University of Zurich[UZH]

Institute of Physiology

PhD Thesis Defense

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Noninvasive Measurement of the Head's Dielectric Properties: a Potential Approach for Assessing Craniospinal Compliance

Space-occupying neurological disorders such as hydrocephalus affect the pressure-volume state within the craniospinal compartment. In patients suffering from these pathologies, the assessment of craniospinal compliance (CC) is clinically useful at different phases of patient care. However, the only accurate and reliable approaches to acquire CC are invasive. The aim of this project was to investigate the continuous measurement of the head's dielectric properties as a novel noninvasive method to estimate CC, since both the head's dielectric properties and CC depend on intracranial volume composition. Through a custom-built apparatus, the electric signal W is measured. To assess whether W contains information on CC, tilt testing was performed in healthy volunteers. AMP, the peak-to-valley amplitude in W due to cardiac activity, was observed to decrease during head-up tilting, and to increase during head-down tilting, both in younger (< 30 years) and older (> 60 years) subjects. AMP decreased with increasing intracranial compliance during tilting. This aligns with the tilt-related changes in how intracranial cerebrospinal fluid and blood volumes vary during the cardiac cycle. Such interpretation of the results was supported by computational electromagnetics simulations. Furthermore, AMP was higher in the older compared to the younger cohort in all investigated conditions, which is consistent with the expected reduction of CC with age. Overall, the present work suggests that W may contain information on CC, with AMP as promising potential CC surrogate. To confirm this, a clinical study with concomitant invasive acquisition of CC and noninvasive measurement of W is in progress.

Thursday, July 11, 2024, 16:00
Lecture Room: Y23 K52
via Zoom, Meeting ID: 614 4226 5943, Passcode: 616250

After the defense, you are cordially invited to an apéro.

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