Commentary: White matter injury and heart surgery—Will we get to the heart of the matter?

Phillip S. Naimo, MD,^{a,b,c} and Igor E. Konstantinov, MD, PhD, FRACS^{a,b,c,d}

From the ^aDepartment of Cardiothoracic Surgery, Royal Children's Hospital, Melbourne, Australia; ^bMurdoch Children's Research Institute, Melbourne, Australia; ^cUniversity of Melbourne, Melbourne, Australia; and ^dMelbourne Children's Centre for Cardiovascular Genomics and Regenerative Medicine, Melbourne, Australia.

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Address for reprints: Igor E. Konstantinov, MD, PhD, FRACS, Royal Children's Hospital, Flemington Rd, Parkville 3052, Australia (E-mail: igor.konstantinov@rch.org.au).

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Igor E. Konstantinov, MD, PhD, FRACS (left), and Phillip S. Naimo, MD, BSc (right)

Central Message

There is no direct correlation between cerebral oxygenation or autoregulation and white matter injury after congenital cardiac surgery.

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It appears that the understanding of cerebral blood circulation has been evolving for centuries. Physicians have been aware of blood flow to the brain since approximately 2800 BCE; however, it was not until 1762 CE that investigation into the physiology of cerebral blood flow commenced.¹ Finally, in the mid-1900s, Kety and Schmidt² reported the first quantitative measure of cerebral blood flow. Since then, there has been a dramatic increase in research on cerebral blood physiology, and a number of noninvasive measurement techniques have been developed. Of particular interest in recent years has been the mechanism of white matter injury during neonatal and infantile cardiac surgery.

In a thought-provoking and thorough study published in the current issue of the *Journal*, Claessens and colleagues³ report that there was no correlation between cerebral oxygenation or cerebral autoregulation and postoperative white matter injury. There have been several methods used as a proxy to measure cerebral autoregulation. In the study of Claessens and colleagues,³ cerebral oxygenation was measured by near-infrared spectroscopy and correlated with mean arterial blood pressure to give an estimation of cerebral autoregulation. Although near-infrared spectroscopy appears to be a useful tool in measuring cerebral oxygenation, care must be taken in interpreting results, because several factors may affect measurements. First, near-infrared spectroscopy will represent a mixed oxygen saturation, of which 75% is determined by venous saturation,³ and thus it may be affected in cyanotic heart conditions. In addition, factors as simple as sensor placement or fluid retention may also alter results.⁴ Although no direct correlation has been demonstrated in this prospective study, it is an important step in our understanding of perioperative white matter injury.

It appears that neonatal cerebral vasculature and autoregulatory systems are underdeveloped, and even more so in neonates with congenital heart defects.^{5,6} In some

patients, autoregulatory systems may not be functioning, and passive cerebral perfusion is not uncommon.⁷ Although studies have shown new white matter injury in 30% to 60% of neonates undergoing cardiac surgery,⁵ it is important to recognize that 20% to 40% of injury may occur preoperatively.^{5,8,9} The direct correlation of white matter injury with cardiac surgery thus remains elusive.

Although this prospective study of Claessens and colleagues³ failed to find any correlation, it did not fail in its purpose. We would like to sum up with a famous statement that often is attributed to Thomas A. Edison, "I have not failed. I have just found 10,000 ways that won't work." Indeed, once again we see no clear correlation between cerebral oxygenation or cerebral autoregulation and white matter damage after cardiac surgery.

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