

SURGERY

Insights into patients' outcomes after the Ross procedure

Patients who undergo bioprosthetic aortic valve replacement are at increased risk of reoperation owing to the limited durability of these valves, while mechanical aortic valve recipients require life-long anticoagulation therapy and are at risk of bleeding and thromboembolism. The Ross procedure, which involves replacement of the aortic valve with the patient's own pulmonary valve (i.e. a pulmonary autograft), avoids these complications and is particularly appropriate for young individuals. A systematic review and meta-analysis by a team of investigators from the Netherlands and the UK reveals that survival after the Ross procedure is excellent, but that durability of the pulmonary autograft declines over time, particularly after the first postoperative decade.

The Ross procedure is a complex surgical technique, pioneered in 1967. Over the last 40 years, it has become the aortic valve replacement method of choice for children and young adults, and global experience with the procedure is now considerable. "We have been performing the Ross Procedure at the Erasmus University Medical Center since 1988," says Johanna Takkenberg, an author of the study, "but our initial enthusiasm for the procedure was tempered by an increasing number of patients returning for reintervention." The authors were concerned by the reported variation in autograft durability between treatment centers, and conducted the systemic review to improve insight into patients' outcomes after the Ross procedure.

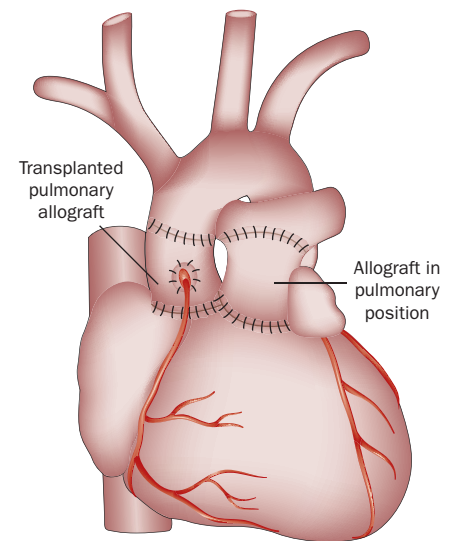
“The observation that patient survival over time runs parallel to survival in the age-matched general population is remarkable”

The analysis included 39 observational studies, published between January 2000 and January 2008. All studies reported

morbidity and mortality in pediatric or adult patients undergoing a Ross operation, and all enrolled 30 patients or more and had at least 90% follow-up. This sample provided the investigators with data from a total of 5,031 patients (22,436 patient years). Mortality and the rate of structural and nonstructural valve deterioration events were calculated for each of the individual studies and the results were pooled using an inverse variance methodology. Although late mortality (≥ 10 years after surgery) was the same in both age groups ($\sim 0.6\%$), early mortality (< 10 years) was higher among pediatric patients than in adults (4.2% versus 3.2%, respectively). Similarly, the rates of pulmonary autograft deterioration (1.38% per patient-year versus 0.78% per patient-year, respectively) and of right ventricular outflow tract deterioration (1.60% per patient-year versus 0.55%, respectively) were higher in children than in adults. The incidence of autograft endocarditis (children: 0.15% per patient-year versus adults: 0.26% per patient-year), and bleeding, thromboembolism, or valve thrombosis (children: 0.18% per patient-year versus adults: 0.36% per patient-year) in patients who had undergone the Ross procedure was low in comparison with individuals who received bioprosthetic or mechanical valves.

Their findings lead the authors to believe that children and young adults can expect a good outcome from the Ross procedure, at least for the first 10 years after surgery. "The observation that patient survival over time runs parallel to survival in the age-matched general population is remarkable," says Dr Takkenberg, particularly "since reports on patient survival after implantation with other valve substitutes uniformly show an increased late mortality relative to the general population." After the first decade, however, valve deterioration does become a problem, particularly in pediatric patients.

Some questions still remain, however. Why is the Ross procedure superior to



other methods of aortic valve replacement? Characteristics of patients, valve pathology, concomitant disease, and variation in surgical technique could all be important, and further studies will be needed to shed light on the effects of each of these factors on patients' outcomes. Takkenberg and colleagues now plan to use echocardiographic follow-up data from patients who have undergone the Ross procedure to develop a model that will help predict pulmonary autograft dilatation and failure. In the future, such a model could be used to identify patients for reintervention and prevent life-threatening events such as aortic regurgitation and dissection of the pulmonary autograft. The systematic review by Takkenberg *et al.* highlights the need for detailed, long-term follow-up of patients who have undergone a Ross operation. Particularly close attention should be paid to pediatric patients whose grafts have been in place for 10 years.

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Original article Takkenberg, J. J. M. *et al.* The Ross procedure: a systematic review and meta-analysis. *Circulation* 119, 222–228 (2009).