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


Regional cerebral oxygen saturation (rS\textsubscript{O2}) obtained from near-infrared spectroscopy (NIRS) provides valuable information during cardiac surgery. The rS\textsubscript{O2} 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 (ΔcHbi), oxygenated (Δ\textsubscript{O2}Hbi), and deoxygenated (ΔHHbi) 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 Δ\textsubscript{O2}Hbi, ΔHHbi, and ΔcHbi 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 Δ\textsubscript{O2}Hbi, unchanged ΔcHbi, and increased ΔHHbi. Reduced cerebral arterial blood flow is suggested by decreased Δ\textsubscript{O2}Hbi and ΔcHbi, with variable ΔHHbi. Finally, acute cerebral congestion may be suspected with increased ΔHHbi and ΔcHbi with unchanged Δ\textsubscript{O2}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\textsubscript{O2}, Δ\textsubscript{O2}Hbi, ΔHHbi, and ΔcHbi is proposed. Further explorations involving more patients should be performed to establish the potential role and limitations of monitoring hemoglobin spectral absorption signals.