Comparison Between Changes in Pulse Oximeter Perfusion Index and Laser Doppler Flowmetry during Spinal Surgery in a Non-Human Primate Model for Cauda Equina Injury and Repair

Lee C., Hoang X., Nieto J., Ohlsson M., Christe K., Ri J. American Society of Anesthesiologists 2014; A4078.

The evaluation of changes in microcirculatory blood flow can provide important information about hemodynamics and microvascular perfusion in clinical practice. Laser Doppler flowmetry (LDF) is a reliable and accurate noninvasive technique for evaluating microcirculatory flow and skin perfusion. However, LDF is not ideal for clinical practice use. In this pilot study, we assessed the ability of the peripheral perfusion index as measured by the pulse oximeter as a surrogate of laser Doppler flowmetry to measure changes in microcirculatory flow in an in vivo spinal surgery setting.

Eight monkeys were induced with anesthesia and underwent a spinal surgical procedure that consisted of dura opening and nerve root avulsion. Changes in microcirculation at the hallux were measured using a pulse oximeter (Radical-7, Masimo Corp) and laser Doppler flowmetry (moor-VMS-LDF, Moor Inst). After smoothing the data, % change was then calculated per second and normalized to the mean % change (Fig 1a, 1b). To evaluate the ability of % change in perfusion index (%ΔPI) to reliably detect % changes in laser Doppler microcirculatory flow (%ΔLDF), we used a method based on polar plotting of %ΔPI and %ΔLDF over time of surgery as described by Critchley *et al* 1,2 (Fig 1c). In this method, acceptance limits for good trending ability are an angular bias (mean polar angle) <5°, standard deviation of polar angles (SD) 90% indicated good agreement 3,4.

Overall, concordance rate was high (88.2 ± 10.7%), and CIs and SDs were within acceptable limits of good agreement between %ΔPI and %ΔLDF (30.0 ± 2.2°and 8.9 ± 0.7°) (Table 1). Angular bias was low (13.0 ± 2.0°), however, not less than 5°. In addition, overall mean %ΔLDF and %ΔPI as well as coefficient of variations were observed to be similar (1.7 ± 0.5% vs 2.0 ± 0.5% and 0.7 ± 0.1 vs 0.6 ± 0.2).

This initial analysis indicates there is moderate agreement between %ΔLDF and %ΔPI and that %ΔPI follows %ΔLDF variations. While the angular bias was not within Critchley *et al* acceptable limits of good trending ability, it should be noted that although normalized to the % mean change, the difference in the magnitudes of %ΔLDF and %ΔPI was at times very large and thus may have weighed the angular bias. Further processing of the LDF and PI signals may need to be performed before final statistical analysis. In conclusion, the peripheral perfusion index has the potential to be used as a comparable assessment of microcirculatory flow changes as measured by laser Doppler flowmetry.

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3. Perrino AC Jr, et al. Anesth Analg 1994;78:1060-6
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