

## Comparison of 3-Dimensional Echocardiography and Cardiac Magnetic Resonance Imaging for the Assessment of Aortic Dilation

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### BACKGROUND:

Two-dimensional echocardiography (2DE) is the primary imaging modality for serial assessment of aortic dimensions in at-risk populations. While cardiac magnetic resonance (CMR) imaging is considered the gold standard for aortic measurements, limitations include time and need for sedation in younger children. Three-dimensional echocardiography (3DE) similarly allows acquisition of multiple imaging planes while avoiding these limitations. We sought to compare the ability of 3DE to assess aortic dilation compared to CMR. We hypothesized that 3DE can provide similar sensitivity to CMR in detecting aortic dilation, with both modalities being superior to 2DE.

### METHODS:

Patients undergoing CMR for aortic dilation were prospectively consented to have 3DE obtained during surveillance 2DE. Demographic data were collected. Absolute measurements and Z-scores at the aortic root and ascending aorta were compared between 2DE, 3DE and CMR using a Spearman correlation coefficient. Individual reader 3DE results were compared using intraclass coefficients to assess inter-observer variability.

### RESULTS:

18 patients were enrolled (56% male, age  $13.5 \pm 3.5$  years). Diagnoses represented include Marfan syndrome (33%), Loeys-Dietz syndrome (22%), Turner syndrome (11%), other suspected connective tissue disorder (11%), and bicuspid aortic valve (22%) with some patients having multiple diagnoses. Using CMR as the gold standard, 3DE had 100% sensitivity in detecting an aortic root Z-score  $> 3$ , compared to 77% for 2DE. Both modalities had 100% specificity. 3DE and 2DE measurements both positively correlate with CMR with stronger correlation with 3DE, particularly for ascending aortic measurements. There was low 3DE inter-observer variability for both absolute measurements and Z-scores with all intraclass coefficients  $> 0.98$ .

	<b>2D correlation coefficient</b>	<b>P -value</b>	<b>3D correlation coefficient</b>	<b>P -value</b>
<b>Aortic Root absolute measurement</b>	<b>0.897</b>	<b>&lt;0.001</b>	<b>0.975</b>	<b>&lt;0.001</b>
<b>Aortic Root Z-score</b>	<b>0.930</b>	<b>&lt;0.001</b>	<b>0.945</b>	<b>&lt;0.001</b>
<b>Ascending aorta absolute measurement</b>	<b>0.707</b>	<b>0.002</b>	<b>0.929</b>	<b>&lt;0.001</b>
<b>Ascending aorta Z-score</b>	<b>0.753</b>	<b>0.001</b>	<b>0.936</b>	<b>&lt;0.001</b>

### CONCLUSION:

3DE correlates more strongly with CMR than 2DE, especially with regard to measurement of the ascending aorta. 3DE is also more sensitive than 2DE in detecting significant aortic dilation and avoids limitations of CMR including time and sedation. This project is the first to provide direct comparison of 3DE aortic measurements to CMR in a pediatric population.