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Fetal mean pulmonary artery pressure falls and pulmonary vascular maturation improves after reversal of ductal constriction: a Doppler echocardiographic study

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INTRODUCTION: Constriction of ductus arteriosus is prevalent in third trimester fetuses, as a result of maternal utilization of antiinflammatory pharmacological or dietary prostaglandin inhibitors, with habitual reversal after suspension of the causal agent. Improvement of pulmonary hypertension and pulmonary vascular maturation after this reversal has not been previously demonstrated in human fetuses. This study was designed to test the hypothesis that estimated mean pulmonary artery pressure (MPAP) decreases and pulmonary vascular maturation assessed by acceleration time/ejection time ratio (AT/ET) increases after reversal of ductal constriction and that these effects are independent of gestational age evolution.

METHODS: This is a prospective observational study, comparing Doppler echocardiographic ductal flow dynamics parameters, MPAP and AT/ET ratio in 53 third trimester fetuses at the moment of ductal constriction diagnosis and after 2 weeks of discontinuation of prostaglandin inhibitors to a control group of normal fetuses from local nomograms. MPAP was estimated by Dabestani equation and vascular maturity by AT/ET ratio, according to reported validations. Statistical analysis utilized t test for comparison of the variables at diagnosis and after reversal of ductal constriction. Variations of MPAP and AT/ET ratio at these 2 moments were compared to the normal expected variations at the same gestational period.

RESULTS: Normalization of mean systolic and diastolic ductal velocities (1.85±0.27 to 1.38±0.39 m/s, $p<0.0001$, and 0.43±0.10 to 0.21±0.06 m/s, $p<0.0001$, respectively) and of pulsatility index (1.98 ± 0.20 to 2.60 ± 0.30, $p<0.0001$) was demonstrated after 2 weeks. In this period, mean MPAP decreased (65.0±7.2 to 53.4±6.9 mmHg, $p< 0.0001$), and AT/ET ratio increased (0.19±0.06 to 0.33 ±0.07, $p< 0.0001$). Variation of mean MPAP was -12,5 ±7,5 mmHg, $p<0.001$ (normal variation = -1.3 ± 0.19 mmHg,[9.6 times more], $p<0.001$),and variation of pulmonary AT/ET ratio was +2.12 ±0.48, $p<0.001$ (variation of AT/ET in normal fetuses = + 0.13 ±0.08[16 times more], $p<0.001$).

CONCLUSION: This study shows for the first time that resolution of fetal ductal constriction is followed by fall in the MPAP and increase in pulmonary vascular maturity, at a significant higher degree than the observed in normal fetuses in the same gestational age variation period.