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Role of Transcranial Doppler in Traumatic Brain Injury

Travmatik Beyin Hasarında Transkraniyal Dopplerin Rolü

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INTRODUCTION

Sir, I read with interest this article by Gura et al (3) regarding the use of transcranial Doppler (TCD) sonography derived pulsatility index (PI) as a reliable index of intracranial pressure (ICP) in patients with traumatic brain injury (TBI). I wish to highlight some important issues related to this manuscript.

I agree that one of the important causes of neurological deterioration in patients with TBI is the increase in ICP secondary to cerebral edema (4). An elevated ICP hampers the cerebral perfusion and these dynamic changes can be evaluated in real time by proportionate reduction in blood flow velocities and PI on TCD (2). Thus, TCD can provide important information about ICP and help in early identification of patients who could deteriorate after TBI. Although, TCD parameters reflect ICP, they can be affected by various physiological and disease states. Some of the important factors that can produce false-positive TCD findings (of high PI) are hyperventilation in anxious individuals, diffuse and severe intracranial atherosclerosis and severe cardiac valvular regurgitant lesions (1,6,7). Most importantly, in patients on mechanical ventilation, any hyperventilation and the reduction in carbon di-oxide levels would immediately lead to a significant increase in PI. On the other hand, patients with cerebral ischemia due to traumatic parenchymal injury or arterial dissection may demonstrate a false-negative low PI due to autoregulatory vasodilatation (5).

The best approach for avoiding these false-positive and false-negative findings is the serial TCD assessments. TCD waveforms reflect beat-to-beat changes in cerebral hemodynamics. Since the waveforms (and hence PI) may be affected by various conditions described above, it is important to obtain a baseline examination as soon as possible after TBI, before ICP starts to rise. I believe that if a brief TCD could be performed by the paramedics at the site of accident or during transport, this would provide the most reliable baseline data. As correctly pointed by the Gura et al (3), PI is dimensionless and not affected by the angle of insonation, even less-experienced paramedics can perform this simple test with acceptable reliability. Importantly, such basic TCD waveforms can be obtained within a couple of minutes without interfering with the patient management. Since TBI is usually a diffuse process, spectral waveforms obtained from middle cerebral artery (MCA) or posterior cerebral artery (the only artery that could be mistaken for MCA through trans-temporal approach by inexperienced sonographers) are expected to reflect ICP. The TCD waveforms obtained by the paramedics would serve as a reliable reference for subsequent evaluations and provide important information about the dynamic intracranial effects of TBI and changes in ICP.

Invasive ICP monitoring is an established tool for managing patients with TBI. However, it provides information about ICP only. On the other hand, TCD provides additional real-time information about cerebral perfusion as well as cerebral vasomotor reactivity. Thus, in TBI patients being treated without an invasive monitoring, TCD provides important information about ICP and cerebral hemodynamics. In patients on invasive ICP monitoring, serial TCD examinations provide complementary information. Therefore, TCD is an important tool for monitoring the natural course of the disease, evaluating the effect of medical treatment or various interventions, prognostication as well as selecting high-risk patients after TBI.

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