

Speckle tracking in hypoplastic left heart syndrome: correlation with magnetic resonance imaging and the impact of ventricular morphology

Bellsham-Revell H. (1,2), Bell AJ. (2) Miller O. (2) Greil G. (1,2) Simpson JM. (2)
King's College London, UK (1) Evelina Children's Hospital, Guy's and St Thomas' NHS Trust, London, UK (2)

Introduction: Assessment of function in the systemic right ventricle (RV) is challenging due to the complex geometry. For the single ventricle heart in Hypoplastic Left Heart Syndrome (HLHS) the current gold standard for assessment of systolic function is cardiac magnetic resonance imaging (MRI) which typically requires general anaesthesia in children under 10 years and is relatively expensive. A simple, quick and reproducible echocardiographic method to assess RV function in HLHS would be ideally suited to the clinical identification of myocardial dysfunction.

Methods: Ethical and institutional approval was obtained. Patients with HLHS undergoing cardiac MRI underwent an echocardiogram during the same general anaesthetic. Standard apical four chamber views were acquired using a size appropriate probe (Philips IE33 ultrasound system). Tricuspid annular descent (TAD) was calculated using speckle tracking (figure 1). Two points were placed either side of the tricuspid valve annulus and a third at the apex. TAD was expressed as a percentage of the distance between the tricuspid annular plane and the apex. Speckle tracking derived shortening of a chord placed on the 4 chamber view (figure 2) horizontally in the midcavity region was calculated. Both were then correlated with MRI ejection fraction (EF) (from disc summation from cine images). Left ventricular (LV) morphology and operative Stage were recorded.

Results: 43 patients had TAD and horizontal chord shortening. Overall there was a significant correlation ($p < 0.001$) with MRI EF for both (figures 3 and 4). By LV morphologic type, TAD correlation was only significant in the globular LV group. Chord shortening was significant in both the globular and borderline LV groups. TAD correlation was only significant after Norwood Stage 1 whereas chord shortening was significant after both Stage 1 and 2.

Conclusions: Significant correlations were apparent in these rapid, simple analyses performed on a standard view. Although both correlated significantly overall, the strength of the correlation was dependent on LV morphology and operative stage. In the few patients in our cohort with poor function, both TAD and horizontal chord shortening appeared consistently low, suggesting these tools potentially could be used as a screening tool to elicit patients who need further investigation.



Figure 1



Figure 2

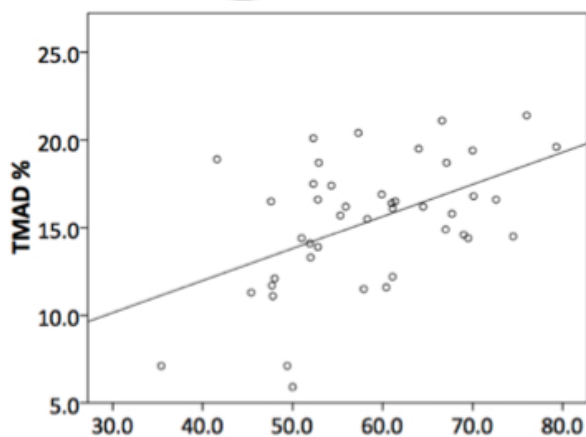


Figure 3 MRI Ejection Fraction

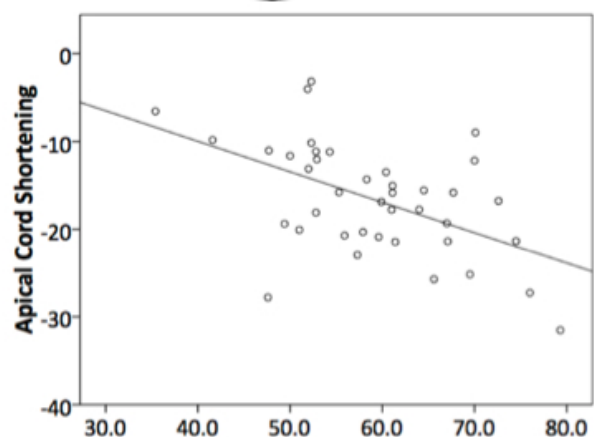


Figure 4 MRI Ejection Fraction