



POSTER PRESENTATION

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Non-invasive assessment of ICP during infusion test using Transcranial Doppler Ultrasonography

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Background

Transcranial Doppler (TCD) based methods have been used to estimate ICP noninvasively (nICP), however their relative accuracy varies between different types of intracranial hypertension: vasogenic, CSF circulatory or secondary to brain volumetric changes (oedema, contusion, hematoma, etc). This study aimed to compare four nICP methods in a prospective cohort of hydrocephalus patients whose CSF dynamics was investigated using infusion tests involving controllable test-rise of ICP.

Methods

FV, ICP and non-invasive ABP were recorded in 53 patients diagnosed for hydrocephalus. nICP methods were based on: I) interaction between FV and ABP using black-box model (nICP_BB); II) diastolic FV (nICP_FVd); III) critical closing pressure (nICP_CrCP) and IV) TCD-derived pulsatility index (nICP_PI). Correlation between rise in ICP (Δ ICP) and Δ nICP and averaged correlations for changes in time between ICP and nICP during infusion test were investigated.

Results

All nICP formulas overestimated ICP at baseline ($p < 0.005$): nICP_BB 10.76 (15.08-7.30); nICP_FVd 16.97 (22.56- 11.64); nICP_CrCP 18.34 (20.38-14.89); nICP_PI 16.57 (17.46-16.06). At plateau of ICP during infusion test, only nICP_BB and nICP_PI presented significant difference from ICP. From baseline to plateau, all nICPs estimators increased significantly (paired t-test, $p < 0.05$). Correlations between Δ ICP and Δ nICP were better represented by ICPn_PI and ICPn_BB: 0.45 and 0.30 ($p < 0.05$). nICP_FVd and nICP_CrCP presented non-significant

correlations: -0.17 ($p = 0.21$), 0.21 ($p = 0.13$). For changes in ICP during individual infusion test ICPn_PI, ICPn_BB and ICPn_FVd presented similar correlations with ICP: 0.39 ± 0.40 , 0.39 ± 0.43 and 0.35 ± 0.41 respectively. ICPn_CrCP presented a weaker correlation ($R = 0.29 \pm 0.24$). In those cases where changes of ICP related to vasogenic fluctuations (plateau waves, B waves) overlapped rise related to CSF infusion, time- correlation between real and estimated ICP seemed to be remarkably better.

Conclusions

Out of the 4 methods, nICP_PI was the one with best performance for predicting changes in Δ ICP during infusion test, followed by nICP_BB. nICP_FVd and nICP_CrCP showed unreliable correlations. Changes of ICP observed during the test were expressed by nICP values with only a moderate correlations. Vasogenic components of ICP seemed to be easier to estimate with TCD, than component related to increased CSF circulation.

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