Editorial Commentary

Mitral valve surgery in infants and children

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Provenance and Peer Review: This is an invited article commissioned and reviewed by the Section Editor Xicheng Deng (Department of Cardiothoracic Surgery, Hunan Children's Hospital, Changsha, Hunan, China).

Comment on: Eltayeb OM, Readdy WJ, Mongé MC, *et al.* Mitral valve replacement in infants using a 15-mm mechanical valve. Ann Thorac Surg 2019;108:552-7.

Submitted Jan 05, 2020. Accepted for publication Mar 30, 2020.
doi: 10.21037/tp.2020.04.01
View this article at: http://dx.doi.org/10.21037/tp.2020.04.01

Dr. Eltayeb and colleagues from Chicago, USA described their experience with mitral valve replacement using the Abbot Masters HP 15-mm mechanical valve (Abbott laboratories, Abbott Park, IL, USA) on a series of 7 patients and reported its outcome as to timing of repeat mitral valve replacement on follow-up (1).

Management of mitral valve disease in infants and children is an enormous surgical challenge, primarily because the leaflets and subvalvular components are small, immature, and fragile. Moreover, mitral valve lesions in the very young may constitute diverse morphological and structural malformations, with concomitant cardiac aberrations and the unpredictable sequel on growth of the mitral valve; hence, surgery would require a technically demanding and zealous modifications of valve repair techniques (2).

In our center, reconstruction or repair of the mitral valve is the favored strategy for any kind of mitral valve disease in infants, children, and adolescents. Confronted with the complete lack of a suitably sized prosthesis for this age group, valve repair circumvents the shortcomings of a foreign material. Repair nullifies the necessity for anticoagulation and the infirmities associated with it. Whilst the primary repair result may not be flawless, sufficient time for repeat valve reconstruction is fostered, delays the need for eventual valve replacement until a fitting adult-size prosthesis can be implanted. We acknowledged that most, if not all, mitral valves repaired or reconstructed during childhood eventually may have to be replaced at some time in life. Nonetheless, repair for MV lesions allows undisturbed somatic growth of the patient as well as growth of the valve (3). Repair can be achieved using a gamut of techniques without using any kind of device foreign to the body. An untreated autologous pericardium may be used both as a strip to stabilize the posterior annulus and as a pledget material for buttressing sutures. Based on our experience, no occurrence of calcification neither shrinkage nor thrombus formation on the pericardial strip has been found during reoperation. A perfect annular homogenization and endothelialization has been likewise observed. Infection was absolutely non-existent based on our experience (3,4). The routine use of intraoperative transesophageal echocardiography, which is obligatory to assess the satisfactoriness of the repair, has contributed significantly to the success of repair for any mitral valve lesions in children.

The restricted permanency of repair has been a major frustration, both for the surgeons and patients. Anyhow, with cautious and vigilant intraoperative appraisal of valve morphology and proper choice of surgical strategy, repair can be sustained for quite a long time.

The lack of a suitable prosthesis in infants and children has been foresighted a great deficiency in surgical management of mitral valve lesions in childhood.

With the 15-mm HP Master mechanical valve, a step towards filling this gap was made. The authors (1) are to be congratulated for undertaking this task. We strongly agree that being confronted with a small annulus narrows the choice of mitral valve replacement in small children. Their apprehension in implantation of a prosthetic valve

larger than annulus is greatly recognized. Nevertheless, the group have overcome this crucial issue by placement of the mechanical valve in a supra-annular position—naturally with its attendant morbidities like heart block or left ventricular outflow tract obstruction aside from a higher level of anticoagulation.

These ensuing complexities are the reasons why we advocate mitral valve repair. In congenital mitral valve insufficiency from restricted leaflet motion, one might be allured to cut off the tissues and reconstruct it with prosthetic rings, or to simply replace the valve, to restore the mitral competence. Various techniques from various investigators and institutions have evolved to correct the problem (5,6). In this very special population, an annuloplasty with either a flexible or even rigid rings would disturb the growth of the valve along its anterior annulus. The disadvantages of rigid rings, i.e., deformation of the natural annular geometry and the possible obstruction of the left ventricular outflow tract has been emphasized by various report. Although the flexible ring has been reported to preserve the function of the left ventricle, it only corrects annular dilatation and does not ensure nor restore the normal architecture of the mitral valve. Valve replacement with a bioprosthesis on the other hand, levies technical impedances because of the diminutive annulus, left atrium, and left ventricle, along with accelerated tissue calcification and degeneration and lifetime anticoagulation.

Our own experience with mitral valve replacement in children, although very limited, is rather poor. We have had 9 cases of infants and children (newborn to 5 years old), all with congenital mitral valve lesions either isolated or with other concomitant cardiac anomalies, on whom we replaced the valve after unsuccessful attempts of repair. At that time, the only available small-sized prosthesis was a St. Jude 17 mm bi-leaflet aortic valve, which we implanted in a reverse position to replace the mitral valve in 8 patients. The leaflets then were protruding to the left ventricle during diastole. In spite of the fact that the surgery was successful, the valves were repeatedly replaced until they came to an age where a properly fitting prosthesis could be implanted. On reoperations, we have observed that the natural annulus was severely fibrotic and resecting the pannus posed a danger of perforation. In the newborn with an atrioventricular septal defect and a severe mitral valve anomaly not amenable to repair, we used a specially made 12 mm xenograft from a company in England. However, the baby developed a heart failure and supported with an extracorporeal membrane oxygenator but succumbed a week later. A biological prosthesis such as pericardial xenograft with anti-calcification process maybe more desirable, but from a standpoint of anticoagulation, it is a strong deterrent. Moreover, the risk of thromboembolism with mechanical valves remains a universal concern. Essentially, it is inevitable to replace the valve when reconstruction fails or is not feasible. Homograft valves could initially result to a superior hemodynamic outcome yet with a risk of accelerated degeneration and limited durability.

In some cases, i.e., rheumatic valve disease, endocarditis, severe mitral stenosis in Shone ‘anomaly or failed repair of atrioventricular septal defect, mitral valve replacement is the last possibility.

Among all valve replacements performed in children, replacement of mitral valve entails the highest mortality and much poorer long-term prognosis, wherein the surgical mortality in infants is 5% to 52% (7). A 5- and 10-year survival rates of 33% to 95%, respectively were reported by various groups (7-18). Survival outcomes among children after mitral valve replacement with bileaflet mechanical prosthetic valve in biventricular heart were satisfactory. However, repeat replacement, due to the small prosthesis size must be anticipated (19). Age younger than 2 years at the initial mechanical valve replacement is associated with significant risk of early mortality and poorer long-term survival (20).

It is a technical challenge to be confronted with small annulus with little possibility of enlargement, hence ending up with valve replacement. Implanting an oversize prosthesis could then lead to subaortic obstruction, leaflet entrapment and conduction block which pose significant postoperative morbidity and mortality (7).

Several institutions applied the Ross technique in highly selected older children and adolescents with adequate size of pulmonary valves. Aside from providing flexibility, it does not require anticoagulation. However, meager reports on long-term outcome exist (21).

A surgical hybrid mitral valve replacement using stented bovine jugular vein graft (Melody valve) has recently been recently been considered a feasible option for implantation in the mitral position. Its implantation is not technically demanding with potential to enlarge the valve to adjust to somatic growth without requirement for long-term anticoagulation. It is however unclear whether or not these valves remain functional until they can be replaced by a larger mechanical prosthesis (22,23). These issues and concerns about mitral valve replacement in infants and children have remained unchanged for the last 20 years (24).

We still would advocate mitral valve repair, even when no ideal result can be achieved to bring a child to an older age for a suitable-sized prosthesis.

Eltayeb and his team must be likewise applauded for undertaking repeat mitral valve replacement on this population. Scar and pannus formation in the annulus could make reimplantation of a larger prosthesis difficult because of the possibility of damage to the periannular structures such as coronary arteries and veins, and the danger of atrioventricular dissection, rupture and aneurysm. Apparently, the Chicago group was able to largely overcome these potential complications.

With their surgical concept of mitral valve replacement using a mechanical valve in infants and children, we are enthusiastic to read further reports from the group involving a larger series of patients and a long-term follow-up.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/tp.2020.04.01). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Cite this article as: Javier Delmo EM, Hetzer R. Mitral valve surgery in infants and children. Transl Pediatr 2020;9(2):187-190. doi: 10.21037/tp.2020.04.01