# CASE REPORT

*Michael A. Clark,*[1] *M.D., Ph.D.*

# Mechanical Failure of a Mitral Valve Prosthesis: An Unusual Case of Sudden Unexpected Death

**REFERENCE:** Clark, M. A., **"Mechanical Failure of a Mitral Valve Prosthesis: An Unusual Case of Sudden Unexpected Death,"** *Journal of Forensic Sciences*, JFSCA, Vol. 30, No. 2, April 1985, pp. 552-555.

**ABSTRACT:** Sudden unexpected death caused by the failure of a cardiac valve prosthesis is a rare occurrence. A 45-year-old female suddenly died three years following mitral valve replacement for rheumatic mitral stenosis. At autopsy, death was determined to be due to a metallic fatigue of the mitral valve prosthesis.

**KEYWORDS:** pathology and biology, cardiovascular system, prosthetic devices

Sudden unexpected death as a result of the failure of a cardiac valve prosthesis is a rare occurrence [*1,2*]. We have recently encountered such a case.

## Case Report

A 45-year-old female with a history of childhood rheumatic fever, first developed signs and symptoms of mild congestive heart failure attributable to mitral stenosis at age 37. She initially did well with medical management, but five years later her condition had worsened and an elective mitral valve replacement with a Bjorg-Shiley prosthesis was performed. She recovered without incident and was seen for periodic follow-up visits in which no complaints were voiced. On the evening of her demise, she was at a party with her husband when she suddenly experienced dizziness, pain in the left arm, and a "tight sensation" in the throat. She arrived at the Emergency Room within 15 min of the onset of symptoms and collapsed in the lobby. Cardiopulmonary resuscitation (CPR) was initiated at once, but at no time during the 60 min of CPR was a peripheral pulse obtained. The case was reported to the local coroner's office and jurisdiction was waived because of the history of open-heart surgery and the willingness of an emergency room physician to certify the cause of death as "thrombosis of prosthetic mitral valve." An autopsy was performed the next day upon request of the husband.

The opinions or assertions expressed herein are those of the authors and are not to be construed as official or as necessarily reflecting the views of the Department of the Navy or the naval service at large.
Presented in part at the 36th Annual Meeting of the American Academy of Forensic Sciences, Anaheim, CA, 21-25 Feb. 1984. Received for publication 15 Sept. 1984; accepted for publication 9 Oct. 1984.
[1]Head, Autopsy Service, Departments of Laboratory Medicine and Clinical Investigation, Naval Hospital, San Diego, CA.

**Autopsy Findings**

The decedent was a slender, well developed female appearing much younger than her recorded age. Aside from a remote midline sternotomy scar and numerous recent needle punctures and defibrillation marks secondary to CPR, her external appearance was unremarkable. Massive generalized visceral congestion and acute pulmonary edema were apparent on internal examination.

Opening of the heart disclosed a prosthetic valve annulus with intact inflow strut in the intra-annular mitral position (Fig. 1). Both the occluder disc and outflow strut were missing; the former was lodged in the aortic arch. The outflow strut was not recovered. The valve annulus and the occluder disc were submitted to the Shiley Company for analysis (Fig. 2). No defects in construction or metallurgical composition were noted and their engineers attributed valve failure to "low stress, high cycle fatigue."

**Discussion**

Death resulting from complications of cardiac valve replacement is divided into early (29 days or less following surgery) and late (30 or more postoperative days) phases [*1,2*]. Early deaths are almost exclusively the result of complications of surgery with thrombosis, dehiscence, and disproportion of valves accounting for only 6% of deaths. Thrombosis and infection of prostheses account for nearly all late deaths with only about 2% of late deaths attributed to mechanical dysfunction of valves [*1*]. Reported late mechanical failures of prosthetic mitral valves have been rare; 8 of 897 patients in 1 series [*3*] and 1 of 99 in another series [*4*] died as a result of prosthetic mitral valve mechanical failures. None of these cases involved a Bjorg-Shiley mitral valve prosthesis failure [*5,6*].

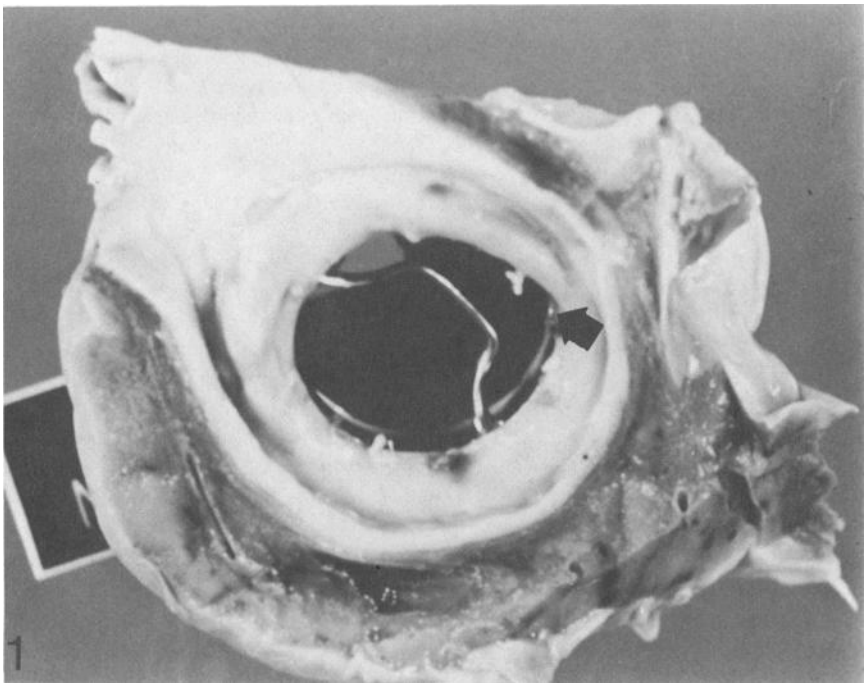

FIG. 1—*Mitral valve prosthetic ring and inlet strut in place viewed from atrial aspect. Broken end of outlet strut at arrow (× 1.5 actual size).*

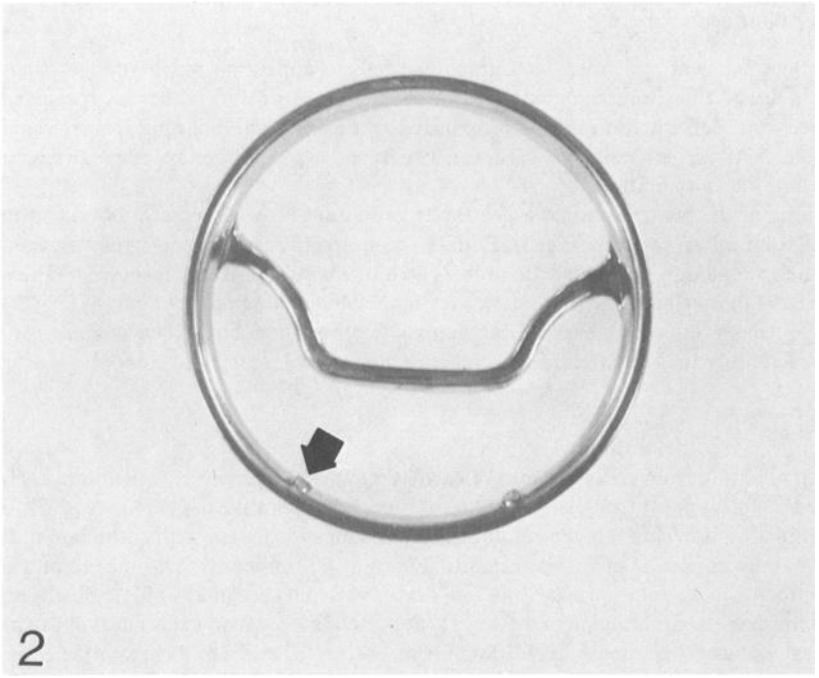


FIG. 2—*Annular ring of prosthesis after removal from heart with intact inlet strut. Fractured outlet strut at arrow (×3 actual size).*

The present case of outlet strut fracture in a Bjorg-Shiley mitral valve followed by disc embolization appears to be unique. The only closely related cases are two instances of sudden death following dislodgement and embolization of occluder disc from Wada-Cutter prostheses [*7,8*].

The true incidence of sudden death resulting from late failure of prosthetic heart valves is probably higher than the few case reports in the literature would suggest. In many cases, physicians are willing to sign death certificates of patients who have a history of cardiac surgery without benefit of autopsy findings. In this case, the physician was willing to certify the cause of death as "thrombosis of mitral valve prosthesis" which the literature suggests may be an accurate cause of death up to 98% of the time [*1-3*]. In most coroner and medical examiner jurisdictions, the willingness of a physician to sign a death certificate in such a case would preclude medicolegal involvement and autopsy. Such a practice may result in cases of prosthesis failure because of wear, improper design, or defects in material or workmanship going undiscovered unless an autopsy is performed at the family's request. If a case of prosthesis failure is identified, the case should be reported to the local medicolegal authorities and the prosthesis retained for analysis by a qualified testing laboratory.

## Summary

A 45-year-old female suddenly died 3 years following mitral valve replacement for rheumatic mitral stenosis. At autopsy, death was determined to be due to a metallic fatigue of the mitral valve prosthesis.

## References

[1] Schoen, F. J., Titus, J. L., and Lawrie, G. M., "Autopsy—Determined Causes of Death After Cardiac Valve Replacement," *Journal of the American Medical Association*, Vol. 249, No. 7, 18 Feb. 1983, pp. 899-902.

[2] Silver, M. D., "Late Complications of Prosthetic Heart Valves," *Archives of Pathology and Laboratory Medicine*, Vol. 102, June 1978, pp. 281-284.

[3] Joassin, A. and Edwards, J. E., "Late Causes of Death After Mitral Valve Replacement. Analysis of 36 Cases," *Journal of Thoracic Cardiovascular Surgery*, Vol. 65, No. 2, Feb. 1973, pp. 255-263.

[4] Saloman, N. W,, Stinson, E. B., Griepp, R. B., and Shumway, N. E., "Mitral Valve Replacement: Long-Term Evaluation of Prosthesis-Related Mortality and Morbidity," *Circulation*, Vol. 56, Supplement 2, No. 3, Sept. 1977, pp. II 94-II 101.

[5] Messmer, B. J., Rothlin, M., and Senning, A., "Early Disc Dislodgement. An Unusual Complication After Insertion of a Bjork-Shiley Mitral Valve Prosthesis," *Journal of Thoracic Cardiovascular Surgery*, Vol. 65, No. 3, March 1973, pp. 386-390.

[6] Gawkrodger, D. J. and Deiraniya, A. K., "Death After Complete Detachment of a Bjork-Shiley Prosthetic Mitral Valve," *British Medical Journal*, Vol. 2, Dec. 1979, pp. 1401-1402.

[7] Schaeffer, J. W., Marks, S. D., Wolf, P. S., Shander, D., Craddock, L. D., and Blount, S. G., Jr., "Systemic Embolization of the Disc Occluder of the Wada-Cutter Prosthetic Valve. A Late Complication," *Chest*, Vol. 71, 1977, pp. 44-46.

[8] duPriest, R. W., Semler, H. J., Oyama, A. A., and Nohlgren, J. E., "Sudden Death Due to Dislodgement of Disc Occluder of Wada-Cutter Prosthesis," *Journal of Thoracic Cardiovascular Surgery*, Vol. 66, 1973, pp. 93-95.

Address requests for reprints or additional information to
M. A. Clark, Commander, MC, USN
c/o Clinical Investigation Department
Naval Hospital
San Diego, CA 92134