Pulmonary valve replacement with annulus enlargement for pulmonary valve infective endocarditis: A case report

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Abstract

Isolated pulmonary valve infective endocarditis (PVIE) is very rare, with a frequency of 1.6-2.7% of all endocarditis cases. We report the case of a patient who underwent successful pulmonary valve replacement (PVR) with a bio-prosthetic valve to treat isolated PVIE.

Key Words

infective endocarditis, pulmonary valve, bio-prosthetic valve, annulus enlargement, autologous pericardial patch

Key Clinical Message

This report aimed to highlight the feasibility and safety of pulmonary valve repair using a bioprosthetic valve and pericardial patch in a patient with infective endocarditis.

Introduction

A 47-year-old woman with no history of congenital heart disease presented with a fever of unknown origin that persisted for two weeks and was referred to our hospital. She had a history of diabetes, and transthoracic echocardiography revealed a large, mobile vegetation attached to the pulmonary valve. Blood cultures were positive for methicillin-sensitive *Staphylococcus aureus* (MSSA). The patient underwent aggressive antibiotic therapy, but the vegetation became larger, and pulmonary emboli were observed in the right lung on computed tomography. She underwent PVR with a bio-prosthetic valve and enlargement of the pulmonary valve annulus using an autologous pericardial patch. Postoperative antibiotic therapy was continued for six weeks. Postoperative transthoracic echocardiography showed a low mean pressure gradient of 6.0 mmHg across the bio-prosthetic valve, and she was discharged without recurrence of infection or comorbidities.

Case presentation

A 47-year-old woman suffered from a fever that persisted for two weeks, and she was initially admitted to another hospital with suspicion of a urinary tract infection.

She had a history of mild diabetes (HbA1c 6–7%, treated with dietary intervention) and

had no history of congenital heart valvular disease or other cardiac diseases, including the need for a pacemaker, and had no history of narcotic medication dependence or alcoholism.

After hospitalization, transthoracic echocardiography, performed as a screening test, revealed a vegetation of 14×7.5 mm on the left cusp of the pulmonary semilunar valve, and mild pulmonary valve regurgitation. No other valvular disease or congenital heart disease was observed. A blood culture analysis was positive for MSSA. The patient was diagnosed with PVIE. The patient did not respond to aggressive antibiotic therapy

consisting of ampicillin and ceftriaxone, which are sensitive to numerous pathogens. The observed vegetation grew, and pulmonary emboli were observed in the right lung on computed tomography. She was transferred to our cardiology department for surgery.

At hospitalization, her blood pressure was 108/67 mmHg, heart rate was 82 beats/min, respiratory rate was 16 breaths/min, and body temperature was 36.6°C. She did not complain of dyspnea, her percutaneous oxygen saturation was 96% in ambient air, and there was no peripheral edema. Laboratory investigations revealed a white blood cell count of 6400 cells/μL, C-reactive protein of 1.09 mg/dl, hemoglobin levels were 10.4 g/dL, creatinine levels of 0.37 mg/dL. Despite a negative blood culture at our unit, transesophageal echocardiography revealed mobile vegetation measuring 30×15 mm, and pulmonary emboli were evident on computed tomography (Figure 1 and Figure 2). Surgical repair was indicated because of the observed vegetation and pulmonary emboli.

The patient underwent median sternotomy, and autologous pericardial tissue was harvested. After systemic heparinization, cardiopulmonary bypass was established via the ascending aorta and bicaval drainage. Cardiac arrest was achieved through antegrade cold blood administration of a cardioplegic solution with aortic cross-clamping. After snaring the superior and inferior vena cava, a vertical incision of the pulmonary artery was performed. There was a vegetation of 50 mm×15 mm on the left cusp of the pulmonary semilunar valve. An additional small vegetation was observed on the right cusp of the pulmonary semilunar valve and non-semilunar valves. All leaflets and vegetation were excised because all the valves were damaged. The incision along the pulmonary artery was extended to the right ventricular outflow tract (RVOT) and a bio-prosthetic valve (INSPILIS 25 mm; Edwards Lifesciences, Irving, CA) was implanted with annulus enlargement. The pulmonary artery and RVOT were repaired using autologous pericardial tissue (Figure 3). Tricuspid valve annuloplasty was performed using an annuloplasty ring (Contour 28 mm; Medtronic Sofamor Danek, Memphis, TN, USA) because tricuspid valve regurgitation was detected on transesophageal echocardiography. The patient was weaned from cardiopulmonary bypass uneventfully. The operation time was 322 min, cardiopulmonary time was 179 min, and aortic cross-clamp time was 107 min. Culture from the vegetation revealed the presence of MSSA. Cefazolin, which is sensitive to MSSA, was initiated postoperatively and continued for four weeks, at which time blood cultures were negative. Postoperative transthoracic echocardiography demonstrated a mean pressure gradient of 6 mmHg across the prosthetic valve, trace tricuspid valve regurgitation, and a normal left ventricular ejective fraction of 65%. The patient recovered well and was discharged on postoperative day 30 without other complications. The patient remained in good condition at a three-month outpatient follow-up visit.

Discussion

PVIE is a very rare disease, present in only 1.6–2.7% of all endocarditis cases [1,2, 3, 4, 5]. PVIE is more common in patients with congenital heart disease or after pulmonary valve surgical repair, and the number of cases in patients with non-congenital heart disease cases is small [4].

Liekiene et al. reported eight cases of PVIE, six of which had concomitant congenital heart disease [4]. Predisposing factors for PVIE in adult patients with non-congenital heart valve disease have been reported, including intravenous drug abuse, presence of a pacemaker, central venous catheters, alcoholism, and chronic hemodialysis [2, 3]. In our case, the patient had no history of congenital heart disease, cardiac disease, narcotic medication dependence, or use of immunosuppressive medications. Her only relevant medical condition was mild diabetes, which was well treated with dietary intervention.

Indications for surgery of infective endocarditis in the pulmonary position include persistent fever, recurring pulmonary septic emboli, and large, mobile valve vegetations despite adequate antibiotic therapy [6]. Although the fever present in this case was reduced by antibiotic therapy, the glowing, large, mobile vegetation and septic pulmonary emboli in the right lung necessitated a decision for surgery.

In valve replacement on the right side of the heart with a mechanical valve, anticoagulation therapy with warfarin should be controlled more strictly than valve replacement on the left side of the heart. Mechanical valves also have more complications, including valve thrombosis or bleeding, than bio-prosthetic valves [7,

8]. Alternatively, bio-prosthetic valves have the advantage of being free from the need for anticoagulant therapy, although they have a higher risk of re-operation, especially in young patients. However, Tokunaga et al. reported that in PVR with a bio-prosthetic valve, the valve-related, event-free rate was 85.7% in fifteen years, and that mechanical valves demonstrated a high rate of valve thrombosis [9]. They recommend a bio-prosthetic PVR as the first choice. After discussing the advantages and disadvantages of both valves with the patient side, the patient requested surgery with the bio-prosthetic valve. Deng et al. reported pulmonary valve repair for infective endocarditis using an autologous pericardial patch in four patients [10]. They also reported that the postoperative course was good, and there was no recurrence of infection at three months or two years after surgery. However, valve repair with a pericardial patch is technically complicated. In this patient, valve replacement was performed because of severe valve destruction caused by infection. Several surgeons have reported the effectiveness of annulus homograft replacement for isolated PVIE because they are available in small sizes, requiring no anticoagulation therapy and having low gradients [11, 12]. However, the availability of homografts is limited in Japan.

To reach the optimal effective orifice area index (EOAI) for pulmonary valve replacement, at least 1.0–1.3 cm^2/m^2 coverage is recommended [13]. The patient's body surface area was 1.6 m^2, and to obtain optimal EOAI, we implanted a 25-mm bio-prosthetic valve, which reached an effective orifice area (EOA) of 1.8 cm^2. Annulus enlargement is often required for implanting valves of adequate size. To implant an optimal size prosthetic valve for patients whose native pulmonary valve cusp size is insufficiently smaller, pulmonary valve cusp enlargement with an autologous pericardial patch has been effective.

Conclusion

We successfully implanted a bio-prosthetic valve for PVIE with annulus enlargement using a pericardial patch. The postoperative course was good and revealed a satisfactory mean pressure gradient.

Abbreviations

PVIE, pulmonary valve infective endocarditis; PVR, pulmonary valve replacement;

MSSA, methicillin-sensitive *Staphylococcus aureus* ; CRP, C-reactive protein; RVOT, right ventricular outflow tract; EOAI, effective orifice area index; EOA, effective orifice area.

Author contributions

KA helped write the manuscript. KA, RH, and KS performed the surgery and were responsible for the perioperative management of the patient. KK supervised the study. All authors collected the data and discussed the content of the manuscript. All authors approved the final manuscript.

Conflict of interest

None declared.

Ethical approval ,

The institutional review board of the hospital did not require ethical approval for reporting individual cases

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Legends

Figure 1

Transesophageal echocardiography showing a large, mobile vegetation of 30×15 mm at the pulmonary valve.

Figure 2

Computed tomography showing septic emboli in right lung (black arrow).

Figure 3

1. Vertical incision in the pulmonary artery. A large vegetation of 5.0×2.5 cm was visible attached to left cusp of the pulmonary semilunar valve. Additional valves were also damaged with vegetation (arrow).
2. All damaged valves were successfully resected. For sufficient EOA, the incision was extended toward the RVOT, and a bio-prosthetic valve was implanted.
3. Annulus enlargement was performed with an autologous pericardial patch (arrows).

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