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Validation of three-dimensional rotational angiography measurements in children with an aortic coarctation

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Introduction: Percutaneous interventions are increasingly used for treatment of aortic coarctation (CoA) in children. Successful intervention and follow-up requires adequate imaging of the cardiac and vessel anatomy and surrounding structures. Three-dimensional rotational angiography (3DRA) is a relative new technology to achieve this imaging. The aim of this study was to compare 3DRA aortic diameter measurements in children with CoA to computed tomography (CT) and magnetic resonance imaging (MRI) measurements.

Methods: Patients with CoA who underwent 3DRA guided percutaneous balloon angioplasty (BA) or stent implantations between January 2011 and March 2017 were retrospectively included. Aortic diameters were measured in a standardised fashion on 3DRA, CT and MRI.

Results: Sixteen patients that underwent 17 3DRA guided catheterisations were analysed, with a median age of 12.70 years (range 0.14-18.61 years) and a median weight of 51.50 kg (range 3.78-71.00 kg). CT as well as MRI measurements were significantly correlated with 3DRA measurements (Pearson $r = 0.679$, $p < 0.05$ resp. $r = 0.722$, $p < 0.05$). A mean underestimation of -0.77 mm (95%-CI -7.00 to 5.45, $p > 0.05$) for 3DRA was found compared to CT measurements. 3DRA compared to MRI measurements showed a mean underestimation in 3DRA of -1.59 mm (95%-CI -7.50 to 4.32, $p > 0.05$). Stent measurements gave primarily overestimation, whereas measurements after brachiocephalic artery branching showed primarily underestimation. The linear regression coefficient of the Bland-Altman plot was 0.067 ($p > 0.05$) and -0.052 ($p > 0.05$) for CT resp. MRI comparative measurements.

Conclusions: There is a mean underestimation of aortic diameters in 3DRA measurements compared to CT and MRI measurements, however, it was not statistically significant and large limits of agreement have been observed. The difference in measured aortic diameters varies with location of the measurement.