DEFINING OPTIMAL BLOOD PRESSURE BASED ON A NOVEL CEREBROVASCULAR REGULATION INDEX IN PRETERM INFANTS

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Introduction: Cerebral autoregulation ensures that cerebral perfusion remains constant over a range of arterial blood pressures. Defining optimal cerebral perfusion pressure, based on strength of cerebrovascular reactivity Improves outcome in adult neurocritical care1. The presence and limits of autoregulation in neonates remains uncertain and debate continues regarding the optimal blood pressure in these patients. The assessment of cerebrovascular reactivity should not rely on measurement of arterial blood pressure alone: there is evidence that increasing heart rate is effective in increasing cardiac output in neonates, as the ability to increase stroke volume is limited in this population. A novel index of cerebrovascular reactivity, called tissue oxygen heart rate reactivity (TOHRx) relates the correlation between the tissue oxygenation index (TOI) and heart rate (HR). We aimed to describe TOHRx in a cohort of preterm infants and investigate whether this index could be used to define optimal mean arterial blood pressure (MABPOPT) in this population.
Patients and Methods: 60 preterm infants born at median (range) gestational age of 26+0 (23+4 - 32+1) were studied with signed parental consent. Median (range) age at the study was 34 hours of age (5 to 228h) and median time of recorded data was 2 hours (1 - 24h). The cerebral tissue oxygenation index (TOI) was measured using the NIRO 200NX near-infrared spectrophotometer (Hamamatsu Photonics, KK, Japan). Real time recordings of mean arterial blood pressure, arterial oxygen saturation and heart rate were simultaneously recorded and analysed using ICM+ software2. Severity of clinical illness was assessed using CRIB II score. TOHRx was calculated from moving correlation coefficient, using 5-minutes time windows between 10 seconds average values of TOI and HR. Correlation between TOHRx and CRIB II was assessed using linear regression analysis. MABPOPT for individual patients was determined by dividing MABP into 2mmHg bins and averaging TOHRx within those bins. An automatic curve fitting method was applied to determine the MABP value with the lowest associated TOHRx value (corresponding to maximal cerebrovascular reactivity).
Result: The median (range) of TOHRx was -0.0223 (-0.4631 - 0.3218). TOHRx demonstrated significant correlation with CRIB II (R=0.35, p=0.006). The median (range) MABPopt was 34.5 (25 - 55). The values of MABPOPT calculated for each individual patient were used to determine the average distance of MABP from the ‘optimal'. This measurement of divergence from MABPOPT was significantly greater in those patients who died (4.2 +/-2.7mmHg vs 2.1 +/-1.6mmg, p=0.013 non-parametric test).
Conclusions: TOHRx is a novel index of cerebrovascular reactivity. TOHRx can be used to define a value MABPOPT; using this methodology there was a significant deviation from MABPOPT in those infants who died. The use of TOHRx to define MABPOPT may therefore be a valid approach to managing blood pressure in these infants.
References 1. Steiner LA, et al. Crit. Care Med. 2002;30:733-738. 2. Smielewski P, et al. Acta Neurochir Suppl. 2005;95:43-9.