

Maternal systemic and utero-placental circulations in the second half of pregnancy: a longitudinal study

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Background: Maternal cardiac output (CO) and the uterine artery blood flow (Q_{uta}) are known to increase during pregnancy. However, both parameters have not been measured simultaneously in the same study population. Whether gestational age related increase in utero-placental blood flow is due to an increase in CO or there is a redistribution of maternal circulation remains controversial.

Objective: To measure serial changes in maternal CO, systemic vascular resistance (SVR), Q_{uta} and uterine vascular resistance (UtR), and estimate the fraction of CO distributed to the utero-placental circulation during the second half of pregnancy.

Methods: Fifty-three low risk-pregnancies were evaluated longitudinally at approximately 4-weekly intervals from 22 weeks until term (a total of 253 observations). Mean arterial blood pressure (MAP), CO and SVR were measured using impedance cardiography, and the uterine artery blood flow velocities and diameter using Doppler and B-mode ultrasonography, respectively. Q_{uta} of both uterine arteries was estimated as the product of time-averaged intensity weighted mean velocity and cross-sectional area of the uterine artery. UtR was calculated as: MAP/sum of right and left Q_{uta}.

Results: CO increased from 5.5 to 5.8 L/min ($p = 0.006$) despite a significant increase in SVR from 1046 to 1135 dyne s cm⁻⁵ ($p = 0.0077$) during 22-40 weeks. The UtR decreased from 0.26 to 0.13 mmHg/mL/min ($p < 0.00001$) and the total utero-placental blood flow more than doubled during the same period increasing from 299 ml/min to 673 ml/min which represented 5.6 % to 11.7% of the maternal CO.

Conclusion: We have established longitudinal reference intervals for the fraction of maternal CO distributed to the utero-placental circulation at 22-40 weeks of gestation. Increments in utero-placental blood flow are relatively higher than that of the CO in the second half of pregnancy suggesting redistribution of maternal circulation due to continuous reduction in UtR.