

Comparing Lumbar Puncture Opening Pressure and Optic Nerve Head Height Measured by an Artificial Intelligence in Idiopathic Intracranial Hypertension Patients

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Purpose

Individuals with idiopathic intracranial hypertension (IIH) have elevated lumbar puncture opening pressure (LPOP) and commonly have optic disc edema, resulting in an elevated optic nerve head (ONH) height. We performed a retrospective chart review study and developed artificial intelligence software to investigate the hypothesis that a correlation might exist between LPOP and ONH height. We aimed to explore whether non-invasive measurement of ONH height could serve as a viable surrogate, instead of invasive lumbar puncture, in monitoring patients with IIH.

Methods

Patients aged 15 to 45 without retinal or optic nerve head pathology, diagnosed with IIH between 1986 and 2023 and underwent lumbar puncture and OCT-RNFL within a week of one another were included (n=72, male=8, female=64, mean 30 +/- 9 years). An artificial intelligence software, created with a convolutional neural network-based model. It was trained to map the OCT-RNFL image, including predicting a line that joins two ends of the retinal pigment epithelial (RPE) layer adjacent to the optic disc. Then, the software measured the distance from the highest point of the nerve fiber layer (NFL) to the approximate RPE vertically below to NFL layer (Figure 1). Linear mixed model analysis accounted for the correlation of eyes within a participant, while ordinary least squares (OLS) evaluated the correlation between LPOP and ONH height.

Results

A robust correlation existed between the ONH height of the right and left eyes in the same individual (Spearman's rank correlation = 0.8319, p<0.0001). Conversely, there was a weak correlation between opening pressure and BMI (Spearman's = 0.3383). However, the OLS regression model indicated no statistically significant correlation between LPOP and ONH height (Figure 2).

Conclusions

No significant correlation was found between lumbar puncture opening pressure and optic nerve head height.

Consequently, OCT-RNFL cannot be used solely to monitor IIH patients in lieu of lumbar puncture. An integral aspect of the project was the development of artificial intelligence software, as no pre-existing software calibrated to measure the tissue distance of the optic nerve head based on mapped RNFL images was known to us.