**Introduction**

Severe atherosclerotic calcification in the ascending aorta, also known as a “porcelain aorta,” precludes cardiac surgeons from placing an aortic cross-clamp and direct aortic cannulation due to the increased risk of systemic embolism and stroke.[1,2] 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.[3]

In the present report, we support the option of sutureless valve implantation in a case of an extremely calcified (porcelain) ascending aorta, with deep hypothermic circulatory arrest (DHCA) and also without aortic cross-clamp.

**Case Presentation**

An 81-year-old woman referred to our hospital due to pulmonary edema as a result of severe aortic valve stenosis (aortic valve area 0.5 cm², mean pressure gradient 42 mmHg, and peak pressure gradient 67 mmHg). The patient intubated and admitted to the cardiology intensive care unit while she was in the waiting list for transcatheter aortic valve implantation (TAVI). The patient went to the surgery the next day. From her personal history, the patient had left mastectomy on 1974 because of cancer and hepatic segmentectomy due to a cyst formation on 1988. She also had a chronic renal dysfunction (glomerular filtration rate = 39.9 ml/h).

The patient’s expected operative risk, calculated according to the logistic European System for Cardiac Operative Risk Evaluation, was 29.86%. The programmed conventional aortic valve replacement was abandoned due to the detection of a porcelain ascending aorta from computed tomography (CT) scan preoperatively. CT revealed a severed calcified from the ascending aorta to the aortic arch [Figure 1].

Before sternotomy, an 8-mm prosthetic graft was anastomosed to the right axillary artery. After sternotomy, a cardiopulmonary bypass was initiated with a venous return from the right atrium and a left ventricular venting from the right upper pulmonary vein. Cardiopulmonary bypass was instituted, and the patient was cooled down to 18°C. Because of the porcelain aorta, no clamp was used and the aortic valve replacement went under total circulatory arrest. The proximal ascending aorta with a less calcified site was opened in an elongated fashion [Figure 2]. During 30 min of DHCA, the aortic valve leaflets were removed and a 23-mm perceval S valve was implanted into the decalcified aortic root [Figure 2]. Techniques of valve implantation in patient with porcelain aorta via unclamped aorta and deep hypothermic circulatory arrest. Ann Card Anaesth 2017;20:447-9.

**Address for correspondence:**
Dr. Nikolaos G Baikoussis, 45-47, Ypsilantou Street, Kolonaki, 10676 Athens, Greece. E-mail: niko1aos.baikoussis@gmail.com

**Access this article online**
Website: www.annals.in
DOI: 10.4103/aca.ACA_70_17

**Quick Response Code:**

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

© 2017 Annals of Cardiac Anaesthesia | Published by Wolters Kluwer - Medknow
sizing and implantation were employed as described by Shrestha et al.[4] Myocardial protection was obtained with the Custodiol-histidine-tryptophan-ketoglutarate solution (Essential Pharma, Newtown, PA, USA) retrogradely delivered during hypothermic circulatory arrest (HCA). The aorta was closed with isolated mattress sutures 4-0 polypropylene inforced with Teflon-felt [Figure 3]. The total cardiopulmonary bypass time was 100 min. The postoperative was uneventful without the need of temporal or permanent pacemaker and she discharged home in good clinical conditions. In the follow-up, no significant paravalvular leak was noted while she is in optimal health status.

Conclusion

A severely calcified ascending aorta and arch are considered to increase the risk of a cerebral emboli occurring in patients undergoing aortic valve replacement. Several technical options have been used to avoid this complication, such as DHCA with or without ascending aortic replacement, endarterectomy of the ascending aorta, aortic inspection, and cross-clamping during HCA.[4-6]

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.[7] However, it is well known that there are some extreme cases where transcatheter procedures could be ineffective, such as in the case of an unexpected operative finding of grossly atheromatous ascending aorta, the switching to TAVI could be unfeasible, such as in surgical units that do not dispose of the transcatheter technology or a hybrid operative theater.

In our case report, we successfully manage to replace the aortic valve within a porcelain aorta, using a perceval biological sutureless valve in deep hypothermia and total cardiac arrest. This collapsible and expandable device offers the advantage of the possibility of a small aortotomy.[7-9] The sutureless valve was adopted following intraoperative detection of an unexpected porcelain ascending aorta because of its potential for shortening the duration of DHCA.[9]

Kaneko et al. suggest that device development and technical maturity are likely to improve transcatheter aortic valve replacement outcomes in the future; nevertheless, surgical treatment remains a proven safe procedure, especially in octogenarians, and the current study suggests that selecting patients by age maximizes these benefits.[10]

Despite the notion among physicians including cardiac surgeons that porcelain aorta is “inoperable,” surgical AVR using DHCA, sutureless valve, and total cardiac arrest is a viable option and has to be studied.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The
patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Roach GW, Kanchuger M, Mangano CM, Newman M, Nussmeier N, Wolman R, et al. Adverse cerebral outcomes after coronary bypass surgery. Multicenter Study of Perioperative Ischemia Research Group and the Ischemia Research and Education Foundation Investigators. N Engl J Med 1996;335:1857-63.

2. Djaiani G, Fedorko L, Borger M, Mikulis D, Carroll J, Cheng D, et al. Mild to moderate atheromatous disease of the thoracic aorta and new ischemic brain lesions after conventional coronary artery bypass graft surgery. Stroke 2004;35:e356-8.

3. Fukuda I, Daitoku K, Minakawa M, Fukuda W. Shaggy and calcified aorta: Surgical implications. Gen Thorac Cardiovasc Surg 2013;61:301-13.

4. Takami Y, Tajima K, Terazawa S, Okada N, Fuji K, Sakai Y. Safer aortic crossclamping during short-term moderate hypothermic circulatory arrest for cardiac surgery in patients with a bad ascending aorta. J Thorac Cardiovasc Surg 2009;137:875-80.

5. Gillinov AM, Lytle BW, Hoang V, Cosgrove DM, Banbury MK, McCarthy PM, et al. The atherosclerotic aorta at aortic valve replacement: Surgical strategies and results. J Thorac Cardiovasc Surg 2000;120:957-63.

6. Girardi LN, Krieger KH, Mack CA, Isom OW. No-clamp technique for valve repair or replacement in patients with a porcelain aorta. Ann Thorac Surg 2005;80:1688-92.

7. Zahn R, Schiele R, Gerckens U, Linke A, Sievert H, Kahlert P, et al. Transcatheter aortic valve implantation in patients with “porcelain” aorta (from a Multicenter Real World Registry). Am J Cardiol 2013;111:602-8.

8. Shrestha M, Folliguet T, Meuris B, Dibie A, Bara C, Herregods MC, et al. Sutureless Perceval S aortic valve replacement: A multicenter, prospective pilot trial. J Heart Valve Dis 2009;18:698-702.

9. Santarpino G, Pfeiffer S, Concistré G, Grossmann I, Hinzmann M, Fischlein T. The Perceval S aortic valve has the potential of shortening surgical time: Does it also result in improved outcome? Ann Thorac Surg 2013;96:77-81.

10. Kaneko T, Neely RC, Shekar P, Javed Q, Asghar A, McGurk S, et al. The safety of deep hypothermic circulatory arrest in aortic valve replacement with unclamplable aorta in non-octogenarians. Interact Cardiovasc Thorac Surg 2015;20:79-84.