

Early Detection and Correction of Cerebral Desaturation With Noninvasive Oxy-Hemoglobin, Deoxy-Hemoglobin, and Total Hemoglobin in Cardiac Surgery: A Case Series

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Regional cerebral oxygen saturation (rS_{O_2}) obtained from near-infrared spectroscopy (NIRS) provides valuable information during cardiac surgery. The rS_{O_2} is calculated from the proportion of oxygenated to total hemoglobin in the cerebral vasculature. Root O3 cerebral oximetry (Masimo) allows for individual identification of changes in total ($\Delta cHbi$), oxygenated ($\Delta O_2 Hbi$), and deoxygenated ($\Delta HHbi$) hemoglobin spectral absorptions. Variations in these parameters from baseline help identify the underlying mechanisms of cerebral desaturation. This case series represents the first preliminary description of $\Delta O_2 Hbi$, $\Delta HHbi$, and $\Delta cHbi$ variations in 10 cardiac surgical settings. Hemoglobin spectral absorption changes can be classified according to 3 distinct variations of cerebral desaturation. Reduced cerebral oxygen content or increased cerebral metabolism without major blood flow changes is reflected by decreased $\Delta O_2 Hbi$, unchanged $\Delta cHbi$, and increased $\Delta HHbi$. Reduced cerebral arterial blood flow is suggested by decreased $\Delta O_2 Hbi$ and $\Delta cHbi$, with variable $\Delta HHbi$. Finally, acute cerebral congestion may be suspected with increased $\Delta HHbi$ and $\Delta cHbi$ with unchanged $\Delta O_2 Hbi$. Cerebral desaturation can also result from mixed mechanisms reflected by variable combination of those 3 patterns. Normal cerebral saturation can occur, where reduced cerebral oxygen content such as anemia is balanced by a reduction in cerebral oxygen consumption such as during hypothermia. A summative algorithm using rS_{O_2} , $\Delta O_2 Hbi$, $\Delta HHbi$, and $\Delta cHbi$ is proposed. Further explorations involving more patients should be performed to establish the potential role and limitations of monitoring hemoglobin spectral absorption signals.