

Renal near infrared spectroscopy as realtime indicator for developing acute kidney injury in infants undergoing cardiac surgery with cardiopulmonary bypass

Ruf B. (1), Bonelli V. (2), Balling G. (1), J. Hörer (3), Reiter K. (4), Hess J. (1)

Department for Pediatric Cardiology and Congenital Heart Disease, Deutsches Herzzentrum München, Germany (1)

Department for Anesthesiology, Deutsches Herzzentrum München, Germany (2)

Department of Cardiovascular Surgery, Deutsches Herzzentrum München, Germany (3)

Department of Pediatric Intensive Care and Pneumology, von Haunersche Kinderklinik, München, Germany (4)

Introduction: Acute kidney injury (AKI) is a frequent complication after cardiac surgery with cardiopulmonary bypass in infants. There is currently no standard method to monitor kidney function for early detection of AKI. An improved diagnostic algorithm would possibly allow to develop a strategy for prevention of AKI. Renal NIRS (near infrared spectroscopy) evaluates regional oximetry in a non-invasive continuous realtime fashion and reflects tissue perfusion. The aim of this study was to evaluate the relation between renal oximetry and development of AKI in the operative and postoperative setting in infants undergoing cardiopulmonary surgery.

Methods: In this prospective study we enrolled 59 infants (age median 88 ± 82 days, weight median 4316 ± 1622 g) undergoing cardiopulmonary bypass surgery for congenital heart disease ($n = 37$ cyanotic and $n = 22$ non-cyanotic) for uni- or biventricular repair. Renal NIRS was continuously measured intraoperatively and at least 24 hours postoperatively. The renal oximetry values were correlated with the pediatric Renal-Injury-Failure-Loss-End (pRIFLE) classification for AKI, additional kidney function parameters and the postoperative course.

Results: 27 (46 %) infants developed AKI based on pRIFLE classification. No difference could be shown in the intraoperative renal oximetry of infants with or without AKI. However the NIRS demonstrated significantly lower renal oximetry periods in the first 24 and 48 hours postoperatively in AKI patients as compared to patients with normal renal function ($p < 0.05$). 3 (11 %) of infants with AKI needed a renal replacement therapy and 2 (7 %) died. In the non AKI group no fatal course was reported during the study period. The infants with decreased renal oximetry values developed significantly higher lactate levels 12 and 24 hours after the operation.

Conclusion: Our results suggest that prolonged lower renal oximetry values indicate impaired renal function and decreased systemic oxygen delivery followed by AKI. Renal NIRS might be a promising non-invasive method for the early detection of AKI in infants undergoing cardiac surgery with cardiopulmonary bypass.