Epidural grid monitoring

Subdural grid monitoring (SDG) has the advantage to provide continuous coverage over a larger area of cortex, direct visualization of electrode location and functional mapping. However, SDG can cause direct irritation of the cortex or postoperative headaches due to cerebrospinal fluid fistula. Epidural grid monitoring (EDG) without opening the dura is thought to reduce the possibility of these complications. Park et al. from the Yonsei University reported the experience with Epidural grid monitoring.

They described the surgical technique of EDG in invasive intracranial electroencephalography (iEEG) monitoring. A retrospective review of 30 patients who underwent grid placement of iEEG between March 2019 and December 2020 was performed to compare SDG and EDG.

Of the 30 patients, 10 patients underwent SDG and 20 patients underwent EDG. There was no difference in age between SDG and EDG groups ($p = 0.13$). Also, there was no difference in the number of grid electrodes, craniotomy size, number of electrodes per craniotomy area and postoperative complication rate ($p = 0.32$, 0.84, 0.58 and 0.40). However, the maximum number of electrodes that have been undermined from the bone margin was much higher in SDG group (SDG 4.6 ± 2.2 vs. EDG 2.0 ± 0.9; $p = 0.001$). The demand for postoperative analgesics was significantly lower in EDG group (SDG 13.4 ± 9.1 vs. EDG 4.1 ± 4.3; $p = 0.012$); and the demand for postoperative antiemetics also tended to be low (SDG 4.6 ± 3.6 vs. EDG 1.8 ± 1.6; $p = 0.078$).

There was no significant difference in craniotomy and electrode insertion between the two groups; however, the EDG group showed less postoperative headache and nausea. Though not in direct contact with the cortex, the quality of the electrophysiological signal received through the electrode in EDG is comparable to that of the SDG. The EDG enables to detect the onset of seizure and delineate the epileptogenic zone sufficiently. Moreover, functional mapping is possible with EDG. Therefore, EDG has the sufficient potential to replace SDG for monitoring of the lateral surface of brain [1].

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introduced epidural electrocorticography (ECoG) for monitoring of cortical physiology in a late-stage amytrophic lateral sclerosis patient in completely locked-in state (CLIS). Despite long-term application for a period of six months, no implant-related complications occurred. Recordings from the left frontal cortex were sufficient to identify three arousal states. Spectral analysis of the intrinsic oscillatory activity enabled us to extract state-dependent dominant frequencies at <4, ~7 and ~20 Hz, representing sleep-like periods, and phases of low and elevated arousal, respectively. In the absence of other biomarkers, ECoG proved to be a reliable tool for monitoring circadian rhythmicity, i.e., avoiding interference with the patient when he was sleeping and exploiting time windows of responsiveness. Moreover, the effects of interventions addressing the patient's arousal, e.g., amantadine medication, could be evaluated objectively on the basis of physiological markers, even in the absence of behavioral parameters. Epidural ECoG constitutes a feasible trade-off between surgical risk and quality of recorded brain signals to gain information on the patient's present level of arousal. This approach enables us to optimize the timing of interactions and medical interventions, all of which should take place when the patient is in a phase of high arousal. Furthermore, avoiding low-responsiveness periods will facilitate measures to implement alternative communication pathways involving brain-computer interfaces (BCI) [2]

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Park SH, Jung IH, Chang KW, Oh MK, Chang JW, Kim SH, Kang HC, Kim HD, Chang WS. Epidural grid, a new methodology of invasive intracranial EEG monitoring: A technical note and experience of a single center. Epilepsy Res. 2022 Mar 24;182:106912. doi: 10.1016/j.eplepsyres.2022.106912. Epub ahead of print. PMID: 35339854.

2)

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