HeadSense medical

HeadSense Medical develops inexpensive, easy-to-use devices for patient monitoring and diagnosis of cerebral dysfunction. The HS-1000 is the first product of the company.

The author and the developer of the device, as well as the co-founder and scientific director of the company is Surik Papyan, who is originally from Armenia and currently resides in Israel.

What are the advantages of the HS-1000 over the existing invasive and noninvasive ICP monitoring methods?

Figuratively speaking, the HS-1000 “listens” to our brains.

“The brain, just like the rest of the body, makes a noise when it works. This noise is at “low frequencies,” so we do not hear it. The sound of our circulatory system can be compared with the sounds of running water. The blood makes a different noise when it passes through too narrow or too wide vessels,” Surik Papyan explained.

We can “hear” these “sounds” only when we put a microphone in the ear canal, because of the fact that the outer ear canal, being hermetically sealed, becomes a unique resonator, something like an “organ pipe,” according to Alexander Khachunts, who is the head of the Laboratory of Psychophysiology of the National Academy of Sciences of Armenia and also took part in this project.

Just as a skilled mechanic can detect faults in a vehicle by listening to the sound of the engine, the HS-1000 can identify problems in the brain by listening to its sounds. The mathematical algorithms implemented in the device allow to dynamically measure and display the value of intracranial pressure.

The HS-1000 is equipped with a microphone, which is placed in the ear and records the mixed acoustic signal, which is formed by hemodynamic and liquorodynamic processes in the brain. It also records the air flow in the upper airways.

The acoustic signal is transmitted from the microphone to a tablet, PC or a mobile device with a special application installed. This application calculates the level of intracranial pressure and the physiological parameters needed to assess the patient's condition. Then the results are displayed.

see more
https://med.news.am/eng/news/9852/new-noninvasive-method-of-intracranial-pressure-monitoring-hs-1000-listens-to-the-brain.html

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In a study a new method of Noninvasive intracranial pressure monitoring performed using algorithms to determine ICP based on acoustic properties of the brain was applied in patients undergoing invasive intracranial pressure monitoring, and the results were analyzed.

In patients with traumatic brain injury and subarachnoid hemorrhage who were undergoing treatment in a intensive neurocritical care unit, Ganslandt et al., from the Department of Neurosurgery, Klinikum Stuttgart; and Department of Neurosurgery, University of Erlangen, Germany recorded ICP using the

gold standard method of invasive external ventricular drainage or intraparenchymal monitoring. In addition, they simultaneously measured the ICP noninvasively with a device (the HS-1000) that uses advanced signal analysis algorithms for acoustic signals propagating through the cranium. To assess the accuracy of the NI-ICP method, data obtained using both I-ICP and NI-ICP monitoring methods were analyzed with MATLAB to determine the statistical significance of the differences between the ICP measurements obtained using NI-ICP and I-ICP monitoring.

Data were collected in 14 patients, yielding 2543 data points of continuous parallel ICP values in recordings obtained from I-ICP and NI-ICP. Each of the 2 methods yielded the same number of data points. For measurements at the ≥ 17-mm Hg cutoff, which was arbitrarily chosen for this preliminary analysis, the sensitivity and specificity for the NI-ICP monitoring were found to be 0.7541 and 0.8887, respectively. Linear regression analysis indicated that there was a strong positive relationship between the measurements. Differential pressure between NI-ICP and I-ICP was within ± 3 mm Hg in 63% of data-paired readings and within ± 5 mm Hg in 85% of data-paired readings. The receiver operating characteristic-area under the curve analysis revealed that the area under the curve was 0.895, corresponding to the overall performance of NI-ICP monitoring in comparison with I-ICP monitoring.

This study provides the first clinical data on the accuracy of the HS-1000 NI-ICP monitor, which uses advanced signal analysis algorithms to evaluate properties of acoustic signals traveling through the brain in patients undergoing I-ICP monitoring. The findings of this study highlight the capability of this NI-ICP device to accurately measure ICP noninvasively. Further studies should focus on clinical validation for elevated ICP values [1].

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Ganslandt O, Mourtzoukos S, Stadlbauer A, Sommer B, Rammensee R. Evaluation of a novel noninvasive ICP monitoring device in patients undergoing invasive ICP monitoring: preliminary results. J Neurosurg. 2018 Jun;128(6):1653-1660. doi: 10.3171/2016.11.JNS152268. Epub 2017 Aug 8. PubMed PMID: 28784032.