# Extended hockey stick aortotomy for Perceval valve implantation: how to reshape properly the aortic root

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**Abstract**

The Perceval Valve is a true sutureless aortic bioprosthesis. Overall, excellent performances have been demonstrated in terms of hemodynamic outcomes, safety and versatility of use; furthermore, as a sutureless valve option, it has shown to reduce the surgical burden, shortening the operative times and simplifying minimally invasive procedures. Since the valve has got a high frame profile, the recommended implantation technique requires a high and transverse aortotomy. In case of unplanned Perceval valve implantation, when an extended aortotomy is required, we have come up with a simple technique to reshape the aortic root before the valve is delivered in place: symmetry is pivotal to prevent folding issues and to improve the annular sealing. Although we discuss an out-of-recommendation use, in our experience that technique has shown to be safe and effective.

## Surgical Technique

In an era ruled by a rising drift towards TAVI procedures, there has been a need to reduce the physiological impact of a surgical aortic valve replacement (sAVR). Sutureless implantation can shorten the aortic cross-clamp and cardiopulmonary bypass times (1,2) and facilitate minimally invasive sAVR (3), whereas the lack of a proper stent enables improved hemodynamics (4), especially in case of small annuli. The Perceval valve (LivaNova, London, United Kingdom) consists of double-sheet bovine pericardium leaflets and a self-anchoring, self-expanding and elastic nitinol alloy stent, covered by a thin Carbofilm coating for improved biocompatibility. Due to its nitinol alloy stent height, the Company recommends to do the aortotomy transversely and higher than for traditional AVR, about 3.5 cm above the aortic annulus. The reason for this recommendation is that the Nitinol stent is longer than a traditional valve frame and if the aortotomy is too low, the distal portion could interfere with the closure of the aortotomy or may be caught within the suture. Catching the frame in the aortotomy suture bears the risk of dislodging the valve into the aortic root.

In our experience, we have devised two different scenarios where a Perceval valve might be the best option, even though a conventional extended aortotomy has been necessarily (Fig. 1):

1. Unexpected small annuli, where - due to the narrow outflow tract available - a sutureless/stentless solution might give a larger effective orifice area (EOA), avoiding patient prosthesis mismatch (PPM) (6), improving the hemodynamic performance and the valve durability. We call this scenario “unplanned Perceval implantation”, because we are forced to change the choice of the prosthesis after the direct inspection of the annulus and the left ventricular outflow tract (LVOT).
2. Aortic valve redo cases (5) in small annuli. Technically speaking, the closest approach to the aortic annulus makes easier the valve removal: the annulus has to be thoroughly cleaned to allow a perfect seal, so an extended aortotomy deep down the non-coronary sinus is often required. Of course, the advantage of a larger EOA as described in the previous point, is extremely valuable in this setting, too.

Based on our experience, the easiest way to implant a Perceval valve after making an extended aortotomy is "rebuilding" the aortic root wall up to the point where the recommended transverse aortotomy would be made. That is done with a Blalock suture of 4-0 or 5-0 prolene, pairing in an edge-to-edge fashion the aortic root wall (Fig. 2). Once the aortic root is rebuilt, the suture is tied: indeed the frame radial force could easily loosen the suture if that was not properly fixed. Due to its narrow profile, the Perceval valve can be easily fit in the remaining opening. After the implantation, the aorta is sutured in the usual manner. We would point out the need of symmetry when suturing the aortic root wall; as it is well known, if the frame encountered a not circular and smooth inner aortic surface, there would be a high probability to have a folding issue after the implantation; with an edge-to-edge well-paired suture it's possible to restore the original inner shape and surface.

We briefly reviewed our surgical clinical records; since the Perceval valve became available in our Institution in 2016, we placed that bioprosthesis in 19 cases of "unexpected small annuli" (table 1) and 27 redo cases for structural aortic valve deterioration (Table 2).

**Conclusions**

Although out-of-recommendation, the presented technique is a bailout strategy to implant a Perceval valve after a hockey-stick aortotomy. Indeed, in case of unexpected small annuli or when a closer approach to the annulus is needed, a conventional extended aortotomy does not preclude the Perceval valve option as long as the aortic root integrity is simmetrically rebuilt. In our experience, the technique is safe and effective and it might potentially extend the use of that sutureless valve option.

**References**

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**Tables**

Table 1

Patients n = 19

Total

Total

Age (mean +- SD)

79.5 +- 3.2

79.5 +- 3.2

Male sex (%)

4 (21)

4 (21)

BMI (mean +- SD)

29.7 +- 4.9

29.7 +- 4.9

Hypertension (%)

43.5

43.5

Diabetes (%)

12.3

12.3

Hypercholesterolemia (%)

67.6

67.6

COPD (%)

7.4

7.4

Acute Renal failure (serum creat > 2) (%)

0

0

Peripheral arterial disease (%)

24.7

24.7

Atrial fibrillation (%)

8.5

8.5

Previous Surgery

0%

0%

Surgical approach Right Anterior Mini-Thoracotomy (%)

19 (100)

19 (100)

STS score Mortality (mean +- SD)

1.81% +- 1.31%

1.81% +- 1.31%

STS score Morbidity/Mortality (mean +- SD)

11.66% +- 4.06%

11.66% +- 4.06%

Total Central Cannulation (%)

100

100

Prosthesis size n (%) S M

Prosthesis size n (%) S M

11 (57.8 %) 8 (42.1%)

CPB time (min) Mean SD

CPB time (min) Mean SD

31.6 +- 4.2

Cross clamp time (min) Mean SD

Cross clamp time (min) Mean SD

23.2 +- 4.7

Conversion to other surgical approaches

Conversion to other surgical approaches

0%

30-day mortality

30-day mortality

0%

Table 1

Table 1

Patients n = 27

Total

Age (mean +- SD)

74.5 +- 7.2

Male sex (%)

15 (55.5)

BMI (mean +- SD)

26.7 +- 4.9

Hypertension (%)

73.5

Diabetes (%)

14.5

Hypercholesterolemia (%)

67.6

COPD (%)

12.4

Acute Renal failure (serum creat > 2) (%)

0

Peripheral arterial disease (%)

17.6

Atrial fibrillation (%)

23.5

Previous Surgery Aortic Valve Replacement (%)

27 (100) 27 (100)

Combined Procedure (%) Mitral valve Plasty (%) CABG (%)

8 (29.6) 7 (87.5) 1 (12.5)

Surgical approach Right Anterior Mini-Thoracotomy (%) Median Sternotomy (%)

25 (95.6) 2 (7.4)

STS score Mortality (mean +- SD)

3.61% +- 1.23%

STS score Morbidity/Mortality (mean +- SD)

14.66%+-4.58%

Total Central Cannulation (%)

100

Prosthesis size n (%) S M

17 (62.9%) 10 (37.03%)

CPB time (min) Mean SD

72 +- 15.2

Cross clamp time (min) Mean SD

63 +- 13.7

30-day mortality

0%

Table 2