Agreement of somatic and renal near-infrared spectroscopy with reference blood samples during a controlled hypoxia sequence: a healthy volunteer study


Purpose: O3® Regional Oximetry (Masimo Corporation, California, USA) is validated for cerebral oximetry. We aimed to assess agreement of somatic and renal near-infrared spectroscopy with reference blood samples.

Methods: O3 sensors were placed bilaterally on the quadriceps and flank of 26 healthy volunteers. A stepped, controlled hypoxia sequence was performed by adding a mixture of nitrogen and room air to the breathing circuit. O3-derived oxygen saturation values were obtained at baseline and at six decremental saturation levels (5% steps). Blood samples (radial artery, iliac vein (somatic reference) and renal vein) were obtained at each step. Reference values were calculated as: 0.7 × venous saturation + 0.3 × arterial saturation. The agreement between O3-derived values with blood reference values was assessed by calculating root-mean-square error accuracy and Bland-Altman plots.

Results: The root-mean-square error accuracy was 6.0% between quadriceps oxygen saturation and somatic reference values. The mean bias was 0.8%, with limits of agreement from -7.7 to 9.3%. These were 5.1% and 0.6% (-8.3 to 9.5%) for flank oxygen saturation and somatic reference values, respectively, and 7.7% and -4.9% (-15.0 to 5.2%) for flank oxygen saturation and renal reference values. The kidney depth was 3.1 ± 0.9 cm below the skin.

Conclusion: O3 regional oximetry can be used on the quadriceps and flank to monitor somatic saturation, yet has a saturation-level dependent bias. O3-derived values obtained at the flank underestimated renal reference values. Additionally, it is unlikely that the flank sensors did directly measure renal tissue.