Microdialysis – a new diagnostic tool in research of congenital heart surgery


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Objective: Capillary leak syndrome (CLS) affecting especially neonates and young children after cardiac surgery requiring cardiopulmonary bypass (CPB), contributes to higher morbidity. The mechanism involving the related inflammatory processes is poorly understood. We investigated whether different cytokines, measured with microdialysis, can monitor local inflammation in adipose tissue one of the target organ of CLS and predict the development of CLS on cytokine level, before severe clinical signs appear.

Methods: We performed a prospective feasibility study with serial measurements of inflammatory response in subcutaneous adipose tissue up to 24 hours after surgery. The cohort consists of 23 neonates and infants (median age 155, range 6-352 days; median body weight 5.4, range 2.6–9.2 kg) underwent congenital heart surgery with CPB. Microdialysis catheter were introduced in one lateral thigh subcutaneously using a velocity of 1.0 µl/min. Serial microdialysis analysis for cytokines (interleukin [IL]-6, IL-8, IL-10) and anaphylatoxin (C3a) were performed. CLS was quantified by X-ray subcutaneous-thoracic ratios (S/T). We studied age-related differences of inflammatory response.

Result: Median bypass time was 150 min (range 42-432 min) and aortic crossclamp was 76 min (range 0-188 min). In all patients pro- and anti-inflammatory and complement activation were verifiable. After onset of surgery the C3a levels distinguished rose (167 ng/ml), followed by a release of IL-10 at the end of CPB. The highest levels of IL-6 (55 pg/ml) and IL-8 (66 pg/ml) were detected two hours after CPB. Six of 23 infants developed postoperative CLS. These patients disclosed a gentle but significant second rise 8 to 10 hours postoperatively (CLS 64 ng/ml vs. non-CLS 24 ng/ml; p<0.01). We could show an aged-related difference in the release of IL-6 and C3a. Younger age (p=0.02), longer bypass time (r=0.48; p=0.021), higher inotropic demand (r=0.67; p=0.001) and longer intubation time (r=0.63; p=0.001) correlated closely with the development of CLS.

Conclusion: With diagnostic microdialysis it is feasible to give valid data about local inflammatory response subcutaneously in paediatrics during and after CPB. We are able to disclose age-related differences in the inflammatory response. Our results implicate the possibility to predict CLS early before severe clinical signs appear.