Tissue oxygen supply determined by Microvascular Oxygen Saturation (SO2), Blood Flow (BF) and subcutaneous Tissue pO2 (PsqO2) during whole Body Heating and Normobaric Hyperoxia in healthy Volunteers

Authors: Sommer-N*, Sharma-N+, Taguchi-A+, Kurz-A+

Affiliations: Friedrich Alexander University, Erlangen, Germany*, Washington University, St. Louis, USA+

Objectives: To compare microvascular oxygen saturation (SO2), blood flow (BF) and subcutaneous oxygen partial pressure (PsqO2) measured by tissue spectrophotometry, laser Doppler flowmetry and subcutaneous pO2 electrode as parameters for tissue oxygen supply during whole body heating and normobaric hyperoxia in healthy volunteers.

Methods: In six healthy volunteers (age 25 ± 3, 1 male, 5 female) a fiber optic probe for measurement of SO2 and one probe for measurement of BF was attached to the forearm with a tape. Subsequently a silastic tube was placed subcutaneously close to the other probes and a Clark-type electrode was inserted for measurement of PsqO2. At first body temperature was increased by whole body warming with a warming blanket up to 37°C local skin temperature and SO2, BF and PsqO2 was measured in five minute intervals for an hour. After a resting period of ten minutes volunteers started breathing 100% oxygen through a mask and SO2, BF and PsqO2 were measured each five minutes for 15 minutes.

Results: Linear regression analysis showed a significant correlation (p<0.005) for changes of SO2, BF and PsqO2 during whole body heating (r=0.72 to 93). No correlation was found between SO2 and PsqO2 during administration of 100% oxygen. Whereas PsqO2 increased (to 2.06 +/- 1.00 of baseline value), SO2 was not altered (to 1.04 +/- 0.07 of baseline value) and BF decreased (to 0.79 +/- 0.19 of baseline value).

Conclusions: During hyperthermia oxygen delivery to tissue is increased resulting in increased SO2, BF and PsqO2. During normobaric hyperoxia decrease in BF and stable SO2 indicates stable oxygen delivery to tissue, whereas increase of PsqO2 indicates increased oxygen delivery. Reasons for the discrepancy between SO2 and PsqO2 might be, that capillary-venous oxygen saturation, reflected by SO2, is not measureably increased, as total oxygen delivery to tissue during normobaric hyperoxia is not increased (BF decreases and low amount of physically dissolved oxygen), whereas PsqO2 is increased, as it is biased by disproportionately high arterial pO2.