

Cardiac cycle timing parameters to assess fetal cardiac function in fetuses with pulmonary stenosis

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Objective

To assess fetal systolic and diastolic function in fetuses with pulmonary stenosis (PS) using cardiac cycle timing parameters: filling time fraction (FTF) and ejection time fraction (ETF), and to compare it to healthy fetuses.

Methods

A prospective cohort study was conducted including 11 fetuses with isolated PS (3 critical, 5 moderates, 3 mild) between 26 and 37 weeks of gestation, and 22 healthy controls matched by gestational age and estimated fetal weight at scan. Using valvular clicks on spectral Doppler as landmarks, we analyzed left (LV) and right (RV) ventricular inflow and outflow times to calculate FTF ((Filling time/Cycle time)*100), and ETF ((Ejection time/Cycle time)*100). Z-scores were calculated using nomograms according to heart rate and gestational age. Postnatal data were obtained from medical reports.

Results

Maternal and perinatal characteristics were similar in both groups. Mean gestational age at scan was 32.4±3.5 weeks. 64% of the PS fetuses showed right FTF below 2 z-scores, with significantly reduced right FTF compared to the control group. On the contrary, right ETF showed a non-significant trend to lengthen in PS fetuses. Regarding left cardiac cycle parameters, ETF was reduced in fetuses with PS when compared to controls, with no differences in the FTF. PS was confirmed in all the newborns with 7 cases (63.6%) requiring a pulmonary valvuloplasty in the first month of life. No differences in cardiac cycle timing parameters were observed based on the need of postnatal valvuloplasty.

Conclusion

Fetuses with PS showed reduced right FTF and left ETF as compared with healthy fetuses, which suggests an intracardiac redistribution of flow. Future studies are warranted to assess the potential utility of cardiac cycle timing for the diagnosis and prognosis of PS.

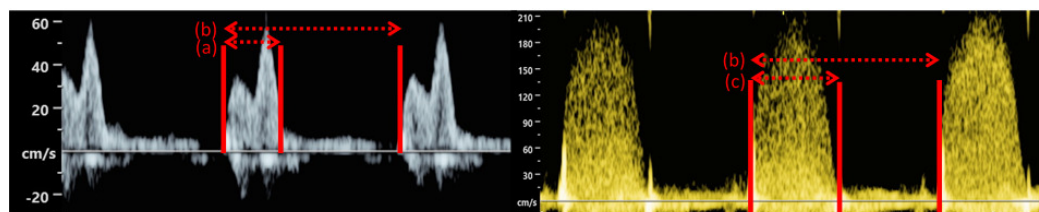


Figure 1. Spectral Doppler tracing of ventricular inflow (left) and outflow (right) waves for the measurement of cardiac cycle timing parameters. (a) inflow time, (b) cardiac cycle, (c) ejection time.

Table. Cardiac cycle timing parameters in fetuses with pulmonary stenosis (PS) and healthy controls.

Parameter	Pulmonary Stenosis (n=11)	Control (n= 22)	P (t-test)
Tricuspid filling time fraction	31.81 ± 2.61	39.28 ± 1.51	< 0.001
Pulmonary ejection time fraction	44.5 ± 3.98	42.76 ± 1.19	0.184
Mitral Filling time fraction	39.38 ± 4.86	42.03 ± 1.75	0.148
Aortic ejection time fraction	39.40 ± 2.19	41.33 ± 1.13	0.017