Correlation of Visible Light Spectroscopy with Mixed Venous Oxygen Saturation in Post-operative Congenital Heart Patients

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Introduction: Visible light spectroscopy (VLS) is a quantitative technology that non-invasively measures real-time tissue oxygenation, using visible light in the range of 475-600nm. VLS differs from near-infrared spectroscopy in the depth of penetration and the volume of tissue in which hemoglobin oxygen saturation is measured. VLS has been validated in detecting adult tissue ischemia and has been shown to reflect changes in brain oxygenation during low-flow perfusion but has not been validated in the post-Operative congenital heart population. We sought to determine if VLS correlated with mixed-venous oxygen saturation (SvO2) in these patients.

Methods: Patients were studied following congenital open-heart procedures using a VLS buccal probe. The probe remained in place up to 48 hours and measured tissue oxygenation continuously. Routine SvO2 measurements were recorded and compared with simultaneous tissue oxygenation by VLS. Correlation analysis was performed.

Results: 25 patients were monitored for a mean of 25 hours after surgery. Median age was 5 months ± 26 months with a mean weight of 6.4 ± 4.3 kg. 4 patients were enrolled after staged single ventricle palliation. The probe was tolerated well, with no skin/soft tissue injury or adverse events. Tissue oxygenation correlated in a linear fashion with direct measurement of SvO2 with a slope of 0.91 and an r² value of 0.44.

Conclusions: Measurements of tissue oxygenation using VLS correlate with measures of mixed venous oxygen saturation in the congenital heart population, over a wide range of saturations. VLS may be considered as a non-invasive surrogate for SvO2 in the postoperative congenital heart patient.