

Fetal acidosis and hypotension during repeated umbilical cord occlusions are associated with enhanced chemoreflex responses in near-term fetal sheep.

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Abstract

This study examined the hypothesis that repeated episodes of brief but severe hypoxia would not attenuate the chemoreflex-mediated rapid initial fall in fetal heart rate (FHR) and, further, that greater hypoxic stress, as shown by hypotension and metabolic acidosis, would be associated with an enhanced chemoreflex response. Chronically instrumented, near-term fetal sheep received 1 min total umbilical cord occlusion either every 5 min for 4 h (1:5 group; n = 8) or every 2.5 min (1:2.5 group; n = 8) until mean arterial blood pressure fell to <20 mmHg on two successive occlusions. Umbilical cord occlusion caused variable decelerations, with sustained hypertension in the 1:5 group and little change in acid-base status (pH 7.34 +/- 0.03 after 4 h). In contrast, the 1:2.5 group showed progressive hypotension and metabolic acidemia (pH 6.92 +/- 0.04 after the last occlusion). The 1:2.5 group showed a significant increase in the rate of initial fall in FHR during the occlusion series, which was greater than the 1:5 group in the last 30 min of the occlusion series (9.4 +/- 1.4 vs. 3.5 +/- 0.3 beats.min⁽⁻¹⁾.s⁽⁻¹⁾; P < 0.01), with a greater fall in FHR (71.9 +/- 6.5 vs. 47.0 +/- 8.7 beats/min; P < 0.05). In summary, this study demonstrated that repetitive laborlike cord occlusions, which led to severe fetal compromise, were associated with an increase in the slope and magnitude of the initial FHR deceleration. These findings support the concept of the chemoreflex as a central, robust component of fetal adaptation to severe hypoxia.