Perceval S aortic valve implantation in mini-invasive surgery: the simple sutureless solution

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Abstract

The Perceval S bioprosthesis (21 and 23 mm) was approved for clinical use in December 2010 and it is now routinely used. This bioprosthesis is suggested for the treatment of patients undergoing minimally-invasive surgery for reasons of safety and reduction in implantation time. Here we describe the use of the Perceval bioprosthesis in patients undergoing minimally invasive cardiac surgery.

Keywords: Aortic valve replacement • Heart valve bioprosthesis • Minimally-invasive surgery • Surgery/incisions/exposure/techniques • Outcomes

INTRODUCTION

A recent report described an increase in the prevalence of patients with valvular heart disease, eligible for aortic valve replacement (AVR), owing to the increased life expectancy of the general population [1]. However, there is an association between older age and related comorbidities, which results in increased surgical risk and this has stimulated the development of minimally-invasive aortic valve procedures that can reduce risk of mortality and morbidity, even in elderly patients. Transcatheter aortic valve implantation (TAVI) procedures have been developed and extensively used in high-risk patients who are considered not to be eligible for standard surgery using cardiopulmonary bypass [2].

To the same extent, older patients pose a significant challenge to modern cardiac surgery, even in the absence of specific high-risk features: in these patients, less invasive procedures are desirable to achieve a reduction in the global risk profile and a better surgical outcome [3]. In this population, a patient-oriented assessment is usually performed, since standardized guidelines on the use of a minimally-invasive approach are not available and there is substantial inter-centre heterogeneity in the clinical implementation of this approach.

We are involved in a multicentre study for the European (CE) approval of the use of the Perceval S aortic valve bioprosthesis. Here we describe the use of the Perceval bioprosthesis in patients undergoing minimally-invasive cardiac surgery.

TECHNIQUE AND RESULTS

The Perceval S aortic valve bioprosthesis (Sorin Group, Saluggia, Italy) needs presurgical transthoracic and transoesophageal echocardiography for complex anatomical features and the implant is not recommended for (i) bicuspid valve replacement with asymmetrical sinus of Valsalva, (ii) major diameter of the aortic annulus >25 mm (the prosthesis has a diameter between 21 and 25 mm and intra-annular implantation is necessary; a 27-mm version will soon be in production) or (iii) a ratio between the diameter of the sinus of Valsalva and the diameter of the superior annulus >1.3 (a ratio >1.3 can prevent a correct fixation of the valve-stent on the aorta).

For minimally-invasive surgery, patients require intraoperative monitoring by transoesophageal echocardiography for the management of cardiopulmonary bypass and the evaluation of the prosthesis.

Under general anaesthesia and orotracheal intubation, the patients undergoing AVR on cardiopulmonary bypass after partial ‘J’ sternotomy at the third/fifth intercostal space (evaluated with chest X-ray in the presurgical screening) and minimal cutaneous incision (8–10 cm) (Fig. 1). Cardiopulmonary bypass was established using a straight arterial cannula in the ascending aorta and/or a two-stage venous cannula in the right atrial appendage (when possible) or in the femoral vein.

The procedures were always performed during aortic cross-clamping with DeBakey, or flexible, or Glauber clamp and continuous infusion of cardioplegia (warm cardioplegia, Calafiore protocol) antegrade and retrograde through the coronary sinus.

If a second infusion of cardioplegia was necessary, it was performed retrogradely with the direct control on the coronary ostia of the correct retrograde flow. In case of lack of retrograde flux from the coronary ostia, we cannulated the ostia directly and infused the cardioplegia antegrade. The transverse aortotomy was localized in a higher position compared to an ordinary aortotomy for AVR: the reference point was the inferior margin of the Concato preaortic bundle. After the exposure of the aortic
valve through the positioning of three commissural sutures, the stenotic valve was completely removed and the annulus was mildly decalcified and sized with appropriate sizers to select the appropriate prosthesis diameter. We evaluated the non-passage of the sizer through the annulus in the ventricle (e.g. if the 22-mm sizer passed into the ventricle and the 23-mm sizer was blocked in the annulus, we would have selected a 23-mm bioprosthesis).

The prosthesis was collapsed in a holder with a specific collapser suitable for the diameter of the prosthesis (Fig. 2). The implantation was performed following these steps:

1. The initial positioning of three intra-annular and middle-commisural 4/0 polypropylene sutures.
2. The sutures were carried into the valvular struts to allow proper valve orientation within the aortic annulus.
After the release of the prosthesis from the holder, the polypropylene sutures, the guiding sutures and the commissural sutures were removed.

A balloon was then inserted into the valve and expanded for 30 s at a pressure of 4 mBar as recommended by the manufacturer. The valve was maintained in a continuous flux of sterile water at 37°C to allow the extension and the intra-aortic wall fixing of the Nitinol stent (Fig. 3).

The surgical procedure was completed with the closure of the transverse aortotomy, or with the other possible associated procedures. In case of associated coronary artery bypass grafting (CABG), the distal anastomosis preceded the implantation of the prosthesis but followed aortotomy and annulus sizing.

Transoesophageal echocardiography was performed during the procedure: in the presence of severe prosthetic valve dysfunction, we proceeded with immediate removal of the prosthesis (the prosthesis was folded and removed with the use of traction tweezers) and implantation of a suture aortic prosthesis. Using the ‘χ movement’, the prosthesis is easily removed, whereas the use of other procedures—even with a stronger impact—does not have the same rate of success.

Between March 2010 and December 2011, 51 patients received a Perceval S bioprosthesis with a ‘J’ sternotomy. Mean logistic EuroSCORE was 10.7 ± 7.5%; mean aortic cross-clamp (ACC) time was 43.8 ± 20.8 min (range: 20–125 min). Mean implantation time was 8.0 ± 3.8 min (range: 4–28 min). In-hospital mortality was 2.4% (one patient for multi-organ failure and one for liver insufficiency). At follow-up, we recorded two deaths (one patient for congestive heart failure and one for gastrointestinal bleeding). After one year, mean NYHA functional class was 1.0 ± 0.6. Mean transprosthesis gradients were 13.4 ± 2.8, 12.6 ± 2.3, 10.8 ± 1.3 mmHg postoperatively, at six months and at one year, respectively.

DISCUSSION

The Perceval S bioprosthesis (21 and 23 mm) was approved for clinical use in December 2010 and it is now routinely used. This new valve shares with the new generation bioprosthesis valve models the transcatheter delivery modality, which allows a more tailored approach for these patients.

In high-risk patients undergoing combined or REDO surgery with prolonged surgical time, as well as in patients undergoing reintervention, the use of sutureless bioprostheses is particularly valuable for its considerable reduction in implantation time.

It is also important to mention that, during minimally invasive surgery, the reduction in the working space for the passage of prosthetic sutures can be technically challenging and this issue can be easily solved with the use of the sutureless Perceval prosthesis. In patients with a critically small annulus, this valve allows maximization of the bioprosthetic diameter. In addition, it may reduce the rate of paravalvular leakage, which is commonly related to suboptimal suturing of the bioprosthesis fixation ring in this clinical setting.

The Perceval S sutureless aortic valve represents an easy and useful instrument for AVR. The Perceval S valve may also be used as first-line option during minimally-invasive procedures.
REFERENCES

