Letter to the Editor, “Clinical Significance of Cerebral Oxygenation During Exercise in Patients With Coronary Artery Disease”

To the Editor:

With great pleasure we read the article by Koike et al. This is an interesting study investigating, by non-invasive near infrared spectroscopy, the forehead cortical oxy-hemoglobin changes (ΔO2Hb) during an incremental symptom-limited cycling exercise test in 344 cardiac patients, and comparing the data with indexes obtained from cardiopulmonary exercise testing. The ΔO2Hb measured from rest to peak exercise was significantly lower in non-survivors than in survivors, suggesting that a decrease in cerebral O2Hb during exercise predicts future cardiovascular events in patients with coronary artery disease.

Although the results are of interest, we believe that certain points concerning the presentation of the brain oxygenation data need to be addressed. For measuring brain oxygenation Koike et al1 used a multi-distance spatially resolved tissue oximeter (NIRO-300, Hamamatsu Photonics, Hamamatsu, Japan) without exploiting the offered advantage to quantify brain oxygenation directly as tissue O2Hb saturation (tissue oxygenation index, TOI%). The TOI reflects the dynamic balance between oxygen supply and oxygen consumption and it is independent of the path length of the near-infrared photons in brain tissue.1-4 Near-infrared spatially resolved spectroscopy implies that the light intensity is measured at several different source-detector distances.5-7 Therefore, this non-invasive technique allows the measurement of the slope of light attenuation vs distance and provides a high signal-to-noise ratio, without being so sensitive to the optical coupling and to the presence of superficial tissue layers. The TOI is supposed to replicate cortical O2Hb saturation8 Using the NIRO-300 in the controlled environment of carotid endarterectomy, it has been demonstrated that TOI is sensitive to changes in hemispheric, intracerebral blood supply and is little affected by extracranial contamination.9 The TOI has also been shown to be independent of hemoglobin concentration, skull thickness, and the area of the cerebrospinal fluid layer underlying the optodes8-9

Koike et al1 did not report changes in TOI, deoxy-hemoglobin (HHb) (measurable also by the NIRO-300), and total Hb (ΔHb=ΔO2Hb+ΔHHb), which are necessary for a correct interpretation of brain oxygenation changes. The ΔHb, being strictly related to blood volume changes, can be considered an indirect measure of changes in local blood flow. Because ΔHHb is closely associated with changes in venous oxygen content and is less sensitive to ΔO2Hb changes than ΔO2Hb changes, HHb changes are believed to be a sensitive measure of relative tissue de-oxygenation due to oxygen extraction only when Hb is stable. Therefore, speculations on the forehead oxygenation changes based only on the increase and decrease of O2Hb during the exercise are not fully reliable. Considering the potential clinical relevance of their findings, we would suggest they expand the results to include the TOI data as correctly done in their other recent interesting clinical studies.10,11

References


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