


# Technical Details of Aortic Valve Replacement using Carpentier–Edwards PERIMOUNT Magna Ease Aortic Bioprosthesis in a Sexagenarian Patient with Severe Calcific Aortic Stenosis: A Video Presentation

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## Introduction

The current guidelines of the American Heart Association (AHA), American College of Cardiology (ACC) from 2014, and the European Society of Cardiology (ESC) from 2012 uniformly recommend mechanical aortic valve replacement in patients under 60 years of age and biologic aortic valve replacement in patients over 70 years of age.<sup>1,2</sup> The recommendations are conflicting for patients between 60 and 70 years of age. The ESC guidelines recommend biologic prosthesis from the age of 65 years onward, whereas the newer AHA/ACC guidelines only recommend biological valves starting 70 years of age. Over the past 20 years, there is a shift away from a clear-cut age limit toward patient's wish and lifestyle considerations.<sup>3</sup>

The number of surgical aortic valve replacements using a bioprosthesis is increasing according to the annual surveys of thoracic surgery in 2013 and 2014 by the Japanese Association for Thoracic Surgery, which states that bioprostheses are used in three-quarters of all aortic valve replacements procedures.<sup>4</sup> In addition, the age limit for implantation of an aortic bioprosthesis is continuously being shifted down with bioprostheses used for aortic valve replacements in 60% of sexagenarian patients and 90% of septuagenarian or octogenarian patients.<sup>3–6</sup> This may be related to the enhanced durability of new-generation bioprostheses, improved outcomes of redo valve replacement surgery, or the development of valve-in-valve (ViV) transcatheter aortic valve implantation.<sup>3–6</sup>

Randomized trials comparing biological and mechanical valve replacements are scanty. In 2009, Stassano and associates randomized 310 patients between 55 and 70 years of age into a mechanical and a biological prosthesis group to undergo aortic valve replacement. At a mean follow-up of 4 years, they found similar mortality and other adverse prosthesis-related events, namely, thromboembolic complications, bleeding, endocarditis, and structural valvular deterioration in the two group of patients.<sup>7</sup>

In 2008, Brown and associates analyzed outcome after aortic valve replacement with mechanical versus biological prosthesis in patients aged between 50 and 70 years at operation. Freedom from reoperation was 98% for mechanical valve and 91% for bioprosthesis ( $p = 0.06$ ). Rehospitalization for hemorrhagic events occurred in 15% of patients with mechanical valves and 7% of patients with bioprosthesis ( $p = 0.001$ ). The 5- and 10-year unadjusted survivals were 87% and 68% for mechanical valves and 72% and 50% for bioprosthesis, respectively.<sup>8</sup> The reported incidence of survival following mechanical mitral valve replacement in the published literature at 10, 20, and 30 years was 61 to 75%, 36.5 to 39% and 22.6%, respectively.<sup>9–14</sup>

The Carpentier–Edwards pericardial prosthesis commercially available since 1980 is the bioprosthesis, which is the most used worldwide. As a second-generation pericardial bioprosthesis, the Carpentier–Edwards pericardial valve was designed to minimize structural valvular deterioration, which plagued the first-generation prosthesis while

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**Table 1** Long-term outcomes assessment for structural valve deterioration with Carpentier–Edwards stented bioprosthesis

Model	Author	Follow-up maximum, mean (years)	Time of structural valve deterioration estimate (years)	Age (years)	Freedom from structural valve deterioration estimate (%)
Carpentier–Edwards	Poirier et al <sup>15</sup>	15, 4.8	14	Mean (not reported) < 60 60–69 ≥70	79.9 ± 5.0 84.7 87.9 100
Carpentier–Edwards	Neville et al <sup>18</sup>	12, 4.7	12	Mean 68 < 60 ≥60	94 (CI: 90–98) 89 (CI: 80–98) 98 (CI: 96–100)
Carpentier–Edwards	Banbury et al <sup>19</sup>	17, 12	15	Mean 65 < 50 50–70 ≥70	77 (CI: 74–82) 48 80 90
Carpentier–Edwards	Dellgren et al <sup>22</sup>	14, 5	12	Mean 71 > 65	86 ± 9.0 100
Carpentier–Edwards	Biglioli et al <sup>20</sup>	18, 6.0	18	Mean 67 < 65 ≥65	52.9 ± 9.9 35.8 ± 10.7 83.7 ± 8.9
Carpentier–Edwards	McClure et al <sup>21</sup>	17, 6.0	15	Mean 74 < 65 65–75 ≥75	82.3 (CI: 67–91) 34.7 CI: 6–67) 99.5 (CI: 97–99.9) 99.5 (CI: 97–99.0)

Abbreviations: CI, confidence interval.

retaining the hemodynamic superiority conferred by pericardial valve substitutes.<sup>14–17</sup> Published literature documents excellent long-term outcomes with the Carpentier–Edwards pericardial valve (► **Table 1**).<sup>15,18–22</sup>

The PERIMOUNT Magna Ease which is a further development of the PERIMOUNT Magna prosthesis (Edwards Lifesciences, Irvine, CA, USA) belongs to the latest generation of aortic valve prostheses. The manufacturer points the following advantages: lower profile, contoured and compliant sewing rings, and larger effective orifice areas, which would result in easier insertion and higher coronary ostial clearance; further, it lowers transprosthetic gradients and avoids prosthesis–patient mismatch; also, lower gradients together with an anticalcification technology prevents early structural valve deterioration.<sup>23–25</sup>

Although the Carpentier–Edwards PERIMOUNT Magna Ease valve is a bioprosthesis with documented excellent hemodynamics and other advantages as stated above, the valve has a gap between the cobalt-chromium-nickel alloy stent and silicone sewing ring. This gap, which is widest just below each of the three commissural struts, lacks silicone and leaves the two-layer polytetrafluoroethylene fabric unprotected. The passage of a needle through this weak area may result in fabric tear, resulting in a true cuff leakage and not the usual paravalvular leakage. To date, there are four case reports of cuff leakage in the literature diagnosed by transesophageal echocardiography. Three patients with cuff leakage were managed conservatively, and in one patient, it was sutured using polypropylene suture.<sup>26–29</sup> Pledged mattress sutures like we have used in our case in this manuscript have been advocated by other authors to prevent this complication.<sup>29</sup>

We report herein a 61-year-old male patient (body surface area 1.7 m<sup>2</sup>) diagnosed with severe calcific aortic stenosis, with a peak systolic left ventricle-to-aortic gradient of 110 mm Hg and normal coronaries undergoing aortic valve replacement using a 21 mm Carpentier–Edwards PERIMOUNT Magna Ease aortic prosthesis under moderately hypothermic cardiopulmonary bypass, St. Thomas (II)-based cold blood cardioplegia and iced normal saline. Postoperative recovery was uneventful.

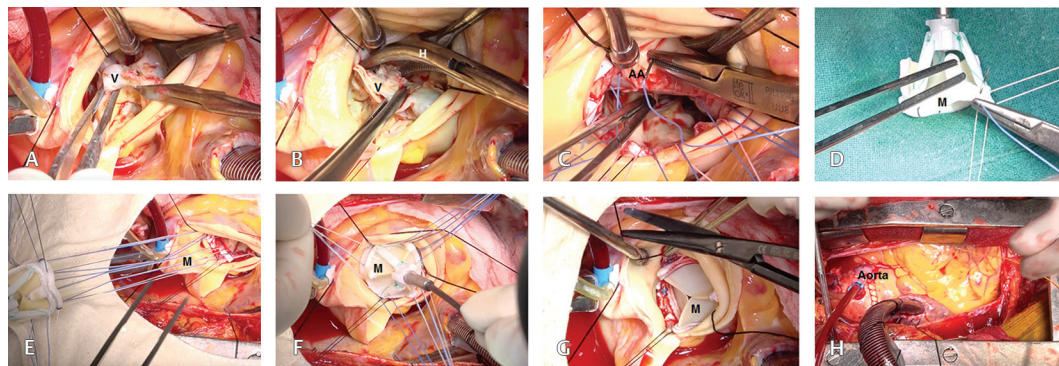
## Surgical Techniques

Following median sternotomy, vertical pericardiotomy, and systemic heparinization, cardiopulmonary bypass was established using aorto-atrial cannulation. It was not necessary to dissect the ascending aorta from the main pulmonary artery.

Under cardiopulmonary bypass on a partially filled heart with the ventilation stopped, the left atrial sump suction vent was inserted through the right superior pulmonary vein. (► **Video 1**).

After aortic cross-clamping, an oblique horseshoe-shaped aortotomy was performed in between stay sutures 1.5 cm above the sinus of the right coronary artery, stopping approximately 1 cm above the midpoint of the noncoronary sinus. Myocardial protection was achieved by integrated myocardial protection using direct ostial St. Thomas (II)-based cold blood cardioplegia (4:1) and topical cardiac cooling using ice cold saline. Successive doses of cardioplegia were repeated every 30 minutes.

Three commissural stay sutures were placed on the three aortic commissures. The stenosed calcific aortic valve was excised in a systematic manner, starting at the midpoint of



**Figure 1 (A–H)** Step-by-step demonstration of implantation of a Carpentier–Edwards Magna Ease aortic bioprosthesis. Abbreviations: AV, calcified aortic valve; H, hemostat; M, Magna Ease bioprosthesis.

the right coronary cusp and proceeding in an anticlockwise fashion.

The calcified aortic cusp was crushed using a thick hemostat, and the aortic valve was carefully excised, avoiding left ventricle-to-aortic discontinuity and injury to the aorto-mitral curtain.

The left ventricular cavity was thoroughly irrigated using cold normal saline, ensuring no embolization of the calcific debris to the left ventricular cavity and the coronary ostia. The aortic valve was sized and a 21 mm Carpentier–Edwards PERIMOUNT Magna Ease valve was selected for aortic valve implantation. The valve was implanted in an intra-annular location using interrupted, nonpledgeted 2–0 Ticron suture (M/s Covidien Domingo, Dominican Republic, USA) (► **Figs. 1A–H**). The aortotomy was closed in two layers using 4–0 polypropylene sutures (Johnson and Johnson Ltd., Ethicon, LLC, San Lorenzo, USA) (► **Video 1**).

#### Video 1

AVR Bio Video. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0040-1721189>.

## Results

The patient was weaned off cardiopulmonary bypass on dopamine 5 µg/kg/min and nitroglycerine 0.5 µg/kg/min. He was extubated after 6 hours. At 6 months follow-up, he is in New York Heart Association functional class I with left ventricular ejection fraction of 0.60 in normal sinus rhythm. Echocardiographically, the mean systolic left ventricle-to-aortic pressure gradient was 8 mm Hg, with no aortic regurgitation and no paravalvular/cuff leakage.

## Conclusion

Use of interrupted pledgeted mattress sutures for implantation of Carpentier–Edwards PERIMOUNT Magna Ease aortic bioprosthesis avoids fabric tear in the structurally weak area of the sewing ring of the Magna Ease bioprosthesis, thus minimizing the chances of cuff leakage.

Implantation of the 21 mm Magna Ease prosthesis yielded acceptable results in terms of survival, physical capacity, and hemodynamic behavior during 6 months follow-up period. Periodic evaluation of late clinical and hemodynamic outcomes with regard to the Magna Ease prosthesis, as well as the effect of prosthesis-patient mismatch, if any, on long-term outcomes is needed.

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#### Conflicts of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of the article.

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