The effects of low birth weight on the microcircultion in the 1st year of life

Introduction: A reduction in capillary density, known as capillary rarefaction (CR), is an established hallmark of essential hypertension (EH). Low birth weight (LBW) infants, known to have an increased risk of developing future EH, were unexpectedly found to have a significantly higher capillary density at birth when compared to normal birth weight (NBW) infants. We therefore hypothesised that there is a microcirculatory window in the 1st year of life of LBW infants, during which a process of extensive capillary loss or "hyperpruning" occurs, and results in CR.

Methods: The George's Capillary Rarefaction Offspring Study (G-CROS) is a longitudinal, multi-centre study of which 284 infants were NBW, born at term, and 77 were LBW. All infants were born to normotensive mothers. Intravital microscopy was used to measure functional (basal) and structural (maximal) dermal capillary density at birth, 3 months, 6 months and 12 months. A mixed model was used to analyse the serial data.

Results: NBW infants showed a gradual reduction in basal capillary density (BCD) and maximal capillary density (MCD) in the 1st 12 months of life. The greatest reduction occurred between birth and 3 months (BCD mean difference = -27.62 cap/field, p <0.0001 and MCD mean difference = -31.49 cap/field, p <0.0001). LBW infants also showed their most significant reduction in BCD and MCD between birth and 3 months (BCD mean difference = -47.01 cap/field, $p < 0.0001$ and MCD mean difference = -48.01 cap/field, $p < 0.0001$). However, LBW infants demonstrated a significantly higher percentage reduction in BCD (mean difference = -7.81%, $p = 0.0194$) and MCD (mean difference = -8.29%, $p = 0.0361$) between birth and 3 months when compared to NBW controls.

Conclusions: Although a reduction in capillary density appears to be a normal physiological process occurring in NBW infants, there seems to be a microcirculatory window in the first 3 months of life during which LBW infants undergo a process of capillary "hyperpruning". Further follow-up studies are required to investigate the role of CR and the microcirculation in the pathogenesis of EH; as well as the mechanisms orchestrating this CR in early life.