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FEASIBILITY OF USING NEAR INFRARED SPECTROSCOPY IN DETERMINING VO2 FOR PREOPERATIVE RISK ASSESSMENT

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ABSTRACT

Introduction: Cardiopulmonary exercise testing (CPX) has been used to identify elderly patients at high risk for mortality during major surgery. Older demonstrated that postoperative cardiovascular-related deaths were predicted by an anaerobic threshold (AT) < 11 ml/min/kg. This methodology is limited by the uncomfortable and claustrophobic facemask used for standard CPX. During cycling, pulmonary-derived oxygen consumption (VO2) is equivalent to twice muscle VO2. Our research group has developed novel methods of using near infrared spectroscopy (NIRS) to determine muscle oxygen saturation (SMO2) and muscle pH and hematocrit (Hct). Hypothesis: NIRS parameters, in combination with heart rate (HR) monitoring, may be used to estimate VO2.

Methods: Ten healthy subjects (SMF) performed CPX. Whole-body VO2 was determined with a metabolic cart simultaneously with NIR spectroscopy measures from the thigh. Muscle VO2 was calculated using the Fick equation VO2 = SV x HR x C(a-v)O2, where stroke volume was estimated from HR. Oxygen content difference was calculated from Hct and SMO2 obtained with NIRS. VO2 from pulmonary measures and NIRS VO2 were compared by Bland-Altman analysis. AT was identified from spectrally determined pH.

RESULTS

• SV was found to be an accurate parameter for the test.
• The Fick equation assumes we measure SMO2, but for VO2 > AT, myoglobin desaturation may contribute substantially to SMO2, thereby overestimating VO2 with the NIRS method.
• Additional work is required to determine whether the limits of agreement between the two methods of measuring VO2 are small enough to be of clinical value.

CONCLUSIONS

• 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 VO2 during exercise are obtained (work on-going).

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REFERENCES