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CASE REPORT

Perceval sutureless aortic valve replacement after ascending aortic replacement

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Abstract

In patients with a narrow sinotubular junction, small sinus of Valsalva, or extensibility loss in the aortic root, aortic valve replacement (AVR) with a standard valve is challenging due to limited surgical field. Detailed preoperative measurements of the aortic root render performing AVR using the Perceval valve easy.

KEYWORDS

aortic valve replacement, ascending aortic replacement, Perceval, sutureless

1 | INTRODUCTION

The Perceval bioprosthesis (LivaNova PLC) is a sutureless valve built on a self-expandable nitinol stent that has a dual role of supporting the valve and fixing it in place with three bovine pericardial leaflets.[1,2] The implantation method is simple, with three guiding sutures placed on each nadir during implantation.[2,3] Subsequently, the sutures are removed from the annulus, which means that ligation is not required. This sutureless system is favorable in cases with a narrow sinotubular junction (STJ), small sinus of Valsalva, or loss of extensibility of the aortic root because, in such cases, it is often difficult to obtain an ideal surgical field for suturing or tying knots in aortic valve replacement (AVR) with standard valves. In patients undergoing ascending aortic replacement using a proximal internal felt strip, mobilization of the STJ or aortic root is restricted; therefore, we often encounter troublesome cases that require removal of the implanted graft and felt strips to perform AVR or aortic root replacement.[4]

Herein, we reported two successful AVR cases using the Perceval valve in patients with a history of ascending aortic replacement, without any manipulation of the aortic root.

2 | CASE REPORT

2.1 | Case 1

A 73-year-old man who had bicuspid aortic valve stenosis accompanied with ascending aortic dilatation underwent AVR using a 21-mm Trifecta aortic valve (St. Jude Medical, Inc.) and ascending aortic replacement using a 26-mm J-graft (Japan Lifeline) in 2014. He suddenly presented with dyspnea on exertion and leg edema in 2020. Chest radiography showed cardiomegaly with a cardiothoracic ratio of 61%, pulmonary congestion, and bilateral pleural effusion. On echocardiography, the non-coronary cusp of the prosthetic valve was disrupted, resulting in severe aortic

insufficiency. The prosthetic valve also revealed mild stenosis, with a mean gradient of 28 mmHg. Mitral insufficiency was moderate, and tricuspid insufficiency was mild, with a peak pressure gradient of 46 mmHg. The diameters of the STJ and aortic valve annulus were 30.3 mm and 23.5 mm (STJ/annulus ratio, 1.29), respectively. The distance between the aortic annulus and the proximal felt strip was 29.6 mm (Figure 1A). In the operative findings, the aortic root severely adhered to the surrounding tissue, and the proximal felt strip reduced the extensibility of the STJ. Aortotomy was performed on the vascular graft approximately 35 mm above the aortic annulus (approximately 5 mm above the proximal felt strip). After removal of the prosthetic valve and pannus beneath the annulus, a Perceval M bioprosthesis was implanted with three guiding sutures, which were placed on each nadir (Figure 1B). The aortotomy line was sufficiently separated from the outflow ring to be closed. The operative, cardiopulmonary bypass, and cardiac cross-clamping times were 380, 150, and 89 min, respectively. No atrioventricular block was observed. Postoperative echocardiography revealed opened left ventricular outflow, with a mean prosthetic valve pressure gradient of 10 mmHg, an effective orifice area of 1.8 cm^2, and no paravalvular leakage. The mitral and tricuspid insufficiencies were both improved to mild, with a peak tricuspid valve pressure gradient of 21 mmHg. A Perceval bioprosthesis was implanted in the optimal position below the proximal felt strips (Figure 1C). The patient was discharged on day 18 postoperatively, without any complications.

2.2 | Case 2

A 79-year-old woman, who underwent ascending aortic replacement using a 26-mm J-graft (Japan Lifeline) for acute aortic dissection 6 months prior, developed acute heart failure due to severe aortic insufficiency. Echocardiography revealed a vegetation-like mass on the aortic valve, which caused severe aortic insufficiency. In addition, a blood culture revealed the presence of *Enterococcus faecalis*. On contrast-enhanced computed tomography, the diameters of the STJ and aortic valve annulus were found to be 27.3 and 24.0 mm (STJ/annulus ratio, 1.14), respectively, and the distance between the aortic annulus and the bottom of the proximal felt strip was 30.6 mm (Figure 2A). After 4 weeks of antibiotic treatment followed by a negative blood culture, AVR was performed. Aortotomy was performed with procedures similar to those used in case 1, and a Perceval L bioprosthesis was implanted in the same manner as in case 1 (Figure 2B). The aortotomy line was sufficiently separated from the outflow ring to be closed. The operative, cardiopulmonary bypass, and cardiac cross-clamping times were 351, 168, and 87 min, respectively. In this case, a postoperative advanced atrioventricular block developed; therefore, a permanent pacemaker was implanted 35 days postoperatively. Postoperative echocardiography demonstrated a mean prosthetic valve pressure gradient of 11 mmHg, and the effective orifice area was 1.4 cm^2, with trivial paravalvular leakage. A Perceval bioprosthesis was implanted below the proximal felt strips (Figure 2C). The patient was discharged 50 days postoperatively.

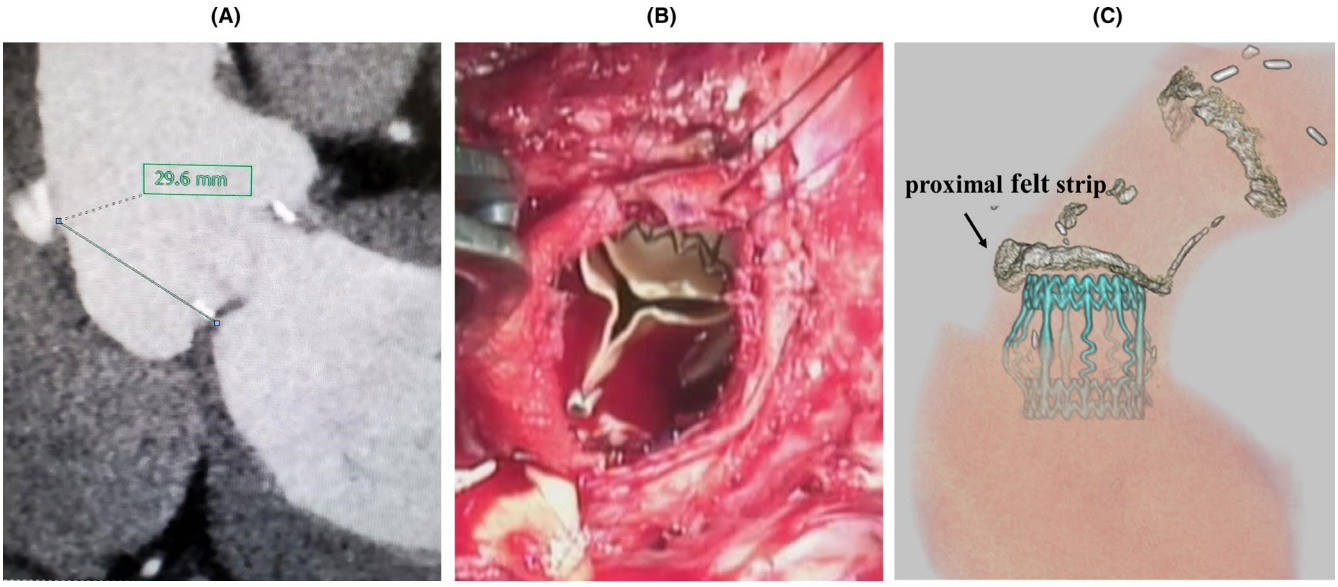

FIGURE 1 (A) Distance between the aortic annulus and the bottom side of the proximal felt strip, as assessed on contrast-enhanced cardiac computed tomography. (B) Intraoperative view showing the positional relationship between the outflow ring of the Perceval valve and aortotomy line. (C) Postoperative contrast-enhanced computed tomography image showing the Perceval valve implanted below the proximal felt strip

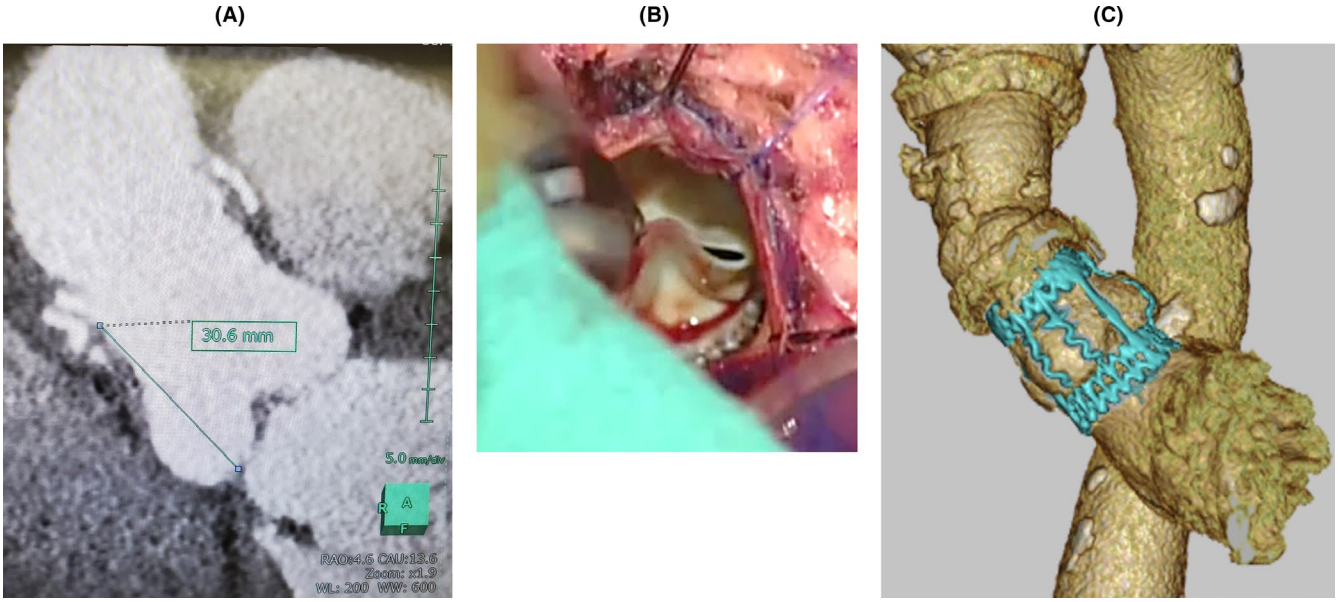

FIGURE 2 (A) Distance between the aortic annulus and the bottom side of the proximal felt strip, as assessed on contrast-enhanced cardiac computed tomography. (B) Intraoperative view showing the positional relationship between the outflow ring of the Perceval valve and aortotomy line. (C) Postoperative contrast-enhanced computed tomography image showing the Perceval valve implanted below the proximal felt strip

3 | COMMENT

According to Glauber et al, the outflow stent height of the Perceval valve is documented as 25, 26.5, 28.5, and 29.5 mm for valves sized S, M, L, and XL, respectively.[3] Considering the outflow stent height of the XL size valve, if the distance between the aortic annulus and the bottom of the proximal felt strip is over 30 mm, a Perceval valve can be implanted without any concerns of deformation. In case 1, we assumed that the implanted valve size was M or L, as a result of the preoperative measurement of the annulus diameter; therefore, we could predict that the valve was implanted below the proximal intimal felt strip, even though the distance between the aortic annulus and the bottom of the proximal felt strip was 29.6 mm. Note that the proximal felt strip restricts the extensibility of the STJ, and valve sizers cannot easily pass the STJ. As a result, underestimation of the size can arise, particularly in cases using a standard valve. Therefore, preoperative measurement of the annulus is crucial for the selection of valve size in such cases. The valve-collapsing delivery system of the Perceval valve would also be helpful in passing a narrow and inflexible STJ. We cannot explain the reason for the development of delayed advanced atrioventricular block in case 2 clearly, but that of the right size was implanted in the right position as shown in Figure 2C. The nature of Perceval self-expandable characteristic would lead to gradual oppression on the atrioventricular node. To determine the optimal valve size by measurement requires more time because of the narrow STJ. With the current experience, we concluded that the optimal valve size can be selected preoperatively if detailed aortic annulus measurement was made, and AVR using the Perceval valve can be performed with aortotomy on the graft and without any manipulation of the aortic root. More experience could make the surgery-related time shorter.

ACKNOWLEDGEMENT
None.

CONFLICT OF INTEREST
The authors declare that there are no conflicts of interest.

AUTHOR CONTRIBUTIONS
Shin Yajima was responsible for the acquisition of the data and writing of the original manuscript. Taichi Sakaguchi assisted with the critical revision of the manuscript. The other authors provided final approval of the version to be published.

ETHICAL APPROVAL
The patients provided informed consent for publication of their case details.

CONSENT
Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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