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Letter to the Editor

# Correlation between transcranial Doppler parameters and parenchymal intracranial pressure in an experimental model of cerebral rebleeding*

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Increased intracranial pressure (ICP) is a common condition in neurosurgery practice, being associated with several conditions, such as traumatic brain injury, cerebral hemorrhages, and neoplasia. Currently, the gold standard methods for monitoring ICP are invasive – intraventricular and intraparenchymal catheters – and complicate with hematomas, infections and misplacement in up to 10% of patients[1-4]. These techniques estimate ICP through tension measuring microsensors or fiber optic catheters, which detects changes in resistance and changes in light reflection, respectively.

During the last years, the use of transcranial Doppler (TCD) has been investigated as a non-invasive surrogate for intraventricular and intraparenchymal catheters, but the results of previous studies were controversial regarding the benefit and usefulness of this method[5,6]. The TCD assess the systolic (SV) and diastolic (DV) velocity of blood flow in the basal arteries of the brain, the direction of blood flow and the characteristics of waveforms. The mean blood flow velocity (MV) and the Pulsatility Index (PI) are variables derived from the values of VS and VD that can be used to evaluate the cerebral hemodynamics. The VM has a linear relationship with the cerebral blood flow (CBF), following the function CBF = VM x insonated vessel area x cosine of insonation angle[3,7]. The PI indicates the resistance to flow downstream of the insonation point, being obtained from the equation IP = (SV – DV) / MV[8].

We performed an experimental study to assess the correlation of TCD parameters with parenchymal intracranial measure in a model of cerebral rebleeding. The results demonstrated a statistically significant inverse correlation between Parenchymal ICP and SV, DV and MV, while the PI demonstrated a statistically significant direct correlation with parenchymal ICP. These findings support previous evidence about the value of TCD as a surrogate for intraventricular and intraparenchymal catheters. This is an important evidence, as the validation of this method can increase the assessment of ICP as part of routine care of neurocritical patients without exposing them to additional serious complications. The main strength of our study is the assessment of cerebral hemodynamic using TCD in hyperacute phases of hemorrhage, which is difficult to be performed in humans, due to the time taken to transport patients to the referral hospital. The standardized lesion and systemic hemodynamic conditions of the models also increases the study internal validity.

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