Distortion Product Otoacoustic Emissions for Non-Invasive Intracranial Pressure Assessment

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Background

Currently, there are no reliable non-invasive methods for assessing intracranial pressure (ICP). Distortion product otoacoustic emissions (DPOAE) are evoked sound waves from the cochlea in response to specific externally delivered frequencies. Due to the connection of the cranial subarachnoid space and perilymphatic fluid via the cochlear aqueduct, changes in the ICP may affect DPOAEs.

Methods

This study was approved by the Baylor College of Medicine Institutional Review Board, and written informed consent was obtained from all subjects. We enrolled 20 subjects in this six month prospective pilot study. The inclusion criteria were: age 18-60 years and required LP based on neurological condition. An upper limit of 20 subjects in this six month prospective pilot study. The inclusion criteria were: age 18-60 years and required LP based on neurological condition. An upper limit of

Results

Technical success was achieved in 90% (n=18) of patients. For data analysis, we divided subjects into three groups based on small, medium or large changes between opening and closing ICPs. Group A, B and C are subjects with large, medium and small ICP changes respectively from pre to post CSF drainage. For DPOAE magnitudes, we found significant increases between pre and post-LP measurements respectively when comparing groups, mainly at DPOAE F2 frequencies between 700 to 1200 Hz. For the DPOAE phase angles, we found significant negative phase angle shifts of 0.1 to 0.25 cycles when comparing groups with large and medium ICP changes vs. those with small ICP changes, mainly at DPOAE F2 frequencies between 1000 to 2000 Hz. Figures 1 and 2 show the pre and post-LP data from subjects in groups A and C respectively. Figure 3 summarizes the DPOAE magnitude and phase angle changes from pre to post-LP by group combining all data points.

Conclusions

We report for the first time that changes in ICP are associated with significant changes in DPOAE parameters. Specifically, DPOAE magnitudes increased, and phase angles shifted when ICP changed. These findings are consistent with a previous study measuring DPOAE before and after body tilt as an analog for producing ICP changes. Further studies are warranted to develop correlation and ROC curves that relate DPOAE parameters with ICP changes, and further characterize the specific frequencies where ICP modulates DPOAE responses.

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