Actual vs optimal fetal hematocrit measured with punctures of cord blood in utero: relationship with umbilical artery resistance

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At birth hematocrit is rather high, but pioneering works by O Linderkamp have shown that it is adapted to fetal circulation. In addition this author investigated the issue of optimal hematocrit in fetal blood in vitro in narrow glass tubes, and found with this in vitro approach values of an optimal hematocrit ranging as high as 60% in the narrowest tubes. A theoretical ‘ideal’ hct can also be predicted with a theoretical curve of h/v vs hct constructed with Quemada’s model. We used the database of one of our previous papers on fetal hemorheology to reinterpret its results with this concept. A series of 28 intrauterine cord punctures (between 19 and 33 weeks gestation) with doppler measurements of resistance in umbilical arteries was studied. The theoretical ‘optimal hematocrit’ was well correlated to actual (r=0.857 p<0.01) but systematically lower (Bland-Altmann plot +12.1[8.52-15.7]) than the actual one. Umbilical artery resistance index is correlated with actual hematocrit (r=0.407 p<0.05), the discrepancy between ideal and actual (r=−0.542 p<0.05) but not predicted ideal hematocrit, suggesting that the discrepancy between ideal and actual may reflect an adaptative decrease aiming at reducing vascular resistance. These findings indicate that prediction of ideal hematocrit with Quemada’s equation makes sense in fetal blood, and suggest that a ‘viscoregulatory mechanism’ maintains hematocrit below this theoretical value in order to avoid excess vascular resistance.