When monitoring brain and forearm simultaneously with near infrared spectroscopy: What can be learned?

Dear Editor,

Cerebral oximeters use near infrared spectroscopy (NIRS) to monitor cerebral oxygenation noninvasively by emitting and detecting light through the scalp. The Beer-Lambert law is then used to calculate oxygenation values based on changes in the spectrum of light absorbed by hemoglobin. This method can detect conditions such as cerebral hypoxia, where the brain is not receiving enough oxygen.[1]

The authors are currently monitoring NIRS of both the brain and the forearm in cardiac surgery patients for investigational purposes. The correlation between the NIRS values of the brain and forearm appears to vary a lot depending on the patient; however, in general, NIRS values of the brain show slightly delayed, obtuse change after the values of the forearm, following cardiovascular changes. Figure 1a shows the changes of two NIRS values after a repeated bolus dose of ephedrine due to hypotension. We describe two interesting events which might imply that monitoring NIRS of the brain and forearm simultaneously may give clinicians helpful information.

Case 1

A 65-year-old male patient with a body mass index of 35 underwent coronary artery bypass graft surgery. The bed was right-tilted to the maximum setting to improve the view of the surgical field. About 3 minutes after tilting, the NIRS value in the patient's right arm decreased from 80% to 30% during approximately 30 minutes [Figure 1b]. However, the waveform of the right radial arterial line and the pulse oximeter of the right digit showed no significant abnormalities during this period. Moreover, the cerebral oximeter values did not decrease. The patient's position was changed back to supine, and the NIRS value in the right arm returned to normal.

Case 2

A 63-year-old female patient with DeBakey type 1 aortic dissection underwent ascending and aortic arch replacement. After aortic cannulation, the blood pressure decreased. Subsequently, the NIRS values in the right side of both the brain and forearm decreased. However, the left side was different; cerebral saturation showed fluctuations while the arm saturation remained stable [Figure 1c]. We discussed the situation with the surgeon and found out the aortic cannulation was too deep and directed far to the left. The surgeon readjusted the direction and depth of aortic cannulation, and the NIRS levels were restored.

We discovered that the NIRS monitoring of forearms could detect perfusion impairments that other monitors may not detect. Even without ischemia, acute venous congestion can cause unfavorable problems, such as the release of inflammatory mediators.[2] Moreover, the direction and appropriateness of the perfusion might be crucial to better outcomes during aortic cannulation. Monitoring forearm NIRS can provide additional information regarding the positioning quickly. Therefore, it would be helpful to be aware of this beforehand, although it may involve additional costs.

Somatic NIRS indeed have a limitation and may show differences in values when there are underlying conditions such as age and vascular disease, making it difficult to make clear judgments.[3] However, it may provide useful information in some cases and may deserve further investigation.

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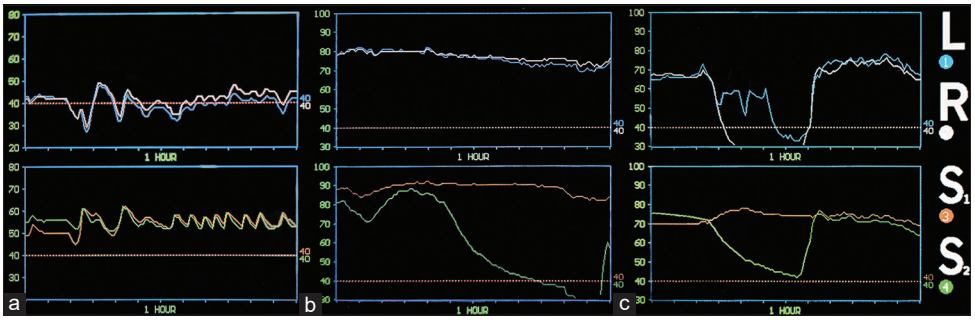

Figure 1: (a) Cerebral and forearm oxygen saturation after repeated bolus doses of ephedrine, (b) The saturation in the right arm is decreasing, (c) The saturation of the right cerebral and forearm has decreased, but the left cerebral saturation has fluctuated, and the left arm saturation is maintained well. Blue line: left cerebral, White line: right cerebral, Orange line: left arm, Green line: right arm

Conflicts of interest

There are no conflicts of interest.

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