

Volumetric Reactivity Index

A prospective study of an innovative non-invasive ultrasonic cerebrovascular autoregulation (CA) monitoring method is based on real-time measurements of intracranial blood volume (IBV) reactions following changes in arterial blood pressure. In this study, we aimed to determine the clinical applicability of a non-invasive CA monitoring method by performing a prospective comparative clinical study of simultaneous invasive and non-invasive CA monitoring on intensive care patients.

METHODS: CA was monitored in 61 patients with severe traumatic brain injuries invasively by calculating the pressure reactivity index (PRx) and non-invasively by calculating the volumetric reactivity index (VRx) simultaneously. The PRx was calculated as a moving correlation coefficient between intracranial pressure and arterial blood pressure slow waves. The VRx was calculated as a moving correlation coefficient between arterial blood pressure and non-invasively-measured IBV slow waves.

RESULTS: A linear regression between VRx and PRx averaged per patients' monitoring session showed a significant correlation ($r = 0.843$, $p < 0.001$; 95% confidence interval 0.751 - 0.903). The standard deviation of the difference between VRx and PRx was 0.192; bias was -0.065.

CONCLUSIONS: This prospective clinical study of the non-invasive ultrasonic volumetric reactivity index VRx monitoring, based on ultrasonic time-of-flight measurements of IBV dynamics, showed significant coincidence of non-invasive VRx index with invasive PRx index. The ultrasonic time-of-flight method reflects blood volume changes inside the acoustic path, which crosses both hemispheres of the brain. This method does not reflect locally and invasively-recorded intracranial pressure slow waves, but the autoregulatory reactions of both hemispheres of the brain. Therefore, VRx can be used as a non-invasive cerebrovascular autoregulation index in the same way as PRx and can also provide information about the CA status encompassing all intracranial hemodynamics ¹⁾.

¹⁾

Petkus V, Preiksaitis A, Krakauskaitė S, Bartusis L, Chomskis R, Hamarat Y, Zubaviciute E, Vosylius S, Rocka S, Ragauskas A. Non-invasive Cerebrovascular Autoregulation Assessment Using the Volumetric Reactivity Index: Prospective Study. *Neurocrit Care*. 2018 Jun 27. doi: 10.1007/s12028-018-0569-x. [Epub ahead of print] PubMed PMID: 29951960.

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