Case Report

Thrombotic Occlusion of Bjork-Shiley Prosthetic Aortic Valve

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ABSTRACT

Thrombotic occlusion of a prosthetic Bjork-Shiley valve is a potentially fatal complication. We present the case of a male, 62 years of age, diagnosed with thrombotic occlusion of prosthetic Bjork-Shiley aortic valve approximately 17 years post implantation. A brief review of the literature focusing on potential risk factors associated with the development of this condition and currently available diagnostic modalities used for evaluation and treatment are presented.

INTRODUCTION

Thrombosis of Bjork-Shiley valves results in occlusion of the prosthetic valve and is associated with high morbidity and mortality. It may also present as congestive heart failure. We report a case of a male, 62 years of age, admitted to a tertiary care center with similar complications.

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CASE REPORT

In 1985, a male, 62 years of age, underwent aortic and mitral valve replacement with Bjork-Shiley prostheses (both 27 mm) for rheumatic heart disease. In 1986 he suffered significant brain trauma in a motor vehicle accident. As a result, there was significant impairment in cognitive and adaptive abilities with memory loss, psychomotor retardation and impaired problem-solving skills. In 2001 he was admitted to another institution for congestive heart failure. A two-dimensional echocardiogram was performed, which revealed no abnormality of the prosthetic aortic and mitral valves. There was bilateral atrial enlargement, left ventricular hypertrophy and pulmonary hypertension with Doppler derived pulmonary systolic pressure of 75 mm Hg.

He was readmitted in August 2002 for congestive heart failure. At that time a two-dimensional echocardiogram was performed that detected stenosis of the prosthetic aortic valve. He was subsequently transferred to our hospital, a tertiary care center.

On examination there was no jugular vein distension. Chest auscultation revealed bilateral posterior basilar rales. The carotid upstroke was normal. There was a grade 2/6 systolic murmur in the lower sternal border. The opening and closing clicks of a prosthetic valve were faintly audible. There was bilateral pitting edema in the lower extremities.

The electrocardiogram showed atrial fibrillation with controlled ventricular response with right axis deviation. A chest x-ray showed cardiomegaly with increasing parenchymal opacity in both lower sides, which may have represented pneumonitis, peribronchial edema, or atelectasis. The patient's international normalized ratio (INR) on admission was 3.9.

An emergent transthoracic echocardiogram was performed and demonstrated only partial opening of the prosthetic aortic disc. Color flow imaging showed crescent flow in systole. The peak instantaneous valve gradient was calculated to be 55 mm Hg. The prosthetic mitral valve appeared to be normal. Cinefluoroscopy of the Bjork-Shiley prosthetic valve revealed an open angle of 10° (figures 1 and 2).

Thrombolytic therapy was considered to be contraindicated because of the patient's high INR. The remaining hospital course was complicated by cardiogenic shock with systolic blood pressure dropping to 70 mm Hg. There was also significant deterioration of renal function and mental faculties. A consultation with the cardiothoracic surgery team determined that the patient was a high-risk case for replacement of the stenotic prosthetic aortic valve. The patient died 5 days after admission.

DISCUSSION

A Bjork-Shiley valve is a tilting disc valve that uses a circular disc as an occluder and is retained by wire-like arms. To date approximately 360,000 standard valves have been implanted. However, in the United States, Bjork-Shiley

Figure 1. Images obtained by fluoroscopy. Arrow indicates closure (A) and opening (B) of the prosthetic aortic valve. The angle of opening was reduced to 10° due to thrombosis.

models have been discontinued. Although they are no longer implanted in the United States, there are still many patients with Bjork-Shiley valves.

Thrombotic occlusion of prosthetic cardiac valves is considered one of the most serious complications associated with tilting disc mechanical valves. The overall risk of major thrombotic occlusion ranges from 1% to 8%.¹ Karp et al. estimated that the cumulative likelihood of thrombotic occlusion of Bjork-Shiley valve for aortic, mitral, and combination mitral and aortic levels is 3%, 13%, and 13%, respectively.² The obstruction of prosthetic valve may be caused by thrombi formation, pannus ingrowth, or a combination of these.

Björk-Shiley Valve

Figure 2. Schematic diagram of normal and thrombosed Björk-Shiley prosthetic aortic valve end systolic excursion. The thrombosed valve in our patient opened approximately 10° by fluoroscopy.

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Thrombosis of prosthetic valves has been reported despite adequate anticoagulation. The risk of thrombosis is higher in prosthetic mitral valves than in prosthetic aortic valves.¹⁻³ The factors that increase the risk of thrombosis are:³

- Inadequacy of anticoagulation,
- Design of valve,
- Pannus ingrowth,
- Orientation of minor orifice,
- Small valve size,
- Decreased cardiac output,
- Increased left atrial enlargement,
- Infective endocarditis.

Furthermore, the small size of the mitral annulus, decreased blood flow through the mitral valve, atrial fibrillation, left atrial enlargement and left atrial thrombosis at the time of valve replacement have all been associated with an increased risk of subsequent thrombosis of a prosthetic mitral valves.¹

The single leaflet disc prosthesis has major and minor orifices. The blood flow through the minor orifice is roughly 23%. This region is associated with decreased peak flow velocity and lower peak shear stress on the sewing rim of the Björk-Shiley prosthesis. Which may result in pannus formation.⁴ Changing the disc to concavoconvex and the orientation

of the prosthetic mitral valve posteriorly increases the blood flow through the minor orifice to 30%. This reduces the risk of thrombosis.^{2,5}

The initial suspicion for complications is based primarily on clinical history with subsequent confirmation by physical and laboratory examination. In a patient with new onset of congestive heart failure and nonimmunologic hemolytic anemia, attention should always be focused toward evaluation of prosthetic valves.⁶

The most helpful diagnostic feature on physical examination is the change in the intensity of opening and closing clicks of the valve. The presence of systolic and diastolic murmur is not an accurate indication of valve function.¹ However, the clinical signs of valve incompetence and disappearance of the sound closure of the valve likely appear before the sign of prosthetic valve stenosis.⁷

The diagnosis can be made with cineradiography, echocardiography and cardiac catheterization. Discs of a Björk-Shiley valve, manufactured after 1975, are incorporated with radio opaque markers. Therefore, cinefluoroscopy has played an important role as a diagnostic tool for the detection of prosthetic tilting disc valve dysfunction. The decrease in the angle of the disc (normal is $60^\circ \pm 2^\circ$) and immobility of the disc can be diagnosed with considerable accuracy.^{1,7}

Two-dimensional echocardiography and transesophageal echocardiography can show a density surrounding the valve and can also calculate the transvalvular gradient. Echocardiographic findings in patients with thrombotic occlusion of prosthetic valve include decreased amplitude of valve excursion, in conjunction with diminished opening and closing rates or absence of disc motion.⁸ A comparison study to the previous echocardiography, especially the change in time of valve opening and closure and chamber enlargement, is helpful.⁷ Besides accurately assessing stenosis and regeneration, cardiac catheterization may show a filling defect because of the thrombosis^{1,7,9} and an excessive pressure gradient across the prosthetic valve.

Thrombotic occlusion of the prosthetic aortic valve is a medical emergency. Thrombolytic therapy for an obstructed prosthetic valve is often ineffective, especially if it is caused by pannus ingrowth. The use of thrombolytic therapy is associated with a failure rate of 16% to 18% and an acute mortality rate of 6%.¹⁰ Thrombolytic therapy should be reserved for those patients in whom either surgery is contraindicated or associated with higher risks. If possible, patients should undergo emergency exploratory cardiectomy. During cardiectomy, there are typically two options: either the debridement of the annulus of the prosthetic valve or the replacement of the prosthetic valve.

Re-operation of prosthetic valves have resulted in high mortality; 40% with valve replacement and 8% with thrombectomy and valve rotation.¹¹⁻¹⁴ Replacement of prosthetic valve

should be limited to cases of extensive, circular pannus underlying the thrombus-like material, or when the primary mechanical cause (i.e., disc wear, mobile module strut, irregular ring contour) is found.¹¹

CONCLUSION

The diagnosis of thrombotic occlusion of Bjork-Shiley valve is suggested by clinical history and physical examination. High mortality rates associated with valve thrombosis are related to delays in diagnosis.

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