

NEARLY HALF A CENTURY OF LILLEHEI KASTER VALVE AT AORTIC POSITION: A HISTORIC CASE REPORT

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ABSTRACT

BACKGROUND: The Lillehei–Kaster pivoting-disc valve was an important early low-profile mechanical heart valve⁽¹⁾. Its titanium housing and free-floating pyrolytic-carbon disc were designed to promote central blood flow and provide long-term mechanical durability⁽¹⁾. These features make its sustained use in the aortic position particularly relevant to understanding the history and performance of mechanical valve design.

CASE REPORT: A 16 year old male presented with exertional dyspnoea, palpitation, hyperdynamic circulation, collapsing peripheral pulses, blood pressure of 140/30 mmHg, and a prominent grade 4/6 diastolic murmur audible at the left sternal border. Cardiac catheterization and aortic root angiography suggested severe aortic insufficiency without mitral insufficiency or aortic aneurysm. On 20th October 1977 the native aortic valve was excised under total cardiopulmonary bypass and was replaced with size 18-A Lillehei-Kastr pivoting-disc heart valve. The postoperative course was unremarkable. Histopathological/operative assessment was summarized as myxoid degeneration of the aortic valve considered a forme fruste of Marfan syndrome. The patient was discharged on aspirin and dipyridamole rather than documented oral anticoagulation therapy.

Follow up: The patient is now 65 years old and is doing well, his recent 2D echo suggested that the peak gradient across the aortic valve is 34mmhg and mean gradient is 17mmhg with normal left ventricular ejection fraction of 60 %. He is on regular anticoagulation therapy and medication.

CONCLUSION: This historical case documents implantation of a Lillehei-Kaster aortic prosthesis in adolescence and provides an opportunity to examine the exceptional durability of an early-generation mechanical valve. Such longevity highlights the robust engineering of early pivot-disc designs despite the subsequent evolution of valve technology toward more hemodynamically optimized models.

Key words:- Lillehei-Kaster valve, Christian Barnard, Devendra Saksena, aortic valve, adolescence

INTRODUCTION

The Lillehei-Kaster valve was developed during the evolution from ball-and-cage prostheses toward lower-profile disc valves⁽²⁾. The design incorporated a free-floating pyrolytic-carbon disc within a one-piece titanium housing, with the goals of central flow, low profile, reduced turbulence, and durable mechanical performance⁽¹⁾. By utilizing a free-floating pyrolytic-carbon disc within a titanium housing, this design sought to minimize turbulence and improve central flow characteristics compared to earlier caged-ball models⁽¹⁾. Very prolonged survival with functioning early-generation mechanical prostheses is clinically important because it illustrates the durability achievable with mechanical valve technology while also highlighting the lifelong issues of thrombosis, thromboembolism, bleeding, pannus formation, and anticoagulation⁽³⁾. We report the historical documentation of a Lillehei-Kaster aortic valve implanted in a 16-year-old patient in 1977 and outline the contemporary follow-up required to establish its present function.

CASE REPORT

A 16-year-old male was admitted to Bombay Hospital with exertional dyspnoea and palpitations. There was no definite history of rheumatic fever. Examination described a thin, tall habitus with features considered suggestive of Marfan disease, a hyperdynamic circulation, collapsing peripheral pulses, blood pressure of 140/30 mm Hg, and a grade 4/6 diastolic murmur in the aortic area.

Cardiac catheterization demonstrated severe aortic insufficiency without evidence of mitral insufficiency. The record states that urine and stool testing, bleeding and clotting time, haemoglobin (15 g/dL), leukocyte count (9,060/mm³). Aortic-root angiography showed a dilated annulus without aneurysm. Blood group was O positive.

On October 20, 1977, under total cardiopulmonary bypass, the aortic valve was excised and replaced with a size 18-A Lillehei-Kaster pivoting-disc prosthesis. Three units of blood were administered intraoperatively. The postoperative period was described as uneventful. The discharge summary characterized the native-valve pathology as myxoid degeneration, described as a forme-fruste of Marfan disease. Discharge medications were aspirin, dipyridamole, and an iron-containing hematinic. The treating surgeon recommended continued antiplatelet therapy and antibiotic treatment for infections.

The patient at present is 65 yrs of age doing well almost 49 years post implantation of Lillehei Kaster valve at aortic position. Currently patient is symptomatically doing well with sinus rhythm, on oral anticoagulation like acitrom 7 & 8 mg and tab sotalol 40mg BD. There has been no history of thromboembolism, prosthetic valve thrombosis, major bleeding, infective endocarditis, haemolysis, heart failure. 2Decho is suggestive of normal functioning left

ventricular function of 60% peak gradient across aortic valve is 34mmhg and mean gradient across aortic valve is 17 mmhg, right ventricular function is normal RVSP is 25 mmhg.

DISCUSSION

The principal significance of this case is the potentially long service life of an early-generation pivoting-disc prosthesis implanted during adolescence. Although the pivoting-disc configuration was intended to promote central flow, in vivo studies found that the disc often did not open fully and that transvalvular gradients varied with prosthesis size, stroke volume, and implantation orientation^(4,5). Earlier reports also documented relatively high gradients and small effective valve areas, particularly with smaller aortic prostheses, indicating that the Lillehei-Kaster design did not consistently provide low-resistance flow^(6,7). The Lillehei-Kaster aortic prosthesis was a pivoting-disc mechanical valve with a free-floating pyrolytic-carbon disc housed within a single-piece titanium frame, a design intended to provide central flow in a low-profile structure⁽¹⁾. Despite its intended hemodynamic advantages, long-term use of this type of valve required ongoing surveillance for structural issues and late complications, such as pannus overgrowth, which can affect transvalvular gradients decades after implantation⁽⁸⁾. The durability of these early-generation devices is also illustrated by rare reports of patients maintaining functional valve performance for several decades, including cases in which anticoagulation was interrupted or withheld⁽⁹⁾. Published clinical experience supports substantial mechanical durability. In a cohort of 273 hospital survivors with Lillehei-Kaster aortic prostheses and 1,253 patient-years of follow-up, Stewart and colleagues reported no mechanical valve failures; valve thrombosis occurred at 0.2 per 100 patient-years, although smaller valve sizes had less favourable effective-orifice-area characteristics. A separate 9- to 17-year follow-up of 262 aortic-valve recipients likewise reported no prosthesis fracture and only two episodes of valve thrombosis⁽¹⁰⁾. These observations are consistent with the engineering durability of pyrolytic-carbon disc technology, but they do not eliminate late risks related to thrombosis, pannus, infection, paravalvular regurgitation, or patient-prosthesis mismatch.

Historical provenance : During Christian Barnard's visit to India, for the first international conference on the surgery in the tropics held on 11th January 1976 he met Dr Devendra Saksena at his Bombay Hospital clinic. He saw Dr Saksena performing in many under privileged patients, so Dr Barnard decide to donated few batch of Lillehei-Kaster prosthetic heart valve to him after he return to south Africa.



the Bombay Hospital Trust
**THE FIRST INTERNATIONAL CONFERENCE ON
THE SURGERY IN THE TROPICS**
on Sunday the 11th January, 1970

DR DEVENDRA SAKSENA WITH
DR CHRISTIAN BARNARD



CHEST-X RAY OF PATIENT WITH
LILLEHEI KASTER VALVE IN SITU

CONCLUSION

Nearly half a century of implantation of Lillehei-Kastor valve 18-A in a then young boy of age 16 years stands as a testament to the remarkable longevity of early pivoting-disc designs. While these devices were susceptible to surface wear and metallic corrugations over extended durations, such structural alterations rarely compromise their clinical integrity or lead to catastrophic failure⁽¹¹⁾. Consequently, clinicians must remain vigilant in monitoring these long-term survivors, as the enduring durability of mechanical prostheses—often exceeding 30 years—does not preclude the development of late-onset complications that necessitate tailored management^(12,13)

DECLARATIONS

Patient consent for publication: patient has given written consent for publication

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