

Near-infrared spectroscopy (NIRS) in a piglet model: readings are influenced by the colour of the cover

Clausen NG^{1,2}, Spielmann N^{1,3}, Weiss M^{1,3}, Ringer SK⁴

¹Children's Research Center, University Children's Hospital of Zurich, Switzerland; ²Department of Anaesthesiology and Intensive Care, Odense University Hospital, Denmark; ³Department of Anaesthesiology, University Children's Hospital Zurich, Switzerland; ⁴Section Anaesthesiology, Vetsuisse Faculty University of Zurich, Switzerland

Background and goal of study

Near-infrared spectroscopy (NIRS) is used to monitor regional tissue oxygenation (rSO_2) during general anaesthesia (1, 2). The measurement might have sources of error still insufficiently examined in the clinical setting.

The goal of this cross-over study was to investigate the effect of differently coloured coverings on rSO_2 in piglets.

Materials and methods

Twenty-five healthy piglets aged 4-6 weeks were anaesthetized, intubated, mechanically ventilated and fully monitored using spirometry, ecg, pulse oximetry, invasive blood pressure and rectal temperature. Neuro-monitoring comprised of oxygen partial pressure (PtO_2) measurement and laser doppler blood flow (CBF) in brain tissue. The rSO_2 was measured by placing NIRS sensors in the supra glabellar region.

In 12 animals sensors were covered with a uni-coloured pink (P) napkin and a turquoise (T) napkin in a random order (Setting A). In further 13 animals sensors were covered with blue-coloured surgical drape (SD) and a napkin with a reddish SantaClaus (SC) motive (Setting B). Uncovered (UC) baseline values were captured and measurements obtained for a period of three minutes. During measurements, the animals were kept in normoterm, normotensive, normoglycaemic and normoxic condition. Inspired oxygen fraction and ventilatory settings were kept constant. One-way ANOVA was used to compare the 3 coverage's during each part of the study ($p < 0.05$).

Results

Part 1: rSO_2 -T differed significantly from rSO_2 -UC and rSO_2 -P (Mean \pm SD rSO_2 -UC₁: 49.7 ± 7.5 ; rSO_2 -P: 49.8 ± 8.1 ; rSO_2 -T: 45 ± 8.0 %) ($p < 0.05$). Part 2: rSO_2 -SD differed significantly from rSO_2 -UC and rSO_2 -SC (rSO_2 -UC₂: 57.4 ± 6.8 ; rSO_2 -SC: 57.5 ± 6.4 ; rSO_2 -SD: 52 ± 5.9 %) ($p < 0.05$). CBF and PtO_2 remained unchanged during measurements in part 1 and 2.

Conclusion

NIRS readings can be influenced by covering of the sensors. The colour of the cover seems to be of importance. This variability is likely to reflect a source of error rather than an actual change in rSO_2 and should be considered, when interpreting rSO_2 in a clinical setting. We suggest application of a black sensor cover to avoid the influence of light.

Acknowledgement:

An INVOS Oximetry monitor was provided with courtesy by Medtronic (Schweiz) AG - 3053 Münchenbuchsee | Switzerland.

1. Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ, Vender JS, et al. Cerebral oxygen desaturation events assessed by near-infrared spectroscopy during shoulder arthroscopy in the beach chair and lateral decubitus positions. Anesthesia and analgesia. 2010;111:496-505.
2. Sorensen H. Near infrared spectroscopy evaluated cerebral oxygenation during anesthesia. Danish medical journal. 2016;63:B5318.



Figure 1: Near-infrared spectroscopy (NIRS) sensor placed on the supra glabellar skin.

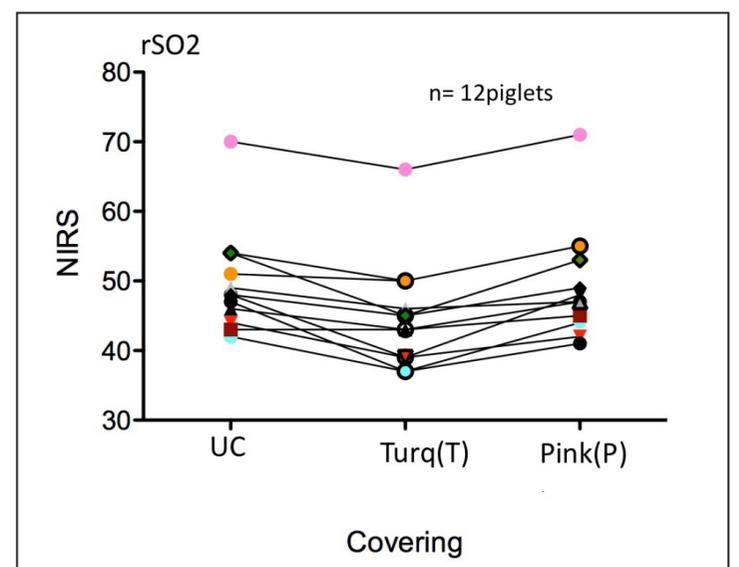


Figure 2 (Setting A): x-axis shows different coverings of the Near-infrared spectroscopy (NIRS) sensor: 'UC'= uncovered, 'T'= turquoise, 'P'= pink and the corresponding values of cerebral regional tissue oxygenation (rSO_2) (y-axis)

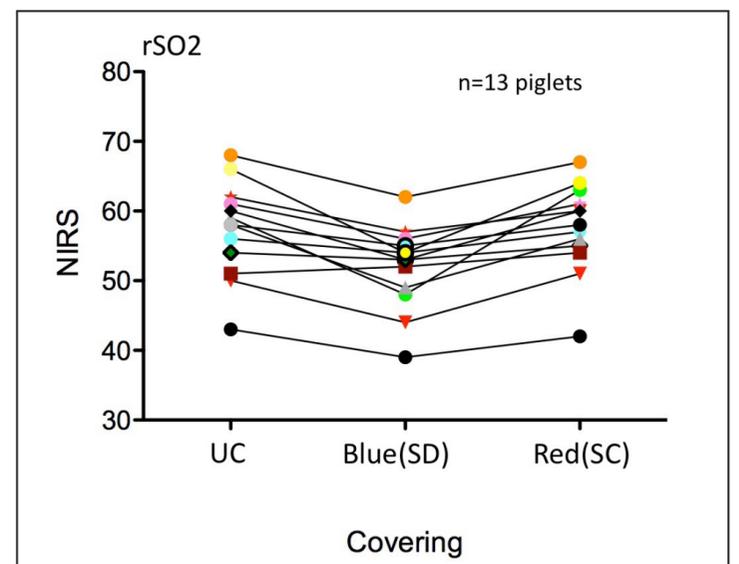


Figure 3 (Setting B): x-axis shows different coverings of the Near-infrared spectroscopy (NIRS) sensor: 'UC'= uncovered, 'Blue(SD)'= surgical drape, 'Red(SC)'= SantaClaus and the corresponding values of cerebral regional tissue oxygenation (rSO_2) (y-axis)