Smeloff-Cutter Mechanical Prosthesis in the Aortic Position for 49 Years

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We describe a 76-year-old male physician who at age 27 underwent replacement of his stenotic aortic valve with a Smeloff-Cutter mechanical prosthesis which functioned normally for 49 years. He died of a noncardiac condition. A normally functioning substitute cardiac valve for this length of time has not been previously reported (1). **(Am J Cardiol 2019;124:457−459)**

Smeloff-Cutter valve first design began production in 1964; a second design was implemented in 1966 and was produced until the end of 1989 at which time the Smeloff-Cutter valve was no longer manufactured.[2] It was one of the first commercially available prosthetic heart valves and the first with double cage design.[2] The double cage design was intended to reduce the risk of thromboembolism secondary to the "self-washing" effect.[3] The Smeloff-Cutter was a popular ball-in-cage valve and had 72,000 valves implanted.[4] It was mostly used in aortic position.[4] Smeloff-Cutter valve durability was comparable to the more popular Starr-Edwards valve and had 25 year survival of 31%.[5] Longest reported implanted Smeloff-Cutter valve was 43 years reported in publications.[1] We recently encountered a physician who had the Smeloff-Cutter valve implanted for 49 years in the aortic position without any complications secondary to the Smeloff-Cutter valve and who died of noncardiac causes. A description of Smeloff-Cutter valve implanted for this length of time has not been previously described.

Case Description

This 76-year-old man underwent replacement of his stenotic aortic valve for congenital bicuspid aortic stenosis at age 27 years by Dr. Denton A. Cooley. During the 49 years that followed, he took warfarin intermittently; he did not take warfarin for approximately a decade because of recurrent gastrointestinal bleeding. No episodes occurred that suggested prosthetic thrombosis or systemic embolism. Later in life, he developed coronary artery disease for which he received 3 drug-eluting stents for unstable angina, and heart failure due to ischemic cardiomyopathy for which he received an implantable cardioverter defibrillator. Weeks before his death, echocardiogram revealed a peak left ventricular outflow velocity of 2.18 m/sec, an aortic valve velocity time integral of 44.2 cm, an aortic valve peak transvalvular gradient of 19 mm Hg and an aortic valve area of 2.9cm^2. His mechanical valve type was identified while he was living using a radiographic guide developed by Mehlman and Resnekov[6] and confirmed at necropsy to be a Smeloff-Cutter type cage in ball. The patient died from chronic renal failure.

The patient was originally from South Korea where he graduated from Seoul National Medical School. He eventually came to the United States where he practiced internal medicine for 40 years. He was strongly desirous that his mechanical prosthesis be examined after his death. The excised poppet of the prosthesis was discolored but its surface was smooth and devoid of indentions and cracks. The poppet moved normally in its cage.

Comments

The Smeloff-Cutter valve was first produced in 1964.[2] It was the first substitute valve to have a double cage in which

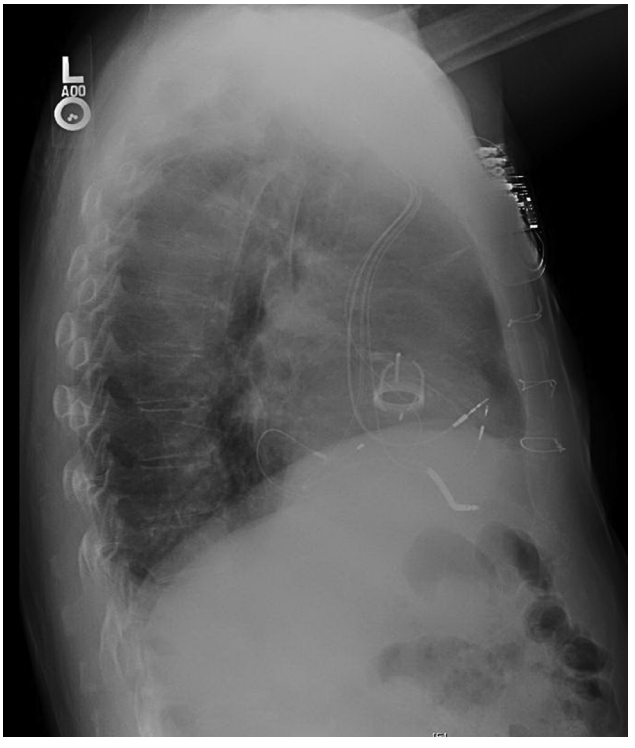

Figure 1. Lateral chest radiograph the distinctive double cage design.

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See page 459 for disclosure information.

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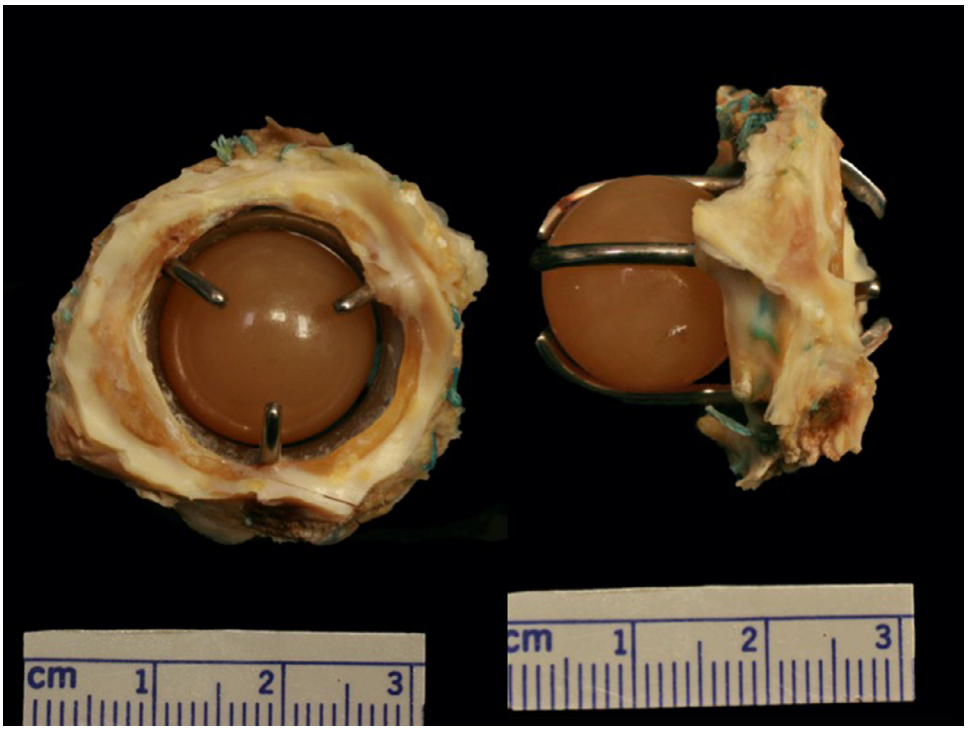

Figure 2. Smeloff-Cutter valve post mortem, note the ball discoloration from lipid absorption.

Figure 3. New Smeloff-Cutter valve.

the silicone rubber ball moved.[2] It also had a "self-washing" effect thought to reduce the risk of thrombosis.[3] This first design (produced from 1964 to 1966) was plagued with poppet malfunction. The poppet absorbed lipids which caused it to swell, a situation that could lead to immobility of the poppet in the cage.[1,2] The second iteration (produced from 1966 to 1989) included changes to the silicon rubber processing (as it did for many other ball and cage valves

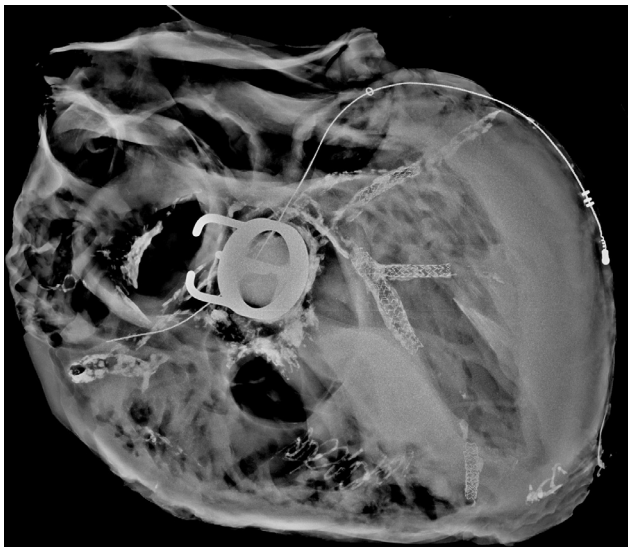

Figure 4. Post mortem radiograph of the heart.

including the more popular Starr-Edwards valve) and the cage was changed slightly.[2] In the newer version, the housing was titanium and the ball was silicone rubber.[2] The incidence of thromboembolism in patients with this valve in the aortic position without anticoagulation was 1% per patient year.[3] Of the 72,000 valves implanted (the Starr-Edwards poppet-in-cage 250,000 has been implanted).[4] The 10, 20, and 25 year survival postvalve implantation was 69%, 47%, and 31%, respectively.[5] The 10, 20, and 25 actuarial freedom rate of valve complication, reoperations or death was 73%, 47%, and 20% respectively.[5] These rates are similar to Starr-Edwards valve.[5] That our patient suffered no complications with his mechanical prosthesis is testament to the durability of the design of the Smeloff-Cutter valve, particularly in the aortic position (Figures 1–4).

Disclosures

The authors have no conflicts of interest to disclose.

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