

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% and 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.