


The first neuronal arterial switch procedure was performed by Norwood and Castaneda in January 1983 at Children’s Hospital Boston [1]. This was the first ‘elective’ neonatal procedure, and not surprisingly its introduction created a storm of controversy. Not only was it elective in the sense that alternative proven satisfactory operations were available, namely the atrial switch procedures and the two-stage arterial switch with preliminary pulmonary artery banding, but in addition, the rationale for its introduction was more theoretical than based on hard statistical data. The hypothesis at the time was that the right ventricle and tricuspid valve of the individual with D-transposition of the great arteries would not perform as well at systemic pressure in the long-term relative to a left ventricle. Those who vigorously opposed the new operation claimed that it could never be done with a comparable early mortality to the atrial switch procedures. When this prediction proved to be incorrect, opponents continued to suggest that there would be important long-term complications including anastomotic obstruction, particularly of the reconstructed pulmonary arteries and late coronary problems. Interestingly, little attention was paid at the time to the possibility that the ‘neo-aortic valve’ might fail, despite the fact that even in the newborn, particularly those with a large ventricular septal defect (VSD), there is often considerable disparity in size between the original large pulmonary valve and the relatively smaller aortic valve.

The first report to examine the fate of the neo-aortic valve was published by Hourihan et al. [2] from Children’s Hospital Boston. The authors reviewed serial echocardiograms on 50 patients after the arterial switch procedure, confirming that the pulmonary root (neo-aortic root) and the pulmonary annulus (neo-aortic annulus) were both larger in infants with D-transposition relative to the aortic root and annulus of control patients. The authors found that there was appropriate growth of the aortic anastomosis, but a surprise finding was that there was progressive dilatation of the neo-aortic root, particularly in patients who had a history of pulmonary artery banding and those with neo-aortic regurgitation. A subsequent study by Schwartz et al. [3] from Children’s Hospital Boston examining 335 patients after the arterial switch procedure for either D-transposition or double outlet right ventricle reported that although the aortic root was indeed dilated relative to control patients, there did not appear to be progressive dilatation at late follow-up. Furthermore, the incidence of greater than moderate aortic regurgitation was quite small, being 93% at 10 years, and the freedom from any surgery on the neo-aortic valve or neo-aortic root was 95% at 10 years. Risk factors for moderate aortic regurgitation or greater were a previous pulmonary artery band and older age at the time of the arterial switch procedure, which were both related to the presence of an associated VSD.
The report in this issue of the Journal from Michalak et al. [4] from Lodz, Poland confirms many of the findings described by Schwartz et al. The authors reviewed 172 patients who underwent an arterial switch procedure during the neonatal period and had >10 years of postoperative observation. Although late neoaortic regurgitation was not uncommon, being seen in 76% of patients, it was rarely moderate or greater, with only 7% of patients having this degree of aortic regurgitation. Interestingly, the neoaortic root diameter was not significantly associated with the presence of neoaortic regurgitation despite the fact that there was progressive dilatation of the neoaortic root. However, as was seen in the Boston series, the sinotubular junction, i.e. the site of the aortic anastomosis adjacent to the tops of the commissures of the valve, was not dilated.

It is interesting to contrast the findings of the current study with the recent report from the German Dutch Ross Registry [5]. In this large report, which reviews 2023 patients late after the Ross procedure, approximately 40% of patients, both adult and paediatric, who had undergone root replacement required reoperation on the autograft by 15 years postoperatively, most commonly because of root dilatation and aortic regurgitation. Important differences from neoaortic regurgitation after the arterial switch include the fact that the neoaortic valve after the Ross operation is truly a neoaortic valve in that it was originally the pulmonary valve. In the case of the arterial switch procedure, the ‘neoaortic valve’ is the semilunar valve originally attached to the left ventricle, even though it initially functioned as a pulmonary valve. Other obvious differences include the fact that a suture line is required for the Ross procedure immediately below the valve leaflets and that the autograft valve must be accommodated in the outflow tract, which may have quite a different diameter to the valve annulus. The coronary artery button suture lines in the Ross operation are placed in the sinuses of Valsalva unlike the arterial switch procedure where the initial higher location of the aortic valve results in the coronary arteries being transferred above the sinotubular junction of the neoaortic valve. The age at surgery may also be important in that the neonate probably has greater adaptive mechanisms, e.g. remodelling the thickness of the neoaortic root, than the older patient undergoing the Ross procedure. Interestingly, the need for autograft reoperation in the Ross registry in adults where the procedure was performed as a subcoronary implant within the original aortic root was very low in contrast to the procedure performed as a complete root replacement.

The report by Michalak et al. does not shed light on how serious a problem aortic valve regurgitation and aortic root dilatation will be for those patients who have had an arterial switch who are at a greatest risk of developing these problems. The series excludes patients who underwent an initial pulmonary artery band and those who had surgery beyond the neonatal period. Nevertheless, the report is reassuring and should help to assuage the fears of those doomsayers from the 1980s who predicted that the neonatal arterial switch procedure would result in a high incidence of late complications.

REFERENCES