Feasibility of Using Near Infrared Spectroscopy in Determining VO$_2$ for Preoperative Risk Assessment

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ABSTRACT

Near infrared spectroscopy (NIRS), in combination with heart rate monitoring, may be used to determine VO2 at the anaerobic threshold.

METHODS

Data Analysis
- NIRS-measured muscle VO2 plotted versus pulmonary VO2 up to AT
- The two methods of measurement compared with Bland-Altman analysis and correlation coefficient.

RESULTS

- Pulmonary-derived VO2 and NIRS-derived muscle VO2 are well-correlated up to the AT (R² = 0.89).
- Larger differences between the two measurements are seen after the AT.

HYPOTHESIS

Near infrared spectroscopy (NIRS), in combination with heart rate monitoring, may be used to determine VO2 at the anaerobic threshold.

INTRODUCTION

Postoperative morbidity and mortality may be reduced by identifying high risk individuals before surgery. Among the parameters identified by cardiopulmonary exercise testing (CPX) is the anaerobic threshold (AT), a point readily obtained by measuring oxygen consumption (VO2). Older has shown that postoperative cardiac disease-related deaths are restricted to patients with an AT of <11 ml/min/kg. He used these preoperative measurements as a means to appropriately triage patients postoperatively (i.e., ICU vs. ward admission). However, restrictive and claustrophobic masks during CPX VO2 analysis may deter some patients.

Grassie has shown that the response of pulmonary-derived whole-body and two times the invasively-measured muscle VO2 during cycling exercise are similar. Our group has used noninvasive near infrared spectroscopy (NIRS) to measure hemoglobin parameters such as pH, Hct, and capillary oxygen saturation (denoted SmO2, as the sensor does not differentiate myoglobin and hemoglobin oxygen saturation). These NIRS-derived parameters may be used for screening of patients with low AT during exercise in a manner which is more comfortable to the subject.

DISCUSSION

- Using NIRS is a feasible method of measuring VO2 up to the AT in young active subjects, but this method must be validated in the target population.
- The accuracy of this technique might be improved if myoglobin desaturation is accounted for and better estimates of SV during exercise are obtained (work on-going).
- Ultimately, NIRS monitoring may prove to be useful alternative to the more involved and potentially uncomfortable technique of measuring VO2 using a metabolic cart.

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REFERENCES