So near, yet so far: Is isolated cerebral near-infrared spectroscopy in neonates nearly as useful as it is noninvasive?

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Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication April 20, 2017; accepted for publication April 21, 2017; available ahead of print May 23, 2017.

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J Thorac Cardiovasc Surg 2017;154:1054-5

0022-5223/\$36.00

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Application of near-infrared spectroscopy probe for cerebral oxygen monitoring in neonate.

Central Message

Isolated cerebral near-infrared spectroscopy in neonates correlated poorly with cerebral venous oxygen saturation.

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Near-infrared spectrometry (NIRS) provides noninvasive and continuous monitoring of cerebral and somatic tissue regional oxygen saturation (rSO_2). NIRS sensors for cerebral assessment of the rSO_2 are placed on the forehead. It is generally recommended to place the probe on the right or left side of the forehead and away from superior sagittal sinus. Such placement, however, is not always feasible, especially, in low-birth weight neonates. Some interference from the superior sagittal sinus thus may still occur, increasing the variability of measurements. Furthermore, some neonates tend to retain fluid after extensive cardiac surgical procedures, particularly procedures that require circulatory arrest with or without isolated cerebral perfusion. Such fluid retention in subdural and subarachnoid spaces may further affect cerebral rSO_2 measurements (Figure 1). Finally, cerebral rSO_2 is significantly lower in cyanotic neonates, particularly those

with systemic-to-pulmonary circulatory shunting, than neonates with normal cardiac physiology, and usually ranges between 40% and 60%. Perioperative management of neonates with hypoplastic left heart syndrome (HLHS) undergoing stage 1 palliation is a perfect example of a clinical setting in which *reliable* cerebral oxygen monitoring would be utterly important yet often not feasible. To complicate the matter further, NIRS monitors are available from at least 10 manufacturers. None of them is identical.

FIGURE 1. Application of a near-infrared spectroscopy probe for cerebral oxygen monitoring in a neonate.

In the recent decades, there has been substantial interest in perioperative continuous monitoring of cerebral oxygen saturation in neonates with HLHS undergoing stage 1 palliation.¹⁻³ The use of postoperative cerebral venous oxygen saturation (ScvO₂) monitoring through an internal jugular vein catheter allows better monitoring of circulation, which in turn may result in improved early outcomes.⁴ Such invasive monitoring, however, is challenging. NIRS is therefore now gaining traction as a noninvasive method of monitoring adequacy of cerebral oxygen delivery in the perioperative period.⁵ Inasmuch as the concept of NIRS oxygen monitoring seems attractive, clinical interpretation of NIRS data in neonates with HLHS after stage 1 palliation, in terms of both absolute values and trends, is difficult regardless of whether isolated cerebral or additional splanchnic monitoring is used.⁶

In an insightful and well-designed study published in this issue of the *Journal*, Rescoe and colleagues⁷ have analyzed correlation of NIRS-derived data with ScvO₂ measured by co-oximetry from the internal jugular vein in 73 neonates after stage 1 palliation for HLHS. They demonstrated that cerebral rSO₂ correlated poorly with low ScvO₂, and they suggest that cerebral rSO₂ not be used in isolation. This problem was somewhat ameliorated by correction of the signal for arterial contamination.

Where do we go from here? NIRS appears to be too valuable a tool to be simply discarded. A perioperative risk

assessment that would include multisite NIRS and hemodynamic monitoring might still allow early determination of low-cardiac output. Two numbers are better than one. Whether the NIRS technology will add any useful information to a simple bedside assessment by an astute clinician is yet to be seen.

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