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Deep intracerebral electric field measurement with stereoelectroencephalography during transcranial electrical stimulations in human in-vivo

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OC19: Visual evoked potentials monitoring during neurosurgical operations: optimizing the protocol—E. Levin, A. Vasyatkina, P. Semin, R. Kiselev (Meshalkin National Medical Research Centre, Russian Federation)

Visual evoked potentials (VEPs) are used for intraoperative neurophysiological monitoring (IONM) during surgeries involving visual system. But unlike other IONM modalities, no standards have been yet developed for the intraoperative VEPs monitoring. Here we consider VEPs registration parameters contributing to their successful and useful monitoring.

Methods. 144 consecutive surgeries (288 eyes) performed using VEPs monitoring were analyzed retrospectively. Stimulation: flash intensity 25000 lx, duration 10 ms, frequency ~1 Hz, 20–100 responses averaged. 7 electrodes placed, three pairs chosen. Bandpass filtering: [10–20] – [200–400] Hz (chosen individually). Alarm: standard 10–50% criteria. Anesthesia: propofol – 110 surgeries, sevoflurane – 14, combined – 20. In 27 surgeries, propofol-to-sevoflurane transition performed after dura closure.

Results. Chosen electrode pairs: Oz-A1&Oz-A2 in 45% of surgeries, O1/O2/Oz-CPz in 25%, O1/O2/Oz-Fz in 24%.

Chosen frequency filters: 100–400 Hz (200 Hz in 67%) low-pass, 5–20 Hz (10 Hz in 59%) high-pass.

Anesthesia effects: 5,9% unresponsive non-blind eyes for propofol and 18,5% for sevoflurane anesthesia. After propofol-to-sevoflurane transition VEPs disappeared in 22% of cases.

Alarm criteria had been reached for 73 eyes. Full recovery observed later in 62%, partial in 23%, no recovery in 15% of cases.

Postoperative visual impairments among eyes with: successful VEPs monitoring without alarms – 3%, full recovery after alarms – 7%, incomplete or no recovery – 23%, unobtainable VEPs – 14%.

Conclusions. Optimal parameters of VEPs recording for IONM should be selected individually and differs from the standards for clinical diagnostics. VEPs recording under (low-to-moderate-dose) sevoflurane is often possible, but the propofol anesthesia is preferable.

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OC20: Deep Intracerebral Electric Field Measurement with Stereoelectroencephalography during Transcranial Electrical Stimulations in Human in-vivo—S. Louvriot^a, L. Tyvaert^b, L.G. Maillard^b, S. Colnat-Coulbois^c, J.P. Dmochowski^d, L. Koessler^a (^aUniversité De Lorraine, Cnrs, Cran F-54000, France, ^bUniversité De Lorraine, Chru-Nancy, Service De Neurologie, F-54000, France, ^cUniversité De Lorraine, Chru-Nancy, Service De Neurochirurgie, F-54000, France, ^dDepartment Of Biomedical Engineering, City College Of New York, United States)

Measuring the electric field generated in several deep brain structures during Transcranial electrical stimulation in humans in-vivo. In addition, we investigated the effects of TES intensities and montages on the intracerebral EF.

Transcranial electrical stimulation (TES) has shown for the last decades promises as a treatment for several neurological and psychiatric disorders. Its efficiency is related to the amount of electric field (EF) magnitude delivered on the target. Very few studies (n=3) estimated the in-vivo intracerebral electric fields in human. They relied mainly on electrocorticographic recordings that require a craniotomy and did not precisely focus on targeting the deep cortical structures which can still lead to some discussion about the TES possibility to reach deep structures.

We applied Transcranial alternating current stimulations simultaneously with intracerebral recordings (SEEG) in 7 drug-resistant epileptic patients. Two low intensities were used in 6 patients (0.5 and 1mA) and 15 different montages were used in 1 patient. We calculated the electric field by subtracting voltage measured on contiguous intracerebral contacts.

We found EF magnitude up to 0.29, 0.38 and 0.54 V/m respectively in the amygdala, the hippocampus, and the cingulate gyrus. Among 91 montage combinations, the global EF difference in the brain was significant in 65% of cases. We also confirmed experimentally that EF magnitude is proportional to TES intensity.

In conclusion, EF at a magnitude which can induces stochastic effects, is achievable in the deep brain structures using low intensities. EF is highly correlated to the stimulation intensity and depends on montages.

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