Near infrared spectroscopy as supplementary hemodynamic monitoring after cardiac surgery


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Background: Near infrared spectroscopy (NIRS) allows continuous and non-invasive monitoring of regional tissue oxygen saturation. We aimed to evaluate the value of NIRS as supplementary hemodynamic monitoring after cardiac surgery with cardiopulmonary bypass in neonates and infants.

Methods: Cerebral (ScO2) and somatic (SsO2) tissue oxygen saturations (INVOS, Covidien®) were obtained after 83 cardiac surgeries (neonates: n=38, infants: n=45). NIRS data was recorded for 48 hours and matched with routine monitoring data. The relationship between regional tissue oxygen saturation and central venous saturation (SvO2) was of special interest.

Results: In neonates, ScO2 declined in the first postoperative hours, reaching a nadir after approximately 4 hours. In infants, a rise of ScO2 was noted directly after surgery. In both groups, ScO2 reached a plateau after approximately 20 and 8 hours, respectively. Mean ScO2 of the entire postoperative course was not different between neonates and infants (71 ±12% vs. 67 ±8%, p=0.071), while mean SvO2 was lower in infants (73 ±8% vs. 63 ±5%, p<0.001).

For the entire cohort, ScO2 and SvO2 were moderately correlated (r=0.644, p<0.001), a weaker correlation existed between SsO2 and SvO2 (r=0.472, p<0.001). For estimation of SvO2 from ScO2, Bland Altman analysis showed a mean bias of 1.4%, but wide limits of agreement (−19.2% to 22.1%). Prediction of SvO2 slightly improved using a combination of ScO2 and SsO2 values.

In neonates, correlation between ScO2 and SvO2 was weaker in the early compared to the later postoperative course (0-8h: r=0.383 vs. 9-48h: r=0.662, p=0.001), while no difference was found in infants (0-8h: r=0.768 vs. 9-48h: r=0.735, p=0.211). In neonates, the mean bias in the early postoperative course was -11% (limits of agreement: −40.6% to 19.2%) compared to 1.6% (limits of agreement: -17.4% and 20.7%) in the later course.

For the estimation of the difference between two consecutive SvO2 measurements from corresponding ScO2 values, Bland Altman analysis showed a bias of -0.5 (limits of agreement: -18.1% and 17.1%)

Conclusion: Despite moderate correlation, absolute values and changes in ScO2 do not necessarily reflect SvO2 measurements. Especially in neonates, the relationship between ScO2 and SvO2 in the early postoperative course is weak.