endocarditis 16 years after Fallot's Tetralogy Repair procedure: A case report

Yulin Wen, Xinpei Liu, Yanxue Zhao, Jianzhou Liu, Qi Miao*

Department of Cardiac Surgery, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

ARTICLE INFO

Keywords:

Quadruple valve replacement
Infective endocarditis
Valvular surgery

ABSTRACT

A 33-year-old man, who had previously undergone repair for Tetralogy of Fallot, presented with extensive infective endocarditis. Following thorough preoperative preparation and evaluation, we performed a simultaneous quadruple valve replacement alongside the repatching of the remaining defect. We posit that this comprehensive one-stage surgical intervention not only enhanced the patient's quality of life but also reduced the necessity for future reoperations. Our approach offers valuable insights for managing adult patients with repaired congenital heart diseases and multiple valve pathologies.

1. Introduction

Infective Endocarditis(IE) involving multiple valves is a challenging clinical condition, surgery including more than two valves is a complex procedure associated with a high early morbidity and mortality. Here, we report a successful case of quadruple-valve replacement in a patient with IE who had previously undergone a Repair of Tetralogy of Fallot.

2. Case presentation

A 33-year-old man was diagnosed with congenital heart disease of Fallot's Tetralogy during childhood and underwent later operated Fallot's Tetralogy Repair procedure at 17 years of age (2006). Since a young age, the patient exhibited cyanosis upon physical exertion. During childhood, an echocardiogram diagnosed Tetralogy of Fallot. Due to financial constraints within the patient's family, the condition remained untreated. During this period, the patient refrained from engaging in any physical activity, so they could essentially tolerate the condition. It wasn't until the age of 17 in 2006 that the patient gained access to a medical facility with the expertise and resources required for cardiac surgery. The surgical procedure involved total correction, closure of the ventricular septum, and the dredging of the right ventricular outflow tract through the main pulmonary artery incision. Following this surgery, the patient's symptoms significantly improved, allowing for a symptom-free life. However, it is noteworthy that regular follow-up was not conducted until the onset of the recent health issue.

Sixteen years postoperatively, the patient referred to our hospital because of a 3-month duration of recurrent fever (maximum

* Corresponding author. Peking Union Medical College Hospital (Dongdan campus), No.1 Shuaifuyuan Wangfujing, Dongcheng District, Beijing, 100730, China.

E-mail address: miaoqipumc@hotmail.com (Q. Miao).

<https://doi.org/10.1016/j.heliyon.2023.e23351>

Received 10 January 2023; Received in revised form 15 November 2023; Accepted 1 December 2023

Available online 5 December 2023

2405-8440/© 2023 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

temperature of 38.5 °C) with chills. Upon further inquiry, the patient reported symptoms of oliguria and edema in the past two months, weakness, and the development of multiple painless rashes on the lower extremities one month ago. Physical examination revealed paleness and poor nutritional status, with a Nutrition Risk Screening-2002 score of 4 points. The patient's general condition had severely deteriorated, presenting with symptoms of cardiac cachexia (SOCC).

No pathogen was isolated from the blood culture due to the prior use of antibiotics from other healthcare institutions. Transthoracic echocardiography (TTE) showed mobile vegetations attached to the pulmonary valve (PV), tricuspid valve (TV) and subvalvular chordae tendineae, which led to severe regurgitation of the tricuspid valve, and mild stenosis and severe regurgitation of the pulmonary valve. Vegetations were also found on all three leaflets of the aortic valve (AV), causing mild aortic regurgitation. No vegetation was detected on the mitral valve (MV) under TTE, although mild regurgitation was evident. His left ventricle was dilated (LVEDD, 56mm), with a reduced ejection fraction (EF, 43 %). The aortic sinus was also dilated (48mm). We also found interventricular residual shunt near the patch graft (Fig. 1A,1B). Multiple nodules of different sizes were found in both lungs by CT Scan. Coronary CT angiography was normal.

After six days of conservative therapy, including antibiotic treatment (Amoxicillin Sodium and Clavulanate Potassium for Injection 1.2g every 8 hours and Amikacin Sulfate Injection 0.4g once daily), surgery was considered to prevent further aggregation of HF or major PE. During anesthesia, transesophageal echocardiography (TEE) revealed vegetations attached to the MV, with other findings consistent with the preoperative TTE. (Fig. 1C,D)

Intraoperatively, an oblique incision on the ascending aorta was made to expose the aortic valve. Large vegetations were found attached to all three leaflets of the aortic valve, leading to valve destruction without annular involvement. Exploration of the tricuspid valve through right atriotomy revealed significant vegetations attaching to leaflets and chordae, causing severe damage to the TV (Fig. 2A). Through an incision of the right ventricular outflow tract, large vegetations attaching to the PV can be seen (Fig. 2B). After an atrial septal incision, large vegetations on both leaflets and subvalvular chordae of the MV were found. We also observed a 1 × 1 cm defect on the lower edge of interventricular patch, and vegetations were found on right ventricular side of the patch graft.

All 4 valves were badly damaged, making it impossible to repair, therefore, we performed quadruple valve replacement. We also excised the involved patch graft and repatched the remaining defect using pericardial patch. TEE (supplementary) after weaning from CBP showed normal functioning of all four mechanical valves. Postoperative radiograph (Fig. 2 E) also showed well of all valves. The patient spent 2 days in the intensive unit and was discharged in the 20th postoperative day (Antibiotic treatment of 'Amoxicillin Sodium and Clavulanate Potassium' and 'Amikacin Sulfate' was continued postoperatively for 4 weeks), the recovery was uneventful.

At 3 months follow-up, TTE showed normal functioning of all four mechanical valves. The patient was in satisfactory condition, experiencing gradual weight gain compared to the early postoperative period (Fig. 2C and D). Approximately 6 months after surgery, the patient remained in good health without adverse events.

3. Comments

Patients with adult congenital heart disease (ACHD) often have residual or deteriorated lesions that require surgical intervention,

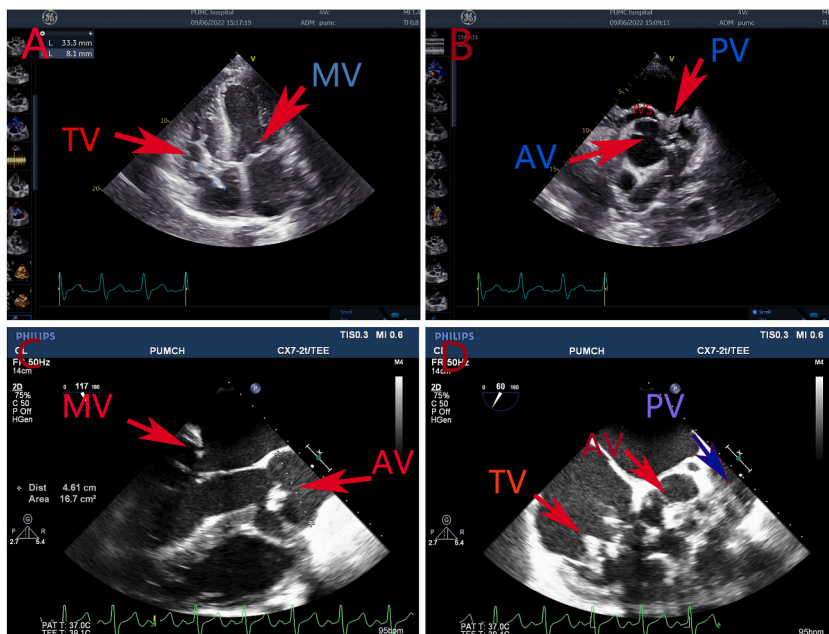


Fig. 1. Transthoracic echocardiography (A,B)and Transesophageal echocardiography(C,D) showing endocarditis of the tricuspid (TV),pulmonary (PV),aortic (AV) and mitral valve (MV).

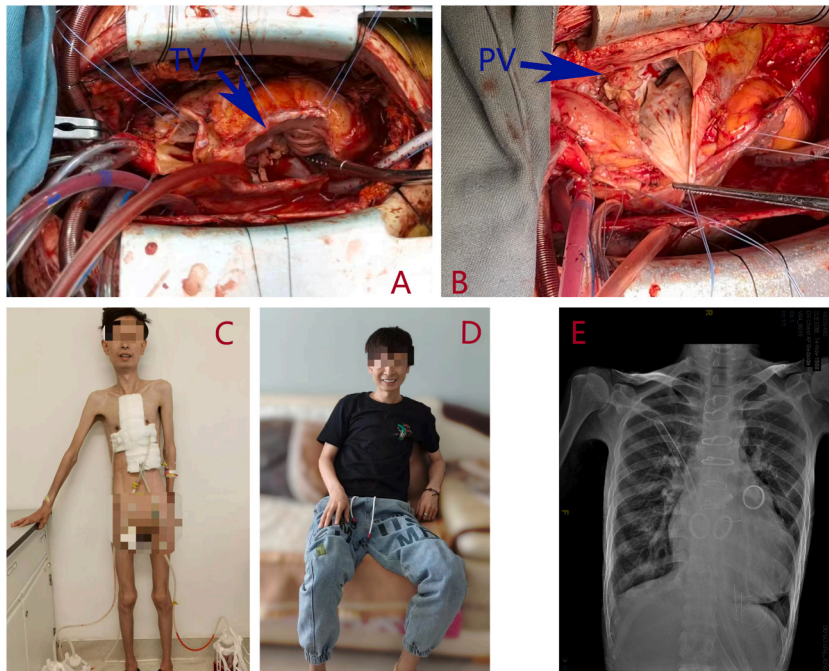


Fig. 2. A B, intraoperative findings. Significant vegetations attaching to leaflets and chordae of TV(A), large vegetations attaching to the PV (B). C D, show condition of 3 months recovering from operation compared to early postoperative period. E , Postoperative radiograph.

while valvular surgery is one of the most common. Infective endocarditis is most often a single-valve disease, the involvement of all four valves in one operation is rare, occurring mainly in carcinoid disease [1]. Isolated cases have also been reported in the context of rheumatic heart disease and a few instances of infective endocarditis [2,3]. To the best of our knowledge, this is the first documented case of quadruple-valve replacement of Infective endocarditis as a redo procedure after Fallot's Tetralogy Repair.

In this patient, the signs of heart failure and severe valve dysfunction become the specific indications of surgery, which is widely agreed. The indications for surgery in accordance with the guidelines of the AHA/ACC and ESC, however, for the timing of surgery, remains a controversial cause for debate. The AATS guidelines [4] conclude that once a surgical indication is evident, surgery should not be delayed. In this case, the patient with the presence of progressive damage to all four valves, both mobile vegetation in right-sided and left-sided heart, and the general condition were progressively exacerbated, we decide to perform “early surgery”. Notably, in a prospective cohort study involving patients with native-valve infective endocarditis, a multivariable analysis adjusted for coexisting conditions demonstrated that a surgical indication without subsequent surgery was an independent predictor of mortality [5]. However, how best to identify patients who are most likely to benefit from early valve surgery is best made by an experienced multidisciplinary team.

Due to the presence of large vegetation on TV and PV, and severe dysfunction of all four valves, reconstructive surgery was not a viable option. The choice between a bioprosthetic or mechanical valve significantly impacts the quality of life and long-term prognosis of ACHD patients with valvular disease. In our case, the patient is young, considering about the complexity of the redo procedure and the even higher complexity of a possible further surgical intervention in case of biological valve replacement, mechanical valves were deemed appropriate for he to reduce the need for future reoperations. This patient consented to the replacement of all 4 mechanical valves.

Native-valve infective endocarditis is relatively rare, with an estimated incidence of approximately 2–10 cases per 100,000 person-year. Cardiac conditions that predispose to infective endocarditis include congenital disease (e.g., ventricular septal defect and bicuspid aortic valve) and acquired valvular disease (e.g., degenerative valvular disease, aortic stenosis, and rheumatic heart disease) [6]. Patients with CHD have an increased risk of IE, especially those with residual cardiac shunts at the site of previous repair and those with uncorrected cyanotic heart disease [7]. Specific predictors of IE in patients with CHD include those with valve-containing prosthetics (defined at prosthetic valves and valve-containing conduits), multiple defects, and male sex [8]. The pre-existing heart disease of residual shunt of ventricular septal defect after Fallot's Tetralogy Repair Procedure was the susceptible factors of IE in our patient, which caused both right-sided and left-sided IE. Depending on the individual case, we should consider the surgical indication and the timing of intervention for any functional or anatomic abnormalities. We are well aware of that good results would achieve after performing surgery in this young patient, based on sufficient preoperative assessments.

In conclusion, replacement of all 4 heart valves in one operation is feasible in patients based on well evaluate, a satisfactory outcome can be achieved without adverse events with IE who had previously undergone a Repair of Tetralogy of Fallot.

Ethics statement

The authors confirm that written consent for the submission and publication of this case report, including images and associated text, was obtained from the patient in accordance with COPE guidelines.

Data availability statement

Data will be available on request.

CRedit authorship contribution statement

Yulin Wen: Writing - review & editing, Writing - original draft, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Xinpei Liu:** Writing - review & editing, Methodology. **Yanxue Zhao:** Formal analysis, Data curation. **Jianzhou Liu:** Formal analysis, Data curation. **Qi Miao:** Validation, Supervision, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] A. Arghami, H.M. Connolly, M.D. Abel, H.V. Schaff, Quadruple valve replacement in patients with carcinoid heart disease, *J. Thorac. Cardiovasc. Surg.* 140 (2010) 1432–1434, <https://doi.org/10.1016/j.jtcvs.2010.05.026>.
- [2] I. Adembesa, A. Myburgh, J. Swanevelder, Quadruple valve replacement in a patient with severe rheumatic heart disease, *Echo Res Pract* 5 (2018) K47–k51, <https://doi.org/10.1530/erp-18-0005>.
- [3] J. Seeburger, H. Groesdonk, M.A. Borger, D. Merk, J. Ender, V. Falk, F.W. Mohr, N. Doll, Quadruple valve replacement for acute endocarditis, *J. Thorac. Cardiovasc. Surg.* 137 (2009) 1564–1565, <https://doi.org/10.1016/j.jtcvs.2008.02.078>.
- [4] G.B. Pettersson, J.S. Coselli, G.B. Pettersson, J.S. Coselli, S.T. Hussain, B. Griffin, E.H. Blackstone, S.M. Gordon, S.A. LeMaire, L.E. Woc-Colburn, 2016 the American Association for Thoracic Surgery (AATS) consensus guidelines: surgical treatment of infective endocarditis: executive summary, *J. Thorac. Cardiovasc. Surg.* 153 (2017) 1241–1258.e1229, <https://doi.org/10.1016/j.jtcvs.2016.09.093>.
- [5] G. Habib, P.A. Erba, B. Iung, E. Donal, B. Cosyns, C. Laroche, B.A. Popescu, B. Prendergast, P. Tornos, A. Sadeghpour, et al., Clinical presentation, aetiology and outcome of infective endocarditis. Results of the ESC-EORP EURO-ENDO (European infective endocarditis) registry: a prospective cohort study, *Eur. Heart J.* 40 (2019) 3222–3232, <https://doi.org/10.1093/eurheartj/ehz620>.
- [6] H.F. Chambers, A.S. Bayer, Native-valve infective endocarditis, *N. Engl. J. Med.* 383 (2020) 567–576, <https://doi.org/10.1056/NEJMcp2000400>.
- [7] K.K. Stout, C.J. Daniels, J.A. Aboulhosn, B. Bozkurt, C.S. Broberg, J.M. Colman, S.R. Crumb, J.A. Dearani, S. Fuller, M. Gurm, et al., 2018 AHA/ACC guideline for the management of adults with congenital heart disease: executive summary: a report of the American college of cardiology/American heart association task force on clinical practice guidelines, *Circulation* 139 (2019) e637–e697, <https://doi.org/10.1161/CIR.0000000000000602>.
- [8] J.M. Kuijpers, D.R. Koolbergen, M. Groenink, K.C.H. Peels, C.L.A. Reichert, M.C. Post, H.A. Bosker, E. Wajon, A.H. Zwinderman, B.J.M. Mulder, B.J. Bouma, Incidence, risk factors, and predictors of infective endocarditis in adult congenital heart disease: focus on the use of prosthetic material, *Eur. Heart J.* 38 (2017) 2048–2056, <https://doi.org/10.1093/eurheartj/ehw591>.