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Letter by Derakhshan Regarding Article, “Intraoperative Magnesium Administration Does Not Improve Neurocognitive Function Following Cardiac Surgery”

To the Editor:

The human brain is a binomial organ, consisting of 2 hemispheres. A hallmark of binomial distribution of lesions affecting supratentorial components is that the highest rate of any sign or symptom attributable to lesions affecting either hemisphere is 50%. For example, the highest incidence of epilepsy or Wernicke aphasia affects the brain is 50%, as is the ultimate rate of postoperative cognitive decline (POCD) in those undergoing coronary artery bypass grafts. This is because all of the conditions enumerated (seizures, aphasia, and cognition) are related to injury involving the major hemisphere (left, in vast majority of right-handed people).

This letter is dedicated to clarifying the reason behind the abovementioned statistical fact, confirmed in a recent article published in Stroke by Mathew et al.

Historically, the first instance of the abovedescribed prediction was the influential work by Kernohan and Woltman in 1929. According to this work, 17 of 35 patients (50%) with supratentorial space-occupying lesions developed ipsilateral pyramidal signs, erroneously ascribed to the compression of contralateral cerebral peduncle against tentorium due to herniation. It has since become clear that the appearance of pyramidal signs on the same side as the major hemisphere is a diaschitic phenomenon unrelated to any intracranial displacement present. Instead, the dreaded clinical findings are because of the withdrawal of excitatory signals originating from the major hemisphere but destined to the minor via the corpus callosum, for activating the limbs on the nondominant side of the body (ie, limbs ipsilateral to the major hemisphere).

Alternatively, the absence of clinical signs in lesions affecting the dominant hemisphere may point to the insensitivity of the method(s) used for eliciting the same, or to the fact that the lesion in question is located at a distance from the frontal lobe in order to influence interhemispheric communications between hemispheres. In case of epilepsy, epileptogenicity of the specific region is the relevant consideration. The occipital lobes, for example, are far less prone to generate seizures than are frontal or temporal lobes. Finally, it is a rare case in which the subject’s neural and behavioral handedness does not match, allowing the person with lesion affecting the supposed major hemisphere (based on behavioral handedness) to escape the expected POCD after a lesion affecting the left (but nondominant) hemisphere.

In the report by Mathew et al (involving n=400 participants equally divided into placebo and intravenous magnesium groups), the incidence of POCD was 45% in both groups. This is the same ratio as that recently reported by Messerotti Benvenuti et al. Fortunately, Messerotti Benvenuti et al’s study included presurgical bilateral continuous transcranial Doppler sonography on all participants undergoing surgery (a total of 31 right-handed patients). After the operation, 14 of the 15 (45%) participants with diminished flow to their left middle cerebral arteries showed decreased performance in part B of the Trail Making Test. The status of flow on the right side was not relevant to the postsurgical outcome. As discussed elsewhere, the one exception to the rule in that study must have escaped POCD because he or she was wired as a lefthander (ie, the participant was right-hemispheric in his/her laterality of motor control).

In light of the above, the authors’ expectation of reducing the rate of POCD to 25% by intravenous magnesium was based on lack of appreciation of the role of laterality-indexed cortical hypoperfusion in generating POCD. Whereas, bimanual simultaneous drawing test in candidates for surgery would have guided the authors by focusing on the integrity of cortical circulation on the side opposite to the hand that drew the longer lines (ie, the dominant hemisphere), sparing those destined to develop POCD after surgery.

Disclosures

None.

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