Prognostic value of serum biomarkers of cerebral injury to assess neurological outcome after in-hospital cardiopulmonary resuscitation in pediatric patients

Kramer P., Miera O., Ovroutski S., Berger F., Schmitt K. 
Deutsches Herzzentrum Berlin, Berlin, Germany

Objectives: Neurological morbidity and mortality is considerable after in-hospital pediatric cardiopulmonary resuscitation (CPR) and early assessment of cerebral injury severity is helpful to guide post-CPR therapy. While an association of the cerebral injury serum biomarkers neuron-specific enolase (NSE) and protein S100b with neurological outcome after CPR has been documented in adults, their prognostic value in children has not been comparably well studied.

Methods: A retrospective analysis of patients admitted to our pediatric cardiac intensive care unit during the last 3 years identified 32 children (congenital heart disease n=28, neonatal asphyxia n=4) who required in-hospital CPR and had subsequent serial measurements of NSE and S100b. Neurological outcome at discharge was classified using the pediatric cerebral performance category score (PCPC). Favorable outcome was defined as ΔPCPC≤1 and unfavorable outcome as ΔPCPC>1. Serum levels of NSE and S100b were analyzed towards their ability to predict post-CPR neurological outcome.

Results: Survival to discharge was 69% (n=22). In 6 patients neurological assessment was not performed due to early death from non-cerebral cause (heart failure n=4, sepsis n=2), they were excluded from further analysis. Of the remaining 26 patients, 18 (69%) had a favorable neurological outcome. Both NSE and S100b were significantly higher in patients with unfavorable neurological outcome at 24 hours (NSE 128.9±25.9µg/l vs. 53.6±11.1µg/l, p=0.003; S100b 2.74±1.32µg/l vs. 0.51±0.15µg/l, p=0.03) and 48 hours (NSE 139.7±26.4µg/l vs. 50.2±14.9µg/l, p=0.02; S100b 6.26±3.97µg/l vs. 0.26±0.06µg/l, p=0.02) after CPR. Area under the curve in receiver operating characteristic curves was 0.89 and 0.87 for NSE and 0.80 and 0.91 for S100b at 24 and 48 hours, respectively. However, cut-off values for NSE and S100b with the best specificity of 100% to predict adverse neurological outcome showed only poor sensitivity (28.6% and 33.3% for NSE and 28.6% and 71.4% for S100b at 24 and 48 hours, respectively).

Conclusions: Serum levels of cerebral injury biomarkers NSE and S100b have the potential to predict adverse neurological outcome at an early stage after pediatric CPR and thus may prove useful to guide therapeutic decisions and parental counseling. However, larger prospective studies are needed to comprehensively evaluate diagnostic accuracy and determine reliable cut-off values.