Aortic valve replacement within an unexpected porcelain aorta: 
the sutureless valve option

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Abstract

Four patients referred for surgical treatment of aortic stenosis presented an unexpected extremely calcified (porcelain) ascending aorta at the intraoperative epiaortic ultrasonography scanning. In each patient, replacement of the aortic valve was successfully performed using a sutureless implantable bioprosthesis during a short period of hypothermic circulatory arrest. In the era of transcatheter aortic valve implantation procedures, the sutureless valve may be a valuable option for surgical units that do not dispose of transcatheter technology or a hybrid operative theatre.

Keywords: Aortic calcification • Aortic valve • Replacement • Cerebral protection • Heart valve • Bioprosthesis

INTRODUCTION

Aortic valve replacement in the presence of an atheromatous ascending aorta has always been a difficult surgical challenge. The impossibility of safely cannulating and clamping the ascending aorta due to the risk of cracking atherosclerotic plaques has generated several methods to minimize aortic manipulation [1]. While these surgical techniques yield acceptable outcomes, the transcatheter aortic valve implantation procedures are producing compelling results even in this difficult subset of patients with aortic stenosis [2].

In the present paper, an option of treatment of the aortic stenosis in the presence of an extremely calcified (porcelain) ascending aorta is fuelled by the use of a sutureless implantable biological valve.

CASE REPORTS

Between January and June 2013, 4 consecutive patients with aortic stenosis enrolled for aortic valve replacement underwent valve operation using a sutureless bioprosthesis, the Perceval S valve (Sorin Biomedica, Saluggia, Italy) [3–5], due to the presence of a porcelain ascending aorta, which was unexpectedly detected by the intraoperative epiaortic ultrasonography scanning. In all patients, hypothermic circulatory arrest with retrograde cerebral perfusion (HCA) was used to avoid aortic clamping.

Patient 1

An 83-year old woman with unstable angina and dyspnoea (New York Heart Association class [NYHA] II) was referred for severe aortic stenosis (aortic valve area, 0.7 cm²; mean pressure gradient, 53 mmHg) and two-system coronary artery disease. The patient's expected operative risk, calculated according to the logistic European System for Cardiac Operative Risk Evaluation (EuroSCORE), was 16.9%. The programme of traditional aortic valve replacement was abandoned due to the intraoperative detection of a porcelain ascending aorta. The ascending aorta was cannulated in a restricted safe area, cardiopulmonary bypass was instituted, and the patient was cooled down. During 30 min of HCA, the aortic valve leaflets were removed and a 23-mm Perceval S valve was implanted into the decalcified aortic root. Techniques of valve sizing and implantation were employed as described by Shrestha et al. [3]. Myocardial protection was obtained with the Custodiol-Histidine-Tryptophan-Ketoglutarate solution (Essential Pharma, Newtown, PA, USA) retrogradely delivered during HCA. The anastomosis between the in situ left internal thoracic artery (ITA) and the obtuse marginal coronary artery was made during cooling on a beating and vented heart, using the CORONEO CorVasc stabilizing system (CORONEO Inc, Montreal, Quebec, Canada). The anastomosis between the in situ right ITA and the left anterior descending coronary artery was made during rewarming.

Patient 2

A 69-year old woman with dyspnoea (NYHA IV) and chronic pulmonary disease was referred for severe aortic stenosis (aortic valve area, 0.9 cm²; mean pressure gradient, 41 mmHg). The patient’s EuroSCORE was 11.6%. Intraoperative detection of a porcelain ascending aorta was overcome by replacing the aortic valve with a 23-mm Perceval S valve during 39 min of HCA. No cardioplagia was used (Figs 1 and 2).
Patient 3

An 80-year old woman with unstable angina and dyspnoea (NYHA III) was referred for aortic stenosis (aortic valve area, 0.8 cm²; mean pressure gradient, 28 mmHg) and three-system coronary artery disease. Diabetes on insulin, renal failure on dialysis, moderate left ventricular dysfunction and stenosis of the left internal carotid artery were risk factors. The patient’s EuroSCORE was 46.1%. The unexpected detection of a porcelain ascending aorta suggested the use of HCA. The end-to-end anastomosis between the stem of the right ITA and a saphenous vein graft, and the assembly (Y-graft) of the in situ left ITA and the right ITA free-graft were made during cooling. The left carotid endarterectomy and the two anastomoses between the circumflex coronary artery and the Y-graft were made on deep hypothermia. A 23-mm Perceval S valve was implanted into the aortic root during 31 min of HCA. The anastomoses between the Y-graft and the left anterior descending coronary artery, and between the saphenous vein and the right coronary artery were made during rewarming. Myocardial protection was obtained with blood cardioplegia retrogradely delivered during HCA.

Patient 4

A 75-year old man with dyspnoea (NYHA III), aortic stenosis (aortic valve area, 0.8 cm²; mean pressure gradient, 34 mmHg) and renal failure underwent aortic valve replacement with a 23-mm Perceval S valve during 28 min of HCA due to the unforeseen presence of a porcelain ascending aorta. The patient’s EuroSCORE was 11.5%.

In all the patients, the intraoperative transoesophageal echocardiographic assessment showed no perivalvular leakages. The first 3 patients had uneventful postoperative courses and were discharged within postoperative day 20. After the early mediastinal re-exploration for bleeding also the postoperative course of Patient 4 was good; he was discharged on postoperative day 19. At the follow-up (range, 1–6 months), all the patients were asymptomatic for angina and dyspnoea and the transprosthetic mean pressure gradient ranged from 9 to 23 mmHg. In Patient 1, there were two small perivalvular leakages.

DISCUSSION

In the presence of a porcelain ascending aorta, traditional aortic valve replacement becomes a challenging operation due to the impossibility of safely manipulating the aorta. Several strategies have been proposed to overcome this issue, including aortic valve replacement during HCA, with or without replacement of the ascending aorta with a tube graft, the use of aortic endoclamps, extensive ascending aortic endarterectomy or apicoaortic conduits [1]. Nowadays, the transcatheter technology allows treating the aortic stenosis in strongly symptomatic patients with prohibitive operative risk or in the presence of a porcelain aorta [2]. However, it is common experience that there are some extreme cases in whom even the transcatheter procedures could be ineffective or dangerous, such as in the presence of a concomitant severe coronary artery disease. Furthermore, in the case of an unexpected operative finding of grossly atheromatous ascending aorta, the switching to transcatheter aortic valve implantation could be unfeasible, such as in surgical units that do not dispose of the transcatheter technology or a hybrid operative theatre.

In the present report, the authors have successfully replaced a stenotic aortic valve within a porcelain aorta in 4 patients using the Perceval S biological valve, a pericardial valve assembled in a...
metal super elastic alloy stent and implantable without the need of suturing. This collapsible and expandable device offers the advantage of the possibility of a small aortotomy [3-5]. The sutureless valve was adopted following intraoperative detection of an unexpected porcelain ascending aorta because of its potential for shortening the duration of HCA [4]. The technique has proved to be safe, quick and easy, though in 1 patient there were two small perivalvular leakages. Actually, the sutureless valve has been previously reported as an effective tool in the special setting of a porcelain aorta by Santarpino and colleagues. These authors, however, did not perform the valve implantation during hypothermic circulatory arrest. Thus, they failed to stress this option [5].

Although the porcelain aorta could be an intraoperative finding detected with the routine use of epiaortic ultrasonography scanning, clearly greater efforts should be accomplished in the pre-operative investigations of the aorta.

Conflict of interest: none declared.

REFERENCES