RIGHT ATRIAL DYSFUNCTION IN FETUSES WITH SEVERE TRICUSPID VALVE DISEASE: NOVEL EXPERIENCE WITH VELOCITY VECTOR IMAGING

ACC Poster Contributions
Georgia World Congress Center, Hall B5
Monday, March 15, 2010, 3:30 p.m.-4:30 p.m.

Session Title: Fetal and Neonatal Cardiology
Abstract Category: Pediatric Cardiology
Presentation Number: 1228-393

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Background: Severe fetal tricuspid valve disease (TVD) with right ventricular volume overload is associated with more frequent hydrops and fetal demise compared with fetal right heart obstructive lesions (RHO). Reduced LV preload has been implicated as a cause for cardiac compromise in TVD. We hypothesize the right atrium (RA) plays an integral role in the return and redistribution of blood flow to maintain the cardiac output in TVD. A novel border tracking software, velocity vector imaging, was used to study RA function in these fetuses.

Methods: Retrospective evaluation of RA function was performed on 23 TVD (Ebstein anomaly 18, tricuspid valve dysplasia 5), 22 RHO (pulmonary atresia/intact septum 12, tricuspid atresia 10) and 33 control fetuses. Doppler indices of LV performance were recorded. A ratio of inferior vena caval velocity time integral ratio of A wave reversal/forward flow was calculated (ARi). Offline fetal RA images were analyzed using velocity vector imaging to attain RA emptying fraction (RAEF), peak volume-adjusted filling and emptying rates, and gestation-adjusted RA volumes. Statistical analysis was performed using student t-test.

Results: TVD maximum and minimum RA volumes were increased compared to RHO and controls (p<0.01). TVD RA function measures were decreased compared to both RHO and controls; RAEF 40% vs 46%, p=0.04 vs 52%, p<0.01; filling rate 2.6 vs 3.0, p=NS vs 3.2ml/s, p=0.02; emptying rate -5.2 vs -7.8, p=0.02 vs -9.7ml/s, p<0.01 respectively. ARi was increased in RHO (p<0.01) but not TVD compared to controls. TVD LV Tei index (0.44 ±0.12) and IVRT (56 ±11s) were increased and ejection times decreased (0.16 ±0.01s) compared to RHO (0.34 ±0.12, 47 ±9s, 0.18 ±0.02s respectively, p=0.02). LV inflow E and A velocities were increased in both TVD and RHO, but A wave peaks were significantly higher in RHO (p<0.01). LV ejection fraction in TVD and RHO did not differ from controls.

Conclusion: Both RA dilation with abnormal filling and emptying combined with abnormalities of LV filling may contribute to the hemodynamic instability of fetuses with TVD. Inferior vena caval Doppler in TVD has less A wave reversal when compared with RHO, possibly reflecting differences in RA function.