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Original Research Paper

Surgery

A STUDY ON SAFETY AND EFFICACY OF OTAKI TECHNIQUE IN VERY SMALL AORTIC ROOT

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ABSTRACT Aortic stenosis tends to pose a challenge to the surgeon when it is associated with a small size annulus. The conundrum as to whether to use a small prosthesis with a borderline effective orifice are index(EOAI) or go for a technically challenging root enlargement procedure in these cases remains. Various such techniques have been described by Kono and associates, Otaki, Nicks and colleagues, Manouguian & Seybold-Epting, and Nunez and associates. In this paper, we describe our experience with the bidirectional enlargement technique described by Yamaguchi and Otaki.

KEYWORDS : small aortic root; patient prosthetic mismatch; aortic root enlargement, Otaki

INTRODUCTION:

Aortic valve disease like aortic stenosis in particular, tends to pose a challenge to the surgeon when it is associated with a small size annulus. It is a common problem in our subcontinent and certain Asian populations.

Kratz and associates reported that in patients with a body surface area greater than 1.7 m2, the 19-mm St. Jude valve should be avoided and an aortic annulus-enlarging procedure must be considered.1 The high pressure gradients associated with the use of small sized prosthetic valves results in persistent postoperative left ventricular outflow tract obstruction, a condition termed prosthesis–patient mismatch (PPM).

It was in 1978 that Rahimtoola first reported this condition and described it as an "effective prosthetic valve area, after insertion into the patient, that is less than that of a normal valve." 2

In 2006, Pibarot and Dumesnil redefined aortic PPM as a prosthetic valve effective orifice area (EOA) indexed to body surface area of less than 0.85 cm2/m2.3

The treatment strategies in such a scenario are multiple and aortic root enlargement (ARE) is one of the cornerstone techniques for tackling a small aortic root. The root can be enlarged anteriorly by techniques described by Kono and associates, and Otaki and posteriorly as reported by Nicks and colleagues, Manouguian and Seybold-Epting, and Nunez and associates.

AIMS AND OBJECTIVES:

To study the safety and efficacy of Bidirectional Aortic root enlargement technique.

MATERIALS AND METHODS:

We did a retrospective data analysis of all the patients undergoing the Otaki procedure in the department from June 2013 to May 2019. The data was obtained from the hospital records and patient files. Statistical analysis was done using SPSS v25 software.

RESULTS:

All patients undergoing Aortic valve replacement in whom the maximum achievable EAOI was less than 0.85, aortic root enlargement had been done. The Nick's or Manouguian technique was used in most cases of small aortic root. However, during double valve replacement, where the Nick's posterior root enlargement was not adequate enough to implant an appropriate sized aortic valve, it had to be complemented by another counter enlargement at the region of the commissure between the LCC and RCC (Figure 1).

In a period of 5 years, 20 patients underwent Otaki procedure for aortic root enlargement. Among these 11 were male and 9 females. All these patients underwent replacement using a St Jude Medical Epic© bioprosthetic valve. 19 patients underwent a double valve replacement during the ARE. One patient was operated for a re-do AVR due to Patient prosthetic mismatch, wherein a 17 size bileaflet mechanical valve was replaced by a 19 size Bioprosthetic valve (Figure 2). The mean age was 51.5+14.2. The mean Body Surface Area was 1.57+ 0.14. The mean tissue annular diameter was 17.65 + 1.15. Post root enlargement, we could achieve a mean TAD of 22.7 + 1.1 (Table 1). The mean EAOI before and after root enlargement were 0.79 + 1.1 and 1.02 + 1.9 respectively. The mean of the mean pressure gradient across the valve was 9.8 + 1.7mm Hg. Two patients underwent re-exploration due to post-operative bleed. There was no mortality in this series.

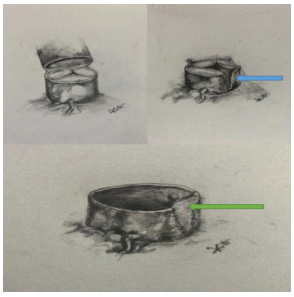

Figure 1: Illustration showing the surgical technique of anterior augmentation as described by Otaki et al. Blue Arrow: Incision placed across the LCC and RCC commissure; Green Arrow: Bovine pericardial patch used to enlarge the anterior aortic root.

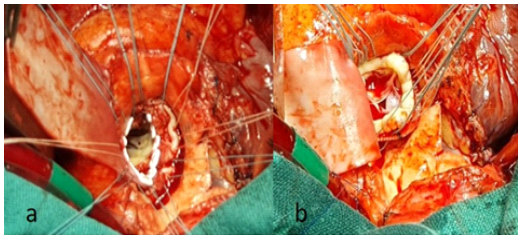

Figure 2: Intra-operative picture of Otaki technique a) annular

pledgeted sutures placed after augmentation with bovine pericardial patch b) A bioprosthetic valve in position

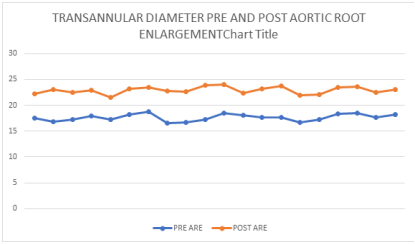

Table 1: Distribution of change in TAD achieved by root enlargement

	Zhong et al	Our study
BSA	1.4 + 0.18	1.57+ 0.14
POST ARE IEOA	1.13 + 0.14	1.02 + 1.9
POST ARE TRANSVALVULAR PRESSURE GRADIENT	10.7 + 2.3 mmHg	9.8 + 1.7 mmHg
POST ARE MEAN VALVE SIZE	20.5	20.9

DISCUSSION:

Aortic root enlargement (ARE) is an important skill in a surgeon's armamentarium, at the time of AVR for a large patient with a small aortic root.7 It has been reported that in the largest analysis to date, there is no increased risk of mortality or adverse events associated with surgical ARE and that small aortic root should be aggressively managed 8 as opposed to implanting an inappropriate sized aortic valve and causing a PPM.

PPM is a strong and independent risk factor for adverse events after AVR. It is associated with reduced early and late survival after AVR. Residual postoperative gradients result in reduced left ventricular mass regression after surgery and lower functional class and exercise tolerance.7

Konno and associates first described the technique of anterior aortic root enlargement by an extensive ventriculotomy. It required opening and enlarging of the right ventricular outflow tract and repair of the subsequent ventricular septal defect.9

In 2010, Zhong and colleagues10 reported their experience with aortic root enlargements in patients undergoing double valve replacement at their institute. They performed posterior aortic root enlargement using a Dacron patch lined with autologous pericardium. Their results are comparable to ours.

Bilateral enlargement of the aortic annulus was originally reported by Yamaguchi and associates. They applied it to younger children with congenital supraannular aortic stenosis by Yamaguchi and associates. A combination of the Nicks procedure with an additional aortotomy incision to the right and left coronary commissures was used.6

Otaki and associates used this technique in adult patients by performing a combination of the posterior procedure with an additional aortoventriculotomy through the commissure between the right and left cusps. They reported that the advantages of performing a bidirectional aortic root enlargement are that it allows implanting an appropriate sized aortic valves when a posterior enlargement alone does not suffice, and implantation of adult-sized valves in older children requiring an AVR. This technique also provides a more central position to the prosthetic valve, thereby, providing a more luminal and physiological flow. Lesser incidence of mitral dysfunction, coronary injuries and conduction disturbances have been reported by this method of aortic root enlargement.4

CONCLUSION:

Bidirectional root enlargement described by Otaki et al, is a safe and effective technique in managing very small aortic roots and in complex procedures like double valve replacement with a small aortic root.

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