PERFUSION INDEX USING ALAR SPO_2 SENSOR MAINTAINED BETTER THAN FINGER LOCATION DURING PERIOPERATIVE CARE IN MAJOR VASCULAR/UROLOGICAL SURGERY

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Background: Perfusion index (PI) is considered to reflect perfusion at that specific measurement site (i.e. local blood volume variation during systole). PI varies among others as a function of local and systemic hemodynamic status. The effective operating range is determined by its location and the light source (transmissive or reflective). Most studies to date have reported peripheral PI values (i.e., finger) and none have examined PI values at the nasal alar by itself or relative to other central or peripheral sites. The nasal alar is a readily accessible and comfortable central site perfused by branches of both the external and internal carotid arteries (1). The purpose of the current study is to describe PI operating characteristics (e.g., typical values and variability) from the nasal alar and to compare it to a finger sensor peri-operatively in surgery with volume shifts.

Methods: The data for this post hoc analysis comes from an observational study on patients scheduled for major abdominal surgery (urological or vascular surgery) in Tilburg, the Netherlands. The study protocol was approved by a regional medical ethics committee and written informed consent was obtained from all patients. Each patient was monitored with ECG, invasive arterial blood pressure (radial artery), with mean arterial pressures between 40 to 120 mmHg, and pulse oximetry. All patients received IV anesthesia induction and maintenance, mechanical ventilation with potentially supplemental oxygen and depth of anesthesia control by bispectral indexing. Additional SpO_2 sensors were applied at the finger “as peripheral” site and at the nasal alar "as central” site. (2)

For this analysis, data from15 adult patients monitored with an alar sensor were used. Measurements included a finger PPG signal (Philips M1191B sensor) and an alar PPG signal (CE marked sensor from Xhale - now Philips nasal alar FAST SpO_2 sensor), as well as each signal’s respective SpO_2 and PI values. These were recorded in a custom-built multi-channel data logger. The dataset was analyzed using the Python scientific, statistical and graphical libraries running under the PyCharm IDE and Excel and the statistics (including mean, standard deviation and % values below a PI threshold of 1%) and non-parametric statistics were computed separately for non-overlapping periods designated as pre-operative, induction, period of surgery and post-operative.

Results: The variance of PI (Figure 1) was strongly significantly different between the finger and alar sensor for the surgical period (p=0.004) (mean variance 4.1 for finger vs 0.51 for alar), nearly significant different for the pre-operative period (p=0.06) (mean variance 6 and1.28) and not significant for induction and post-operative periods (p=0.19 and p=0.46). The percentage of the PI readings less than 1% (Figure 2), which is considered to indicate very low perfusion (3) during induction and surgery were 1% for the alar sensor and 10% for the finger sensor.

Discussion: This is the first study the authors are aware of to report peri-operative PI values from the alar sensor. It illustrates that the PI values from the alar show less variability over the course of these surgical procedures than finger sensors, potentially indicating increased usability and validity. The increase in PI values observed during surgery in the finger sensors seems based on vasoactivity in the peripheral vasculature. The PI values from the alar sensor are similar in magnitude to those from the finger sensor. However, to compare PI from different measurement sites requires further investigation since comparisons between PI from different measurement sites should be done with caution as temperature, vascular tone and perfusion may be different.

Conclusions: This study demonstrates a low variability of alar PI during the peri-operative period despite vascular tone and volume shifts. It supports the value of comparative measurements of peripheral and central PI values to allow comparison of optimal locations.

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References:(1)Arch Facial Plast Surg 2012; 14: 429–36; (2)Br J Anaesth. 2014;112(6):1109-14; (3)ASA Meeting,2022, Abstract A2095.

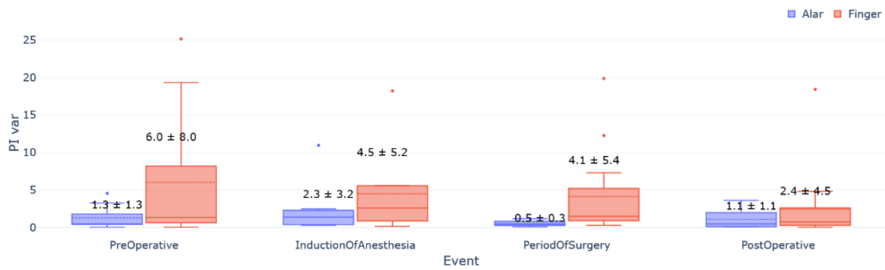

Figure 1 – Variance of PI values during each of the surgical periods (mean ± standard deviation).

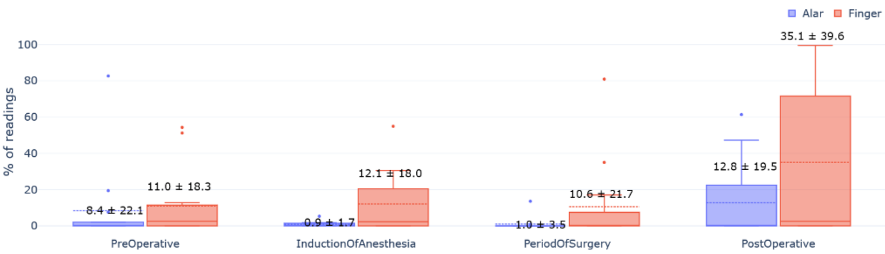

Figure 2 - % of PI readings below 1% during each of the surgical periods (mean ± standard deviation).