

# Aortic valve repair in pediatrics—time to swing the pendulum back?

Yves d'Udekem<sup>1,2,3</sup>

<sup>1</sup>Department of Cardiac Surgery, The Royal Children's Hospital Melbourne, Melbourne, Australia; <sup>2</sup>Murdoch Children's Research Institute, Melbourne, Australia; <sup>3</sup>Department of Paediatrics, Faculty of Medicine, The University of Melbourne, Melbourne, Australia

Correspondence to: Yves d'Udekem, MD, PhD, FRACS. Department of Cardiac Surgery, The Royal Children's Hospital, 50 Flemington Road, Parkville 3052, Melbourne, Australia. Email: yves.dudekem@rch.org.au.



Submitted Feb 14, 2019. Accepted for publication Apr 05, 2019.

doi: 10.21037/acs.2019.04.15

View this article at: <http://dx.doi.org/10.21037/acs.2019.04.15>

In 1983 came the report of the first balloon dilatation of the aortic valve. Since that time, the treatment of congenital aortic valve stenosis in the pediatric age has been mainly in the hands of interventional cardiologists. The arguments to favour this approach have been a less invasive procedure and cosmetic superiority. In the majority of the cases, there has been no consensual discussion on this topic and the reason for the predominance of interventional catheterization has been that this population has been captive because their cardiologist is their first point of contact. There has been in recent years several reports highlighting the superiority of the outcomes achieved by surgery over those obtained after balloon dilatation (1,2). So, has the pendulum swung yet?

## Evolution of surgical techniques

For decades, surgery of congenital aortic valve stenosis has been limited to blade commissurotomy. It was no surprise that the results of this surgery were equivalent to balloon dilatation in terms of rate of reintervention: the opened fused commissure was either leaking by lack of support, or becoming stenotic again because its pliability was not restored if debulking and thinning of the valve was not pursued (3). It is now clear that debulking of the valve, thinning of the leaflets, re-creation of an opened inter-leaflet triangle and resuspension by patches of the opened commissures is necessary but how often this is performed by surgeons is unclear. One can suspect also that a vast majority of aortic valve repair beyond the neonatal age has predominantly consisted in tricuspidization by opening of the valves and patch extensions of the free edges of the cusps (4,5).

These techniques have been very successful in achieving

short-term competence, but these patches have not last long and all of these types of repair fail within 10 years and require reoperation within 15 years (5). Recently, Ozaki *et al.* introduced a technique of entire replacement of the valve by patches, a technique strangely assimilated to a repair (6). This standardized technique of valve replacement has met some early successes. The lack of growth of these patches will, however, limit the use of this technique in the pediatric age and many believe that the result of this technique will be limited in time in the same way as it was seen when attempted in the 70s.

In the last decades, techniques of valve repair preserving native valve tissue have been developed for adults with aortic valve regurgitation (7). Only a fraction of pediatric cardiac surgeons has adopted these techniques and the longevity of these operations in the pediatric age are still unknown. We have, in Melbourne, demonstrated that the rate of failure was higher if more patch tissue is used in the repair, but we have yet to find out whether repairs reducing their use result in longer lasting outcomes (5).

## Results

It seems clear that patients undergoing surgery have similar survival than those undergoing balloon dilatation of their valve, but that the rate of reintervention is smaller if surgery is offered (1). In a meta-analysis of over 2,000 patients arising from 20 recent studies, long-term survival was identical, but 10 years after the first intervention, half of those undergoing surgery did not require reintervention while three quarters of those dilated had to undergo another procedure.

## Knowledge gaps

It is now realized that congenital aortic stenosis is a lifelong condition and that the vast majority of patients will need an aortic valve replacement over their lifetime. The majority of these replacements will be Ross procedures, which are also subjected to failure. Performed as a free-standing graft, a quarter of the pulmonary autograft fail within 2 decades imposing the need for a mechanical valve replacement (8). The inclusion techniques, which can only seldom be made in the children and young adolescents, may provide better results (9). An inclusion in a graft may be performed in adults only and it may be that there is a better age to perform the Ross procedure. Today, the real question is the burden of the aortic valve disease over an entire lifetime and we do not know (1) the difference in very long-term survival if they have a primary balloon dilatation or surgery. Additionally, we do not know if a proportion of patients undergoing any of these approaches will remain free from a second operation for decades (2), even though it can be suspected that only surgery can provide this possibility. Finally, we do not know whether these two approaches impact the ventricular function in different ways. Balloon dilated valves tend to fail by an association of stenosis and regurgitation while operated valves tend to fail by repeated episodes of stenosis (3). Some have advanced that the association of regurgitation to stenosis may be responsible for the diastolic dysfunction observed in the young adults who were born with congenital aortic valve stenosis (10).

## Decision algorithms

Congenital aortic valve stenosis remains a potentially lethal condition especially in the neonatal age and the option that provides the smallest mortality should be offered. Which option is the safest will be subjected to centre variation? It is likely that the most dysplastic of these valves will have similar reoperation rates. It is, however, very difficult to assess the quality of the valve with the mode of investigations at our disposal today. The balance of risk of an earlier reintervention should there be balanced against the cosmetic benefits of balloon dilatation in discussions with the families. Finally, one should not lose sight of the excellency of outcomes achieved with the Ross procedure. Performing it electively in the neonatal period may protect against the high rate of dilatation of the aortic root observed at a later age. When performed in patients who have reached an adult size and when an inclusion technique can

be performed, it achieves a longevity and functional results that are difficult to match.

So, has the pendulum swung yet? As long as the surgical techniques of repair will be so disparate, we will not be able to compare their outcomes to those achieved after balloon dilatation. Pediatric surgeons have to train to become more familiar with the techniques used by the most expert of the adult aortic valve surgeons and only thereafter we will be able to compare both approaches. Until then, the patients will remain primarily in the hands of cardiologists and the debate will remain open.

## Acknowledgments

The Victorian Government's Operational Infrastructure Support Program supported this research project.

## Footnote

*Conflicts of Interest:* Yves d'Udekem is a consultant for MSD and Actelion. He also is a NHMRC Clinician Practitioner Fellow [1082186].

## References

1. Hill GD, Ginde S, Rios R, et al. Surgical Valvotomy Versus Balloon Valvuloplasty for Congenital Aortic Valve Stenosis: A Systematic Review and Meta-Analysis. *J Am Heart Assoc* 2016. doi: 10.1161/JAHA.116.003931.
2. Siddiqui J, Brizard CP, Galati JC, et al. Surgical valvotomy and repair for neonatal and infant congenital aortic stenosis achieves better results than interventional catheterization. *J Am Coll Cardiol* 2013;62:2134-40.
3. McCrindle BW, Blackstone EH, Williams WG, et al. Are outcomes of surgical versus transcatheter balloon valvotomy equivalent in neonatal critical aortic stenosis? *Circulation* 2001;104:I152-8.
4. Polimenakos AC, Sathanandam S, Elzein C, et al. Aortic cusp extension valvuloplasty with or without tricuspidization in children and adolescents: long-term results and freedom from aortic valve replacement. *J Thorac Cardiovasc Surg* 2010;139:933-41; discussion 941.
5. d'Udekem Y, Siddiqui J, Seaman CS, et al. Long-term results of a strategy of aortic valve repair in the pediatric population. *J Thorac Cardiovasc Surg* 2013;145:461-7; discussion 467-9.
6. Ozaki S, Kawase I, Yamashita H, et al. Midterm outcomes after aortic valve neocuspidization with glutaraldehyde-

- treated autologous pericardium. *J Thorac Cardiovasc Surg* 2018;155:2379-87.
7. Lansac E, de Kerchove L. Aortic valve repair techniques: state of the art. *Eur J Cardiothorac Surg* 2018;53:1101-7.
  8. Tan Tanny SP, Yong MS, d'Udekem Y, et al. Ross procedure in children: 17-year experience at a single institution. *J Am Heart Assoc* 2013;2:e000153.
  9. Skillington PD, Mokhles MM, Takkenberg JJ, et al. The Ross procedure using autologous support of the pulmonary autograft: techniques and late results. *J Thorac Cardiovasc Surg* 2015;149:S46-52.
  10. Friedman KG, McElhinney DB, Rhodes J, et al. Left Ventricular Diastolic Function in Children and Young Adults With Congenital Aortic Valve Disease. *Am J Cardiol* 2013;111:243-9.

**Cite this article as:** d'Udekem Y. Aortic valve repair in pediatrics—time to swing the pendulum back? *Ann Cardiothorac Surg* 2019;8(3):396-398. doi: 10.21037/acs.2019.04.15