Editorial

Reduction of QRS duration following pulmonary valve replacement in tetralogy of Fallot: implications for arrhythmia reduction?

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This editorial refers to 'Reduction of QRS duration after pulmonary valve replacement in adult Fallot patients is related to reduction of right ventricular volume'† by B. Hooft van Huysduynen et al., on page 928

Tetralogy of Fallot is the commonest form of cyanotic congenital heart disease, and early outcomes following surgical repair are steadily improving. Nonetheless, these patients remain at risk for late-onset arrhythmias as well as sudden death.1,2 Increased QRS duration and right ventricular (RV) dilation secondary to pulmonary regurgitation have both been described as markers for increased risk of ventricular arrhythmias and sudden death.3–5 Pulmonary valve replacement (PVR) in these patients has been shown to stabilize the QRS duration and, when combined with cryoablation, to decrease the incidence of ventricular arrhythmias.6

Hooft van Huysduyren et al.7 present a retrospective series of adult patients with tetralogy of Fallot, who were assessed before and after PVR with both electrocardiograms (ECG) and cardiac magnetic resonance imaging. In their series, patients demonstrated a significant decrease in both RV end-diastolic volume and QRS duration, with reasonable correlation between these two values. This is the first paper to demonstrate a decrease in QRS duration, rather than simply stabilization. Interestingly, not all patients showed a reduction in QRS duration, but there was a non-significant trend toward greater reduction in RV volumes in those patients with a decrease in QRS duration. QRS duration measurement was performed using averaged beats rather than the more standard technique of using maximal QRS length in any lead on a standard ECG. Although this may have influenced absolute values of QRS, it is unlikely to have biased the results, as it is the change from pre-operative to post-operative rather than the absolute value of the QRS that was considered.

The findings of this study are, at least to some degree, different from those reported previously. Therrien et al.6 showed no overall difference in QRS duration at a mean of 4 years post-operatively, in a group that appeared to have significant reduction in RV dilatation by echocardiogram. In comparison, a control group showed a small but consistent increase in QRS duration. If these data are considered individually, one finds a highly heterogeneous response following PVR, with both substantial increases and decreases in QRS within the study population. The follow-up ECGs in Hooft van Huysduyren’s study patients were performed at a median of 14.3 months (IQR 3.8–20.1 months); a much shorter follow-up period than that of the Therrien study. This raises the concern that the reduction in QRS duration is transient; the reason these two papers reached different conclusions was that they considered the populations at two different time intervals and that by 4 years the average QRS duration has returned to the pre-operative value. The answer to this question lies in serial review of large numbers of ECGs following PVR, from immediately post-operatively to the latest available. If the QRS response continues to appear heterogeneous, it would be important to consider what factors may be influencing this variability.

When the relationship between RV dilation, QRS prolongation, and malignant arrhythmias was first recognized, the so-called mechano-electric interaction, it was unknown whether PVR would alter this relationship or whether mechanical and electrical reverse remodelling could occur. The current data are encouraging in this regard. If, indeed, there is true reversal of QRS...
prolongation following PVR, this may indicate reduced arrhythmia vulnerability. Currently, most centres are only performing PVR on patients who are symptomatic with exercise intolerance or clinical arrhythmia, or those with the most severe RV dilation. If, indeed, there is a threshold above which RV mechanical and electrical reverse remodelling is less likely, and the risk of malignant arrhythmia is reduced following PVR if performed before this threshold is reached, it would be reasonable to liberalize the indications for valve replacement. However, before any such conclusion can be drawn, more information is required as perioperative mortality and morbidity is not zero, and the insertion of a conduit will essentially guarantee the need for repeated interventions (albeit possibly by transcatheter techniques) in the future.

We have come a long way over the past 15 years. Chronic pulmonary regurgitation after repair of tetralogy was once considered benign. It is now known that it leads to RV dilation in many, with concomitant development of exercise intolerance, congestive heart failure, and atrial and ventricular arrhythmias. It may be that timely reduction in RV volume and QRS duration will protect against irreversible dysfunction and the development of clinical arrhythmia. The results of large-scale prospective studies are eagerly awaited.

References