Aortic homograft replacement in a patient with a porcelain aorta: A case report

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Patients with a severely calcified (porcelain) aorta are often unsuitable candidates for cardiac surgery because of the high risk of neuroembolic complications from loose calcified particles.¹ We describe a surgical technique in a patient with a porcelain aorta undergoing an aortic homograft replacement for infective endocarditis that used an oscillating saw and a surgical hand drill for suturing the calcified plates.

CLINICAL SUMMARY

A 49-year-old man with a history of aortic mechanical valve replacement in 2001 was referred to our hospital for treatment of infective aortic valve prosthetic endocarditis. Chest radiography showed a hyperdense aspect of the aortic annulus extending circumferentially to the aortic arch. Further analysis with computed tomography confirmed a severely circularly calcified aortic root and ascending aorta (Figure 1, A through C). Despite antibiotic therapy, the patient's hemodynamic condition deteriorated with progressive atrioventricular conduction disturbances. Because there were no other options, the patient was scheduled for an aortic root replacement with a homograft.

SURGICAL TECHNIQUE

Cardiopulmonary bypass (CPB) was established through cannulation of the left femoral artery and the right atrium with a 2-staged venous cannula. Body temperature was then cooled to 18°C, and deep hypothermic circulatory arrest was achieved. Retrograde cardioplegia was administered. Calcification of the aortic wall made routine aortotomy impossible because of the risk of aortic wall fragmentation. Distal aortotomy was therefore performed with an oscillating saw at approximately 1.5 cm proximal to the brachiocephalic artery, exposing a completely calcified aorta with a wall thickness of 2 to 3 mm (Figure 2, A). From there, the ascending aorta to the aortic annulus was resected.

Intraoperative view of the calcified ascending aorta after use of a surgical hand drill.

Central Message

A successful surgical technique for a porcelain aorta used an oscillating saw and surgical hand drill for suturing calcified plates.

See Editorial Commentary page 412.

No antegrade cerebral perfusion was performed because of the potential for embolization of loose calcified particles on insertion of the cannulas in the carotids. A 0.6-mm orthogonathic surgical hand drill was subsequently used to create a series of circular holes in the severely calcified wall at approximately 5 mm from the aortotomy (Figure 2). With a 4-0 Prolene running suture (Johnson & Johnson, New Brunswick, NJ), a tubular prosthesis (26 mm Gelweave; Vascutek Ltd, a Terumo Company, Inchinnan, United Kingdom) was anastomosed to the distal aortotomy end with the tiny drill holes. For hemostasis, a 2-cm bovine pericardial patch was glued with BioGlue (CryoLife, Inc, Kenesaw, Ga) over the anastomosis (Figure 2, B). An aortic clamp could then be placed on the Gelweave prosthesis, and CPB was recommenced. Subsequently, the infected mechanical prosthesis was resected, with accompanying débridement of the aortic annulus. The aortic root was replaced with an aortic homograft. Because of severe calcifications, it was necessary to resect and reconstruct the left coronary ostium with a bovine pericardial patch. Consecutively, the new root end was sutured with interrupted Ethibond 2-0 sutures (Johnson & Johnson). The ascending aorta part of the homograft was sutured distally with a running 5-0 Prolene suture to the proximal part of the Gelweave prosthesis. Circulatory arrest time was 45 minutes, aortic crossclamp time was 225 minutes, and total CPB duration was 350 minutes.

FIGURE 1. A, Preoperative chest radiography showed a hyperdense aspect of the ascending aorta and aortic wall. B, Computed tomography confirmed severe circular calcification of the aortic root and ascending aorta. C and D, Three-dimensional reconstructions clearly show the calcified aorta before the operation (C) and the aortic homograft in situ after the operation (D).

Postoperative computed tomographic scan showed an excellent result of the aortic homograft implantation (Figure 1, D). The postoperative course was uneventful, and the patient was discharged after 21 days.

DISCUSSION

Cardiac surgery in patients with a porcelain aorta is complex and carries major risks of postoperative complications, with these circumstances often resulting in denying surgery to these patients. In rare cases, however, such as in our case, surgery is mandatory for survival. Several techniques have been outlined in the literature through the decades to solve this predicament, such as femoroaxillary arterial cannulation for CPB, use of an intraluminal balloon catheter as a substitute for external clamps, circulatory arrest, and endarterectomy of the ascending aorta.¹⁻⁵

Only 2 case reports have illustrated the use of an oscillating saw for an aortotomy such as we used in our case.^{4,5} Those 2 case reports described an aortic valve replacement and a Bentall procedure the implemented such a saw to perform an endarterectomy.^{4,5} An endarterectomy is challenging in severely calcified plates, however, and it usually is not possible. In addition, performing such exfoliation under these circumstances carries a high risk of aortic mural perforation and longitudinal fissures throughout the arch and descending aorta, necessitating major aortic surgery.

We illustrated the use of the oscillating saw to perform an aortotomy. Instead of carrying out an aortic endarterectomy as demonstrated in earlier reports, we used a 0.6-mm orthognathic surgical hand drill to create a series of circular holes in the severely calcified ascending aorta. This was done to reinforce the aortic wall with a Gelweave prosthesis and bovine pericardial patch so that the homograft could be

FIGURE 2. A, The heavily calcified ascending aorta with a calcified shelf approximately 2 mm thick. B, An intraoperative view of the calcified ascending aorta and the distal end of the Gelweave prosthesis (Vascutek Ltd, a Terumo Company, Inchinnan, United Kingdom) after the use of a surgical hand drill. C, The surgical hand drill used, with a diameter of 0.6 mm.

sutured distally. This technique allowed subsequent aortic clamping, followed by more or less routine aortic root replacement with a homograft.

In conclusion, we demonstrate an effective and feasible method for the surgical treatment of aortic valve prosthetic endocarditis that would otherwise be inoperable because of a severely calcified ascending aorta. The use of an oscillating saw for a clean aortotomy and an orthognathic surgical hand drill to create a series of circular holes for sutures proved to be of great help in dealing with a porcelain ascending aorta.

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