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Tissue motion annular displacement (TMAD) of the mitral valve using two dimensional speckle tracking echocardiography predicts left ventricular ejection fraction in normal children.

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Introduction:
The gold standard for determining left ventricular ejection fraction is cardiac magnetic resonance imaging (CMRI). This is time consuming, costly and often requires general anaesthesia in children. Other echocardiographic parameters for determining ejection fraction such as MMode are operator dependant and often inaccurate. Assessment of the displacement of the mitral valve annulus using two dimensional speckle tracking echocardiography potentially provides an accurate and simple method of determining left ventricular ejection fraction in children.

Method:
A total of 70 children aged 9 years were assessed using cardiac magnetic resonance imaging and two dimensional trans-thoracic echocardiography. These children are part of the Southampton Women's survey and have no history of cardiovascular disease. A total of 48 patients were included in the study, exclusions were for poor image quality and incorrect image acquisition. All echocardiograms were analysed using the Tissue motion annular displacement (TMAD) feature of the cardiac motion quantification (CMQ) plug in. (Phillips QLAB version 9.0). TMAD is based on speckle tracking technology and calculates the valvular annular displacement over time. Three points on the apical four chamber view of the left ventricle were identified, the lateral and medial mitral valve annulus and the apex, and tracked using this feature. The mid point displacement of the mitral valve was automatically calculated and using a quadratic formula a predicted ejection fraction was calculated. This predicted ejection fraction was compared with CMRI and MMode derived ejection fractions.

Results:
The ejection fraction from CMRI (64.5+/-4.6) was not significantly different from that derived from TMAD mid point (60.9 +/-2.7) or that derived from MMode(61.9+/- 7). The TMAD mid point correlated strongly with the CMRI ejection fraction ($r=0.69$ $p<0.001$) as did the predicted ejection fraction ($r=0.67$ $p<0.001$). The MMode ejection fraction showed a poor linear correlation with both CMRI and TMAD values ($r=0.33$ and 0.02).

Conclusion:
TMAD of the mitral valve is a simple, effective and highly reproducible method of assessing left ventricular function in normal children. It shows a strong linear correlation with CMRI derived ejection fraction and is superior to MMode derived ejection fraction.