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Title: 0052 - Research

3-Dimensional Printing of Congenital Heart Defects for Procedural Planning: Accuracy, Feasibility and Preliminary Outcome Data.

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Abstract: **(Your abstract must use Normal style and must fit into the box. Do not enter author details)**

Background: Patients with complex congenital heart disease (CHD) undergo extensive pre-procedural planning to determine the best procedural approach. Currently, state-of-the-art non-invasive imaging provides only two-dimensional representations of the complex, three-dimensional (3D) cardiovascular anatomy. The next paradigm shift in imaging techniques involves creating 3D anatomic representations of complex CHD.

Objective: To determine if 3D printing of CHD is accurate and feasible in patients with cross-sectional imaging obtained *prior to* procedural planning and intervention.

Methods and Results: Cross-sectional imaging data of nine patients with CHD was reconstructed off-line and a patient-specific model was 3D printed. The median time from imaging study to 3D printed model creation was 2 days (interquartile range (IQR) = 2, 10). The median time for 3D model to procedural planning date was 2 days (IQR = 2, 4). All models were confirmed to be accurate representations of the anatomy by the surgical team at time of operation. Early outcome data was compared between cases with 3D models (5 patients with aortic arch reconstruction) and controls without 3D models (15 patients with aortic arch reconstruction). Cardiac bypass time (Cases, 155 min ± 4 vs. Control, 156 min ± 47; p= 0.6), cross-clamp time (Cases 37 min ± 12.5 vs. Control, 51 min ± 33; p= 0.4), and post-surgical echo arch gradient (Cases 12 mmHg ± 4.6 vs Control, 12.4 mmHg ± 9; p= 0.6) were not different, however, the study is not appropriately powered to date. Interestingly, 20% (3) of the control group had a post-surgical arch velocity of > 2m/s consistent with residual obstruction compared to arch velocity < 2m/s for all cases with 3D models.

Conclusion: 3D printing is accurate and feasible in patients with complex CHD. As demonstrated, 3D printed models can be ready within 48 hours of notification. More patients are required to determine if there is a statistical advantage of 3D models for procedural outcomes.

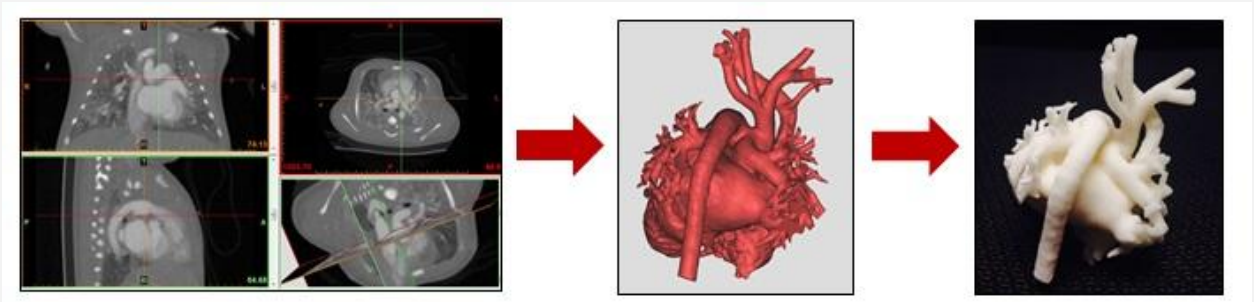

Figure: 3D Printing Techniques. This series of images depicts how a CT/MR data set is transformed into a virtual 3D reconstruction and subsequent 3D-printed model.