Case Reports

Valve Replacement with a Sutureless Aortic Prosthesis

in a Patient with Concomitant Mitral Valve Disease and Severe Aortic Root Calcification

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Aortic valve replacement with concomitant mitral valve surgery in the presence of severe aortic root calcification is technically difficult, with long cardiopulmonary bypass and aortic cross-clamp times.

We performed sutureless aortic valve replacement and mitral valve annuloplasty in a 68-year-old man who had severe aortic stenosis and moderate-to-severe mitral regurgitation. Intraoperatively, we found severe calcification of the aortic root. We approached the aortic valve through a transverse aortotomy, performed in a higher position than usual, and we replaced the valve with a SORIN Perceval S sutureless prosthesis. In addition, we performed mitral annuloplasty with use of an open rigid ring.

The aortic cross-clamp time was 63 minutes, and the cardiopulmonary bypass time was 83 minutes. No paravalvular leakage of the aortic prosthesis was detected 30 days postoperatively.

Our case shows that the Perceval S sutureless bioprosthesis can be safely implanted in patients with aortic root calcification, even when mitral valve disease needs surgical correction. ***(Tex Heart Inst J 2016;43(2):186-8)***

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Aortic valve (AV) replacement with concomitant mitral valve (MV) repair or replacement is the standard treatment for patients who have MV and AV disease. However, AV replacement in patients who have severe aortic root calcification is a technically difficult procedure with long cardiopulmonary bypass (CPB) and aortic cross-clamp times. The use of a sutureless aortic bioprosthesis has been described as a viable option in these cases.[1] However, there are few relevant reports in the presence of MV disease that needs concomitant surgical correction.[2,3] We describe a case of sutureless AV replacement with concomitant MV annuloplasty in a patient who had severe AV stenosis, moderate-to-severe mitral regurgitation, and severe aortic root calcification.

Case Report

In February 2015, a 68-year-old man was referred to our institution for the surgical correction of severe aortic stenosis. The patient's medical history included hypertension, smoking, and the implantation of a dual-chamber pacemaker for heart block. Upon hospital admission, the patient had dyspnea (New York Heart Association functional class III). Transthoracic echocardiograms showed severe AV calcification and stenosis (mean aortic transvalvular pressure gradient, 42 mmHg), and moderate left ventricular (LV) systolic dysfunction (LV ejection fraction, 0.35). Moderate-to-severe mitral regurgitation was caused by the tethering of both leaflets (Fig. 1). Echocardiography revealed no calcification of the aortic root, so computed tomography was not performed. Preoperative coronary angiograms showed normal coronary arteries.

After a standard median sternotomy, CPB was instituted with aortic and bicaval cannulation, and the heart was arrested by means of antegrade normothermic blood cardioplegic solution. Intraoperatively, we observed severe calcification of the aortic root and the proximal portion of the ascending aorta. For this reason, we approached the AV through a transverse aortotomy in a higher position than is usual in AV replacement (that is, 1 cm distal to the sinotubular junction and 3 cm distal to the

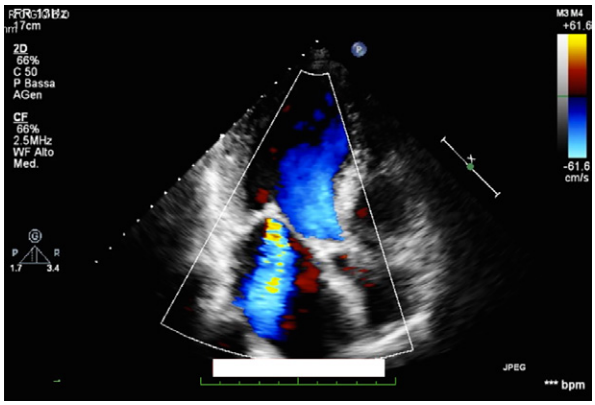

Fig. 1 *Preoperative echocardiogram (3-chamber view) shows heavy calcification of the aortic valve and moderate-to-severe mitral regurgitation caused by the tethering of both leaflets.*

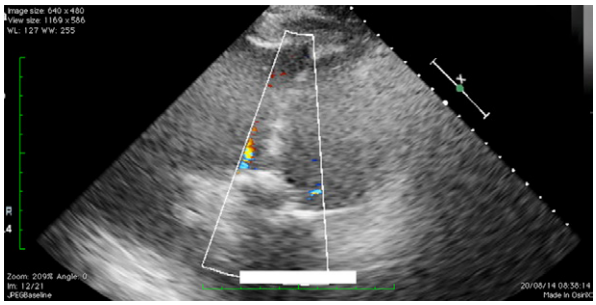

Fig. 2 *Postoperative echocardiogram (5-chamber view) shows mild aortic regurgitation caused by paravalvular leakage.*

aortic annulus). The reference point was the adventitial thickening of the ascending aorta, 8 to 12 mm above the origin of the right coronary artery. The aortic root had a porcelain appearance; the valve was tricuspid but extremely calcified. We made a dissection in the Sondergaard groove and performed mitral annuloplasty with use of a 32-mm CG Future® ring (Medtronic, Inc.; Minneapolis, Minn). We chose an open, rigid ring to leave the anterior aspect of the mitral annulus free from prosthetic material and thus to enable the subsequent expansion of the sutureless aortic bioprosthesis. Ring implantation was achieved by placing a series of 2-0 mattress sutures through the posterior mitral annulus, from the posteromedial (right) fibrous trigone to the anterolateral (left) fibrous trigone.

We then excised the native AV and used scissors and scalpels to remove all the calculus from the aortic annulus, in order to minimize the risk of paravalvular leakage after the release of the sutureless bioprosthesis. We observed no dislodgment or fragmentation of the calculus on the aortic wall. We replaced the native valve with a large-sized Perceval S sutureless prosthesis (SORIN S.p.A.; Milan, Italy; now LivaNova PLC; London, UK). (This prosthesis is not yet approved for use in the United States.) Three double-needle 4-0 Prolene sutures were placed at the lowest point of the valve sinuses, corresponding to the native-valve annulus; these sutures served as a guide for positioning the sutureless prosthesis. We slid the collapsed sutureless valve over the guide sutures inside the valve annulus. After the release of the prosthesis from its holder and subsequent balloon expansion, the valve was maintained in a continuous flow of sterile water at 37 °C, to enable extension and intra-aortic wall fixing of the nitinol stent of the bioprosthesis. Good prosthetic positioning and normal function without paravalvular leakage were determined by means of intraoperative transesophageal echocardiography. We closed the aortotomy with continuous 4-0 Prolene suture and weaned the patient from CPB. The aortic cross-clamp time was 63 minutes, and the CPB time was 83 minutes.

The patient's postoperative course was uneventful, and he was discharged from the hospital 6 days after the operation. Echocardiograms obtained before his discharge showed a well-functioning aortic bioprosthesis with mild aortic regurgitation caused by paravalvular leakage, a mean pressure gradient of 8 mmHg, no residual mitral regurgitation, and an LV ejection fraction of 0.45 (Fig. 2). Thirty days postoperatively, the patient was asymptomatic without prosthesis malfunction or paravalvular leakage. The mean pressure gradient of 7 mmHg was stable relative to the postoperative value. Thereafter, the patient was lost to follow-up.

Discussion

Surgical AV replacement with concomitant MV repair or replacement is the gold standard of treatment in patients who have MV and AV disease. A severely calcified aortic root can increase the perioperative risk in these cases because of the challenge of implanting a conventional prosthesis in the aortic position and the longer cross-clamp and CPB times that are associated with an increased operative mortality rate in cardiac surgery.[4] In our patient with an extensively calcified aortic root and concomitant MV regurgitation, we performed mitral annuloplasty, decalcified the aortic annulus, and implanted the Perceval S sutureless bioprosthesis.

The Perceval S valve is a biological prosthesis composed of bovine pericardium mounted within a superelastic alloy frame. This bioprosthesis can be collapsed through a dedicated device and positioned by means of a specific delivery system with no need for sutures. In the presence of a severely calcified aortic root, the sutureless option enables prosthesis implantation with good hemodynamic performance and without the need for surgical sutures, which might be difficult to pass through the annulus after the aortotomy is performed in a higher position than usual.

Currently, in cases of severe aortic root calcification, an AV can be implanted percutaneously through

a transapical or transfemoral approach (TAVI). Both methods follow a common route of not removing the diseased valve. However, particularly when an aortic root is highly calcified, dislodged calcific débris can embolize to the brain and occlude the coronary arteries.[5] The Perceval S aortic prosthesis is implanted after the diseased valve is surgically removed, as in conventional valve replacement. Furthermore, this procedure can be done under direct vision, thus ensuring secure positioning without diminishing blood flow to the coronary ostia. In our patient, conventional TAVI was not possible, because he also needed correction of severe mitral regurgitation.

Investigators have achieved satisfactory clinical and hemodynamic results after treating isolated AV stenosis with the Perceval S.[6] However, few experiences have been described in combination with concomitant MV disease that needs surgical correction, perhaps because of possible interference of the mitral ring or prosthesis with the self-expansion of the bioprosthesis, and the consequent risk of paravalvular leakage.[2,3] Minh and colleagues[3] reported good hemodynamic results in 10 patients with concomitant MV disease who were treated with a sutureless aortic prosthesis; however, none of those patients had a porcelain aorta. We used an open ring to minimize this risk; after 30 days, we observed no paravalvular leakage.

We think that Perceval S implantation can be a feasible and safe procedure in patients who have aortic root calcification, even in the presence of MV disease that also needs correction.

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