57

USE OF NIRS TO DETECT CEREBRAL AUTOREGULATION: A VALIDATION STUDY IN PIGLETS

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BACKGROUND AND Aims: Impaired cerebral autoregulation (CA) is common and associated with brain damage in sick neonates. Frequency analysis between spontaneous changes in arterial blood pressure (ABP) and cerebral NIRS has been used to detect the presence and estimate the magnitude of this impairment. Coherence (i.e. correlation in the frequency-domain) detects its presence. Gain estimates its magnitude by analysing the magnitude of ABP-variability passing from systemic to cerebral circulation. We aimed to validate this dynamic method by comparing it with a static measurement of CA-capacity in piglets.

Methods: Piglets (n=7, age 1-2 days) were anaesthetized and monitored during normo- and hypovolaemia. In both states, dynamic CA was estimated with analysis of coherence and gain between spontaneous changes in ABP and cerebral oxygenation (NIRS) in four 10-minutes epochs. Both before and after this dynamic period, static CA-capacity was estimated from changes in cortical flux (laser-Doppler probe) to induced rises in ABP by repeated inflations of a thoracic aorta balloon for 30 seconds. Subsequently, CA-capacity was calculated as $\% \Delta \text{CVR} / \% \Delta \text{ABP}$ (i.e. percentage of full autoregulatory capacity), where CVR (i.e. cerebral vascular resistance) was estimated as ABP/Doppler flux.

Results: Linear regression demonstrated an inverse relationship between coherence and static CA-capacity ($R^2=38\%$, $P=0.02$). Likewise, linear regression indicated an inverse, however weak, relationship between gain and static CA-capacity, with R^2 increasing from 1% ($P=0.72$) to 55% ($P=0.09$) when measurements with insignificant coherence were excluded.

Conclusions: Frequency analysis of spontaneous changes in ABP and cerebral NIRS is associated with cerebral autoregulation as measured with laser-Doppler during ABP-challenge.

58

LOW MORTALITY WITH IMPLEMENTATION OF A NATIONAL HYPOTHERMIA TREATMENT PROGRAM

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Background & aims: Induced hypothermia (HT) is an effective neuroprotective treatment. We aimed to prospectively evaluate implementation of national HT guidelines for the entire Swedish birth population over 3 years (2007-2009).

Methods: In March 2007 a national consensus was taken to treat all eligible infants with HT (33.5°C for 72 hours) using the standard inclusion criterias: a) low Apgar scores or severe acidosis followed by b) moderate/severe HIE. Data on all newborn infants treated at the neonatal units in Sweden were prospectively collected according to a preset HT protocol and entered in a national perinatal database (PNQ) with an add-on module for HT.

Results: During the study period, 188 HT infants were reported in the register giving an incidence of; 2007: 0.36 (range 0-0.9) (39/108.000), 2008: 0.64 (range 0-0.9) (71/110.000), 2009: 0.67 (range 0-0.9) (78/115.000). The overall mortality rate was 10%. One infant was treated with ECMO and 20 with inhaled NO for pulmonary hypertension. Two infants had severe arrhythmia due to lidocaine infusion.

Conclusion: The implementation of a national HT program has been successful. The mortality rate was lower than previously reported. However, we have revealed substantial regional differences in numbers of HT treated infants, suggesting that all eligible infants did not receive this therapy.