

Durability Beyond Our Wildest Dreams: The Caged-Ball Valve at 60 Years

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Knowing our surgical history does more than provide terrain for moral contemplation and a sense of identity for our cardiothoracic specialty. Probing the human endeavor also provides a window into the continuum of our collective experience. The 1950s saw the beginnings of modern cardiothoracic surgery, with nearly every segment of the aorta successfully replaced during the decade. However, treatment of diseased aortic and mitral valves was essentially limited to commissurotomy, and there was no truly curative surgical technique available at the time. It was not until 1960 that surgical replacement of cardiac valves was made possible.¹⁻³ That year, Dwight Harken and Albert Starr first used caged-ball devices to replace the aortic and mitral valves within months of each other.^{2,3} The development of the caged-ball valve was one of the marvels of 20th-century medical science.

When Starr (only 30 years old at the time of his innovative collaboration with 60-year-old engineer Lowell Edwards) reflected on the development of the Starr-Edwards valve, he attributed its rapid advance from bench to bedside to several factors present in 1960 but not in today's medical environment.⁴ One was freedom from oversight: the United States Food and Drug Administration was not focused on medical devices at the time, and there were no institutional review boards, informed consent requirements, or ethical guidelines for human subject research. As a result, Starr and Edwards were able to move rapidly through multiple iterations of the caged-ball valve—first in animals, then in humans. Surprisingly, this pioneering spirit laid the groundwork for the subsequent development of numerous iterations of cardiac valves: continued modification of the ball-and-cage valves, Alain Carpentier's use of the porcine tissue valve and the other bioprosthetic valves that followed, and the evolution of mechanical valves that eventually culminated in pyrolytic carbon bileaflet mechanical valves.⁵

In this issue of the *Texas Heart Institute Journal*, De Martino and associates⁶ trace the history of a true milestone in cardiac surgery, the evolution of the caged-ball prosthesis. Their historical review provides valuable knowledge to everyone from nascent medical students to clinicians in the later years of their cardiovascular careers. It is also an amazing testament to the pioneering spirit of Harken and Starr that has led to the various iterations of the caged-ball and subsequent valves, provided so many patients with decades of functional life, and ultimately transformed the treatment of valvular disease in millions.

Published: 7 April 2022

Funding/support: Dr. Coselli's work is partly supported by the Cullen Foundation. Dr. Coselli consults for, receives royalties and a departmental educational grant from, and participates in clinical trials for Terumo Aortic; consults and participates in clinical trials for Medtronic, Inc., and W.L. Gore & Associates; and serves as a co-investigator for CytoSorbents.

References

1. Braunwald NS. It will work: the first successful mitral valve replacement. *Ann Thorac Surg* 1989;48(3 Suppl):S1-3.

Citation:

Coselli JS. Durability beyond our wildest dreams: the caged-ball valve at 60 years. *Tex Heart Inst J* 2022;49(2):e217672. doi: [10.14503/THIJ-21-7672](https://doi.org/10.14503/THIJ-21-7672)

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2. Harken DE, Soroff HS, Taylor WJ, Lefemine AA, Gupta SK, Lunzer S. Partial and complete prostheses in aortic insufficiency. *J Thorac Cardiovasc Surg* 1960;40:744-62.
3. Starr A, Edwards ML. Mitral replacement: clinical experience with a ball-valve prosthesis. *Ann Surg* 1961;154(4):726-40.
4. Starr A. A cherry blossom moment in the history of heart valve replacement. *J Thorac Cardiovasc Surg* 2010;140(6):1226-9.
5. De Martino A, Milano AD, Thiene G, Bortolotti U. Diamond anniversary of mechanical cardiac valve prostheses: a tale of cages, balls, and discs. *Ann Thorac Surg* 2020;110(4):1427-33.
6. De Martino A, Milano AD, Barbera MD, Thiene G, Bortolotti U. The caged-ball prosthesis 60 years later: a historical review of a cardiac surgery milestone. *Tex Heart Inst J* 2022;49(2):e207267.