

The Ross procedure is under-used although long-term results show superior results to those obtained following mechanical aortic valve replacement

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The ideal choice for aortic valve replacement depends on several factors that should be considered in every patient on an individual basis. Several themes have to be addressed.

Life expectancy of the patient, durability of the implant, need for anticoagulation, risk of device-related complications, risk of further redo-operations, as well as potential adverse effect on quality of life and others. At the end, the opinion of the patient, that may be influenced by recommendations from relatives, other patients or from internet-based informations, should be respected.

Based on the currently available guidelines from different scientific societies and organizations (the AHA/ACC Guidelines, the ESC/EACTS Guidelines), the optimal choice of an aortic valve substitute consists of a mechanical valve in patients younger than 60 years while tissue valves are increasingly offered to patients older than 60 (sometimes even younger), since a later transcatheter option as a valve-in-valve strategy is nowadays considered the ideal procedure when a tissue valve degenerates (1,2).

The Ross procedure using the patient's own pulmonary valve (autograft) as a substitute for a diseased aortic valve has been described decades ago, mainly for younger patients in whom some growing of the autograft would be beneficial and could reasonably be expected. This strategy offers the potential benefits of optimal hemodynamics, very low rate of valve-related complications and a late survival that is quite similar to that of a matched general population. Unfortunately the Ross procedure has never been considered as a gold standard nor as an attractive alternative in large collectives of patients. However, a small number of institutions worldwide, have been very dedicated to this intervention.

Different reasons are found in the literature for the very little interest of surgeons to embrace the pulmonary autograft operation: technical complexity, prolonged learning curve until the surgeon feels comfortable with the procedure, but also the potential long-term adverse outcome due to the degeneration of the pulmonary autograft and of the substitute for the reconstruction of the right ventricular outflow tract: homograft or xenograft. Most recently, public reportings of surgical results by institutions or even by surgeon have had a considerable influence on the willingness of the surgeons to introduce or further develop an operative procedure that is considered by the cardio-surgical community as technically demanding. In fact, the Ross procedure has been described to be followed by a higher 30-day mortality than a conventional valve replacement in large registries. Analysis of outcomes from the STS database show for 2014 that mortality rate following the Ross procedure was by far superior than that of conventional aortic valve replacement: 2.7% vs. 0.9% (3). Major aspects around the Ross procedure are the low average number of cases performed per institution and the suspected prolonged learning curve.

In that sense, the very long-term results from Tirone David and the Toronto group are welcome because they show, once more, that the Ross procedure may afford excellent long-term results, mainly when the valve-related complications are considered (4). Especially freedom from stroke and major bleeding events was significantly higher following the Ross procedure. However, the survival of patients following the Ross procedure or a conventional aortic valve replacement using a mechanical valve was very similar. Surprisingly, valve-related reoperation rates were

similar after both types of procedure, although one would have expected more re-interventions following the Ross procedure due to autograft dilation or failure and/or RVOT homo-, or xenograft degeneration.

Unfortunately some important questions have not been answered or even addressed by T. David's group: namely the difference of long-term performance between the two technique of implantation: the mini-root technique and the subcoronary implantation. Further, quality of life analysis would have given important insights from the daily life of the patients: what does life-long oral anticoagulation mean for them? Does self-management of anticoagulation improve the quality of life, how do patients adhere to this relatively new possibility and how compliant are they? Finally do less complications occur when the patients do INR assessment themselves?

Concerning the optimal technique (subcoronary versus full root) Sievers reported his experience with more than 500 patients operated using the subcoronary technique during a 14-year period (5). Early and late mortality were 0.4%, valve-related mortality was 1.2%. The overall survival did not differ from that of the normal population. Despite the fact that the large majority of the patients did not receive anticoagulation, neurological events occurred in 22 patients and major bleeding in 9 patients. Freedom from autograft and homograft reoperation was 91.9% at 10 years but no autograft dilation was observed.

Another large series comparing aortic valve replacement in 1,501 patients after advanced matching, both in pairs and in a 3-way manner, using a Bayesian dynamic survival model was published recently (6). Out of them, 47.8% received a Ross procedure. To some extent, the results described here—although provided by multiple institutions—are similar to those reported by David's group. The patients who received a Ross procedure had a 12.7% higher event-free probability (death or any re-intervention) at 10 years compared to those patients who received a mechanical prosthesis as aortic valve substitute. Younger age was associated with mortality and pulmonary reintervention in the Ross group and with aortic reintervention in the mechanical AVR. Of all three options, only the patients undergoing the Ross procedure approached the survival of the general population.

Very interestingly, the surgical group at Montreal Heart Institute described very recently their experience with the start of a program dedicated to the Ross procedure since 2011 (7). This program was developed by one younger surgeon with a specific training in aortic surgery, within

his first year of practice. The program gradually grew to include at the end a total of four surgeons. The authors analyzed the impact of the learning curve on short-term outcomes looking mainly at safety (perioperative mortality and morbidity, postoperative bleeding), efficiency and efficacy (duration of the operation and ischemic time).

The authors conclude that under well-prepared conditions, the Ross procedure may be offered to younger adults with a similar quality than that observed in aortic valve replacement with a mechanical prosthesis, but with significant clinical benefits for the patients (7). The learning curve required about 75 to 100 procedures, which was similar to that reported by Stelzer (8).

While early mortality was not statistically different between the early and late groups in the Montreal series, the CUSUM analysis demonstrated an improvement after ~100 cases when adjusted for the STS predicted mortality.

I believe that the conclusion of the authors, that in specialized centers the Ross procedure represents an excellent option—better said a real alternative to the implantation of a mechanical prosthesis, is probably too smooth to convince a larger number of cardiac surgeons to adopt this strategy. Unlike invasive cardiologists who are generally very proud to introduce new strategies as well as new devices in their daily practice, cardiac surgeons are much more reluctant to change their attitudes; this is especially true when the procedures are technically more demanding. Nevertheless, this should be one of the goal of academic institutions—as well presented by the Montreal Heart Institute (7).

Beside the Ross procedure as a valuable alternative to aortic valve replacement using a mechanical valve, there is urgent need for a mechanical valve that does not require life-long anticoagulation. Preliminary experimental results of the Tri-Flo valve (a tri-leaflet mechanical valve that mimick the flow characteristics of a native tri-leaflet valve) are very promising and one should hope that such a valve replacement device will soon enter the market.

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Footnote

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References

1. Vahanian A, Alfieri O, Andreotti F, *et al.* Guidelines on the management of valvular heart disease (version 2012): the Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur J Cardiothorac Surg* 2012;42:S1-44.
2. Nishimura RA, Otto CM, Bonow RO, *et al.* 2014 AHA/ACC guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Thorac Cardiovasc Surg* 2014;148:e1-e132.
3. Reece TB, Welke KF, O'Brien S, *et al.* Rethinking the Ross procedure in adults. *Ann Thorac Surg* 2014;97:175-81.
4. Mazine A, David TE, Rao V, *et al.* Long-Term Outcomes of the Ross Procedure Versus Mechanical Aortic Valve Replacement: Propensity-Matched Cohort Study. *Circulation* 2016;134:576-85.
5. Sievers HH, Stierle U, Charitos EI, *et al.* Fourteen years' experience with 501 subcoronary Ross procedures: surgical details and results. *J Thorac Cardiovasc Surg* 2010;140:816-22, 822.e1-5.
6. Sharabiani MT, Dorobantu DM, Mahani AS, *et al.* Aortic Valve Replacement and the Ross Operation in Children and Young Adults. *J Am Coll Cardiol* 2016;67:2858-70.
7. Bouhout I, Ghoneim A, Poirier N, *et al.* Impact of the learning curve on early outcomes of the Ross procedure. *J Thorac Cardiovasc Surg* 2016. [Epub ahead of print].
8. Stelzer P, Itagaki S, Varghese R, *et al.* Operative mortality and morbidity after the Ross procedure: a 26- year learning curve. *J Heart Valve Dis* 2013;22:767-75.

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