Feasibility and Validity of Printing 3D Heart Models from Rotational Angiography

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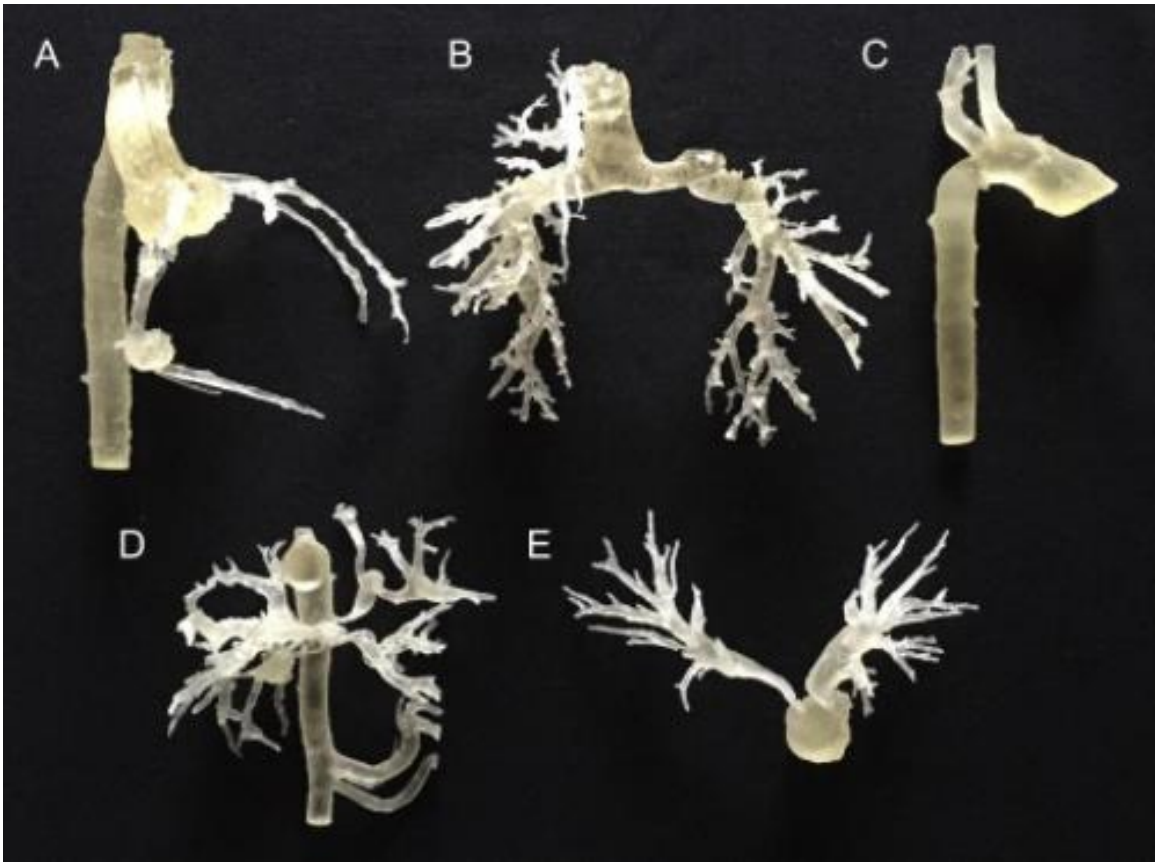
Background: Rotational angiography (RA) has proven to be an excellent method for evaluating congenital disease (CHD) in the cardiac cath lab, permitting acquisition of 3D datasets with superior spatial resolution. This technique has not been routinely implemented for 3D printing in CHD. We describe our case series of models printed from RA and validate our technique.

Methods: All patients with models printed from RA were selected. RA acquisitions from a Toshiba Infinix-I system were postprocessed and printed with a Stratasys Eden 260. Two independent observers measured 5-10 points of interest on both the RA and the 3D model. Bland Altman plot was used to compare the measurements on rotational angiography to the printed model.

Results: Models were printed from RA in 5 patients (age 2 mo - 1 yr). Diagnoses included a) coronary artery aneurysm, b) Glenn shunt, c) coarctation of the aorta, d) Tetralogy of Fallot with MAPCAs, and e) pulmonary artery stenosis. There was no significant measurement difference between RA and the printed model ($r= 0.990$, $p<0.01$, Bland Altman $p=0.987$). There was also no significant interobserver variability. The MAPCAs model was referenced by the surgeon intraoperatively and was accurate.

Conclusions: Rotational angiography can generate highly accurate 3D models in congenital heart disease, including in small vascular structures. These models can be extremely useful in patient evaluation and management.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