

Can myocardial contractility be assessed by tissue Doppler imaging? An experimental study in an acute fetal sheep model

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Objective: To test the hypothesis that the myocardial isovolumic contraction velocity (ICV) and its acceleration reflect left ventricular (LV) contractility in the fetal sheep.

Methods: The experiments were performed in 11 sheep fetuses at 127-138 (term 145) days of gestation. dP/dt_{max} was measured using a 3F Millar catheter inserted into the LV via the carotid artery. Fetal arterial blood pressure and the acid base status were monitored using a cannula inserted into the fetal descending aorta through the femoral artery. The LV contractility was altered by infusing angiotensin II via a femoral vein cannula. Fetal echocardiography was performed using a 10 MHz phased-array transducer (Vivid 7 Dimension) through the uterine wall and longitudinal myocardial velocities of the LV were recorded using pulsed-wave tissue Doppler imaging (TDI) at the level of mitral annulus.

Results: The average fetal weight was 2787 g. The LV end-systolic pressure (64 ± 18 versus 93 ± 26 mmHg; $p=0.001$), end-diastolic pressure (14 ± 6 versus 20 ± 9 mmHg; $p=0.005$), dP/dt_{max} (1224 ± 330 versus 2030 ± 476 mmHg/s; $p=0.003$), and mean arterial pressure (43 ± 6 versus 65 ± 14 mmHg; $p<0.001$) increased significantly following angiotensin II infusion. There was a corresponding increase in the LV ICV (4.1 ± 2.3 versus 6.4 ± 2.4 cm/s; $p=0.039$) and its acceleration (3.5 ± 2.5 versus 7.8 ± 4.9 m/s², $p=0.022$) but the other longitudinal myocardial velocities, heart rate, cardiac cycle time intervals and the Tei index did not change significantly.

Conclusion: An increase in fetal LV contractility (dP/dt_{max}) is reflected in myocardial ICV and its acceleration measured by TDI.