

Assessment of Cardiac Axis In Fetuses With Conotruncal Abnormalities And 22q11.2 Microdeletion Using Spatiotemporal Image Correlation Volumes

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Objective: To evaluate the association between the fetal cardiac axis and conotruncal abnormalities (CTA), with and without 22q11.2 deletion, and the thymic-thoracic ratio (TT- ratio)

Methods: Database records were reviewed for cases of fetal conotruncal and arch abnormalities with a known karyotype between January 2007 and September 2013. Cardiac axis (the angle between the midline of the thorax and the interventricular septum in a four-chamber view) and TT-ratio (as previously described) were measured retrospectively in 81 fetuses with CTA using stored 3-dimensional spatiotemporal image correlation volume datasets independently by two authors without knowledge of the karyotype. Inter-observer and intra-observer reproducibility was assessed on a random sample of 20% of fetuses.

The results were compared to a control group of 55 normal fetuses.

Results: The median gestation in the control and CTA groups was 20 and 23 weeks, respectively. Of the 81 cases of CTA, 18 had 22q deletions. The mean cardiac angle in controls was 43.8 degrees (± 7.2); in CTA with normal karyotype, it was 58.1 degrees (± 13.06) and in CTA with 22q11.2 microdeletion, 67.8 degrees (± 14.2). Using one-way ANOVA, this increase in angle is significant ($p < 0.0001$). There was displacement of the angle of the septum to the left in 88% of fetuses with conotruncal abnormalities. The sensitivity of a cardiac axis greater than 60 degrees in diagnosing conotruncal abnormalities was 55% and the specificity was 100%. There was no linear correlation between the cardiac angle and TT-ratio. Inter- and intra-observer variability was 4% and 3% respectively.

Conclusion: Reliability of measurement of the cardiac axis is good. Leftward displacement was most commonly seen in fetuses with 22q11.2 microdeletion. There is overlap of the angle between those fetuses with the deletion and those without, so this cannot be used in isolation as an indicator for which patients to offer cytogenetic analysis for Di George syndrome. Our data does not show a close relationship between the cardiac axis and the TT-ratio. Our data suggests that an abnormal septal axis in the fetus, a characteristic which is readily assessed during routine obstetric ultrasound assessment, is an indication for specialist fetal echocardiography.