Characteristics of Electroencephalogram in the Prefrontal Cortex during Deep Brain Stimulation of Subthalamic Nucleus in Parkinson's Disease under Propofol General Anesthesia

Background: Monitoring the depth of anesthesia by electroencephalogram (EEG) based on the prefrontal cortex is an important means to achieve accurate regulation of anesthesia for subthalamic nucleus (STN) deep brain stimulation (DBS) under general anesthesia in patients with Parkinson's disease (PD). However, no previous study has conducted an in-depth investigation into this monitoring data. Here, we aimed to analyze the characteristics of prefrontal cortex EEG during DBS with propofol general anesthesia in patients with PD and determine the reference range of parameters derived from the depth of anesthesia monitoring. Additionally, we attempted to explore whether the use of benzodiazepines in the 3 days during hospitalization before surgery impacted the interpretation of the EEG parameters. Materials and Methods: We included the data of 43 patients with PD who received STN DBS treatment and SedLine monitoring during the entire course of general anesthesia with propofol in a single center. Eighteen patients (41.86%) took benzodiazepines during hospitalization. We divided the anesthesia process into three stages: awake state before anesthesia, propofol anesthesia state, and shallow anesthesia state during microelectrode recording (MER). We analyzed the power spectral density (PSD) and derived parameters of the patients' prefrontal EEG, including the patient state index (PSI), spectral edge frequency (SEF) of the left and right sides, and the suppression ratio. The baseline characteristics, preoperative medication, preoperative frontal lobe image characteristics, preoperative motor and non-motor evaluation, intraoperative vital signs, internal environment and anesthetic information, and postoperative complications are listed. We also compared the groups according to whether they took benzodiazepines before surgery during hospitalization. Results: The average PSI of the awake state, propofol anesthesia state, and MER state were 89.86 ± 6.89, 48.68 ± 12.65, and 62.46 ± 13.08, respectively. The preoperative administration of benzodiazepines did not significantly affect the PSI or SEF, but did reduce the total time of suppression, maximum suppression ratio, and the PSD of beta and gamma during MER. Regarding the occurrence of postoperative delirium and mini-mental state examination (MMSE) scores, there was no significant difference between the two groups (chi-square test, p = 0.48; Mann–Whitney U test, p = 0.30). Conclusion: For the first time, we demonstrate the reference range of the derived parameters of the depth of anesthesia monitoring and the characteristics of the prefrontal EEG of patients with PD in the awake state, propofol anesthesia state, and shallow anesthesia during MER. Taking benzodiazepines in the 3 days during hospitalization before surgery reduces suppression and the PSD of beta and gamma during MER, but does not significantly affect the observation of anesthesiologists on the depth of anesthesia, nor affect the postoperative delirium and MMSE scores.