

Clinical Significance of the Perfusion Index in Healthy Normal Volunteers

Hiromi M., Masayasu A., Yasuharu K., Masaya T., Masayuki K., Hirotsugu O. *Eur J Anaesthesiol.* 2013; 30 (Supplement 51)

Background

Recently, a new multiwavelength pulse oximeter, the Radical-7 (Rad7; Masimo, CA, USA) was developed that offers noninvasive measurement of blood components. Perfusion index (PI) derived from the Rad7 is one of the markers that allows noninvasive and continuous monitoring of peripheral perfusion, but little is known about the true meaning of PI. The objective of this study was to determine the significance of PI in healthy normal volunteers.

Study Design

Two studies were carried out with 12 adult volunteers. Study 1: Rad7 probes were attached to the right forefingers of 6 volunteers. On the same side as the Rad7 probe, a tourniquet (ATS 750; Zimmer, USA) was wrapped around the upper arm, and pediatric rSO₂ probes (INVOS 5100; Somanetics, MI, USA) were attached over the deltoid and brachioradial muscles (for upper and lower rSO₂, respectively). After the baseline measurement (BL), the pressure in the tourniquet was increased step by step from 50 mmHg to 150 mmHg every 20 mmHg (T50-T150); and PI and upper and lower rSO₂ values were recorded at each pressure. Study 2: PI and radial arterial velocity on the same side were measured in the other 6 volunteers. Arterial velocity was measured with an ultrasound transducer (Phillips iE33, 7-15 MHz linear probe). The study protocol using tourniquets and measurement points were the same as in Study 1. Wilcoxon signed-rank test was used to compare between BLs for related samples. Comparisons between upper and lower rSO₂ were made using Mann-Whitney U test. Correlations between PI and rSO₂, and PI and radial arterial velocity were assessed using Spearman's rank correlation coefficient. $P < 0.01$ was considered to indicate statistical significance.

Results

PI significantly decreased from T110 to T150. Lower rSO₂ was significantly decreased at T70 to T150; and at each point, there were significant differences between upper rSO₂. A correlations between PI and rSO₂ were $y = 2.0x + 51.1$, $r^2 = 0.41$ ($P < 0.001$), correlation between PI and time-averaged mean velocity were $y = 0.33x + 0.67$, $r^2 = 0.31$ ($P < 0.001$).

Conclusions

The study protocol implemented low perfusion status distal to the tourniquets. Thus, PI measured at the fingertip is positively correlated with radial artery flow velocities and the lower rSO₂. The lower rSO₂ decreased similarly to arterial flow velocities, which suggests that decrease in rSO₂ reflects inadequate tissue oxygenation. Therefore, PI is an accurate index of peripheral blood flow.