

CASE REPORT

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Strut Fracture in a Bjork-Shiley Aortic Valve Prosthesis

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ABSTRACT: Strut fracture can be a life-threatening adverse effect of mechanical prosthetic heart valves. This complication has occurred in the DeBakey, the Beall, the Cooley-Cutter and, most recently, the Bjork-Shiley valves. We report the case of a 35-year-old man who died suddenly 16 months after a 60° Bjork-Shiley Convexo-Concave heart valve prosthesis was inserted in the aortic position. At autopsy, the two welded attachments of the valve's outlet strut had fractured. The valve's tilting disc was found in his abdominal aorta.

KEYWORDS: pathology and biology, accidents, prosthetic devices, iatrogenic injury, cardiac valve prosthesis

Prosthetic heart valves are associated with numerous serious complications [1-3]. Thromboembolism, abnormal bleeding, and hemolysis are frequent problems. Additionally, perivalvular leakage, infection, thrombosis, and mechanical failure of the prosthesis may occur. Strut fracture can be a life-threatening adverse effect of mechanical heart valves. We report a sudden death that occurred when the outlet strut welds of a 60° Bjork-Shiley Convexo-Concave prosthetic aortic valve fractured.

Case Report

A 35-year-old male was found dead behind a restaurant where he had been emptying refuse. At age 15, the deceased had rheumatic fever with aortic valve involvement. Thirteen months before his death he was noted to have severe aortic regurgitation with moderate enlargement and functional impairment of the left ventricle of the heart. At this time his aortic valve was replaced with a 29-mm Bjork-Shiley 60° Convexo-Concave prosthetic valve. Three months before his death he consulted a physician because of chest pain.

At autopsy, the pathologist noted a vertical surgical scar on the chest. The heart weighed 730 g and the left ventricle was markedly hypertrophied. The outlet strut of the Bjork-Shiley aortic prosthesis had fractured and was recovered from the chamber of the left ventricle (Fig. 1).

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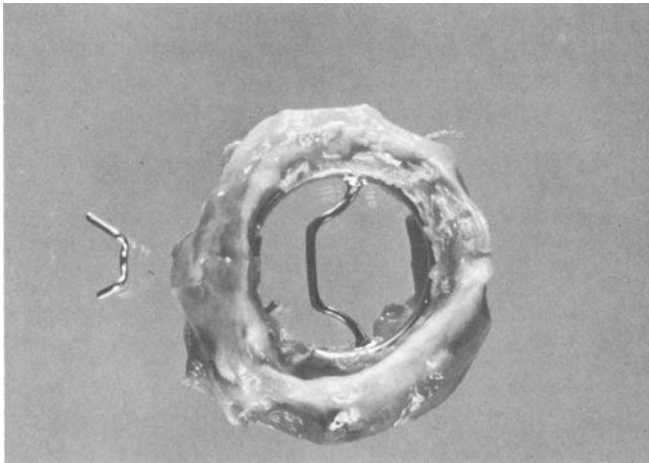


FIG. 1—Failed Bjork-Shiley aortic valve prosthesis (right) removed at autopsy. Fractured outlet strut (left) was recovered from the left ventricle of the heart.

The valve disc occluder had embolized to the bifurcation of the aorta. No abnormalities of the remaining heart valves or coronary arteries were noted.

Discussion

Release of the ball or disc from a mechanical heart valve is a serious, often fatal event [4-12]. Deformation, wear, or breakage of the occluder have resulted in this complication. Bending the metal valve struts while inserting the valve or postoperative fracture of the struts may also allow the poppet to escape. Strut fracture has occurred in the DeBakey, the Beall, and the Cooley-Cutter valves [13-15].

The Bjork-Shiley tilting disc heart valve is the most commonly used mechanical prosthesis in the world [2]. The valve has been popular and effective; several long-term studies attest to its value [16-19]. There are, however, many reports of strut fracture with disc embolization in Bjork-Shiley mitral prostheses [20-28]. We have found a single previous report of strut fracture in a Bjork-Shiley prosthesis in the aortic position [29]. While strut fracture with disc escape is the most common mechanical failure of the device, other malfunctions causing obstruction have been described [30-32].

In the original model of the Bjork-Shiley valve, both the major inlet strut and the minor pivot or outlet strut were welded to the orifice ring. In an improved model of the valve, the larger inlet strut was thickened and formed as an integral part of the valve ring while the smaller outlet strut continued to be welded in place [33]. Since that time, only fractures at the welds of the outlet strut have been reported. Scanning electron microscopy performed in one case suggested that the mechanism is a brittle fracture caused by segregation of carbides at the welding points [27]. In our case the strut fractures occurred in a Bjork-Shiley prosthesis in the aortic position. The fracture occurred at the welded attachments of the outlet strut suggesting that the mechanism of failure is similar to that of previously reported cases.

In December 1984, the U.S. Food and Drug Administration (FDA) issued a warning to physicians about the risk of outlet strut fractures in the Bjork-Shiley prosthesis [34]. Currently, Shiley Incorporated estimates that 80 000 Convexo-Concave valves have been implanted; these are equally divided between the aortic and mitral positions. The FDA reports 106 strut fractures in the mitral prostheses and 19 in the aortic prostheses. Mitral strut fractures have caused 69 deaths. Aortic strut fractures have been uniformly fatal.

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