POSTERIOR MIDLINE CORTICAL CHANGES ASSOCIATED TO PROPOFOL LOC AND ROC ARE MIRRORED IN SURFACE EEG

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Introducción: During the last decade, imaging techniques (PET, fMRI) have taught us a great deal about large-scale brain dynamics associated to the phenomenon of unconsciousness caused by general anesthetics[1].
Objetivo General: Our utmost objective is to find new ways to approach consciousness monitoring using scalp EEG, considering the most recent information about brain dynamics changes during anesthesia.
Material y Métodos: 14 healthy volunteers (12 males) were studied after written informed consent using stepwise propofol TCI (Schnider PK model): induction phase consisted of 0.5 ug/mL increases every 7 minutes until LOC (loss of command/consciousness), followed by two extra 0,5 µg·mL-1

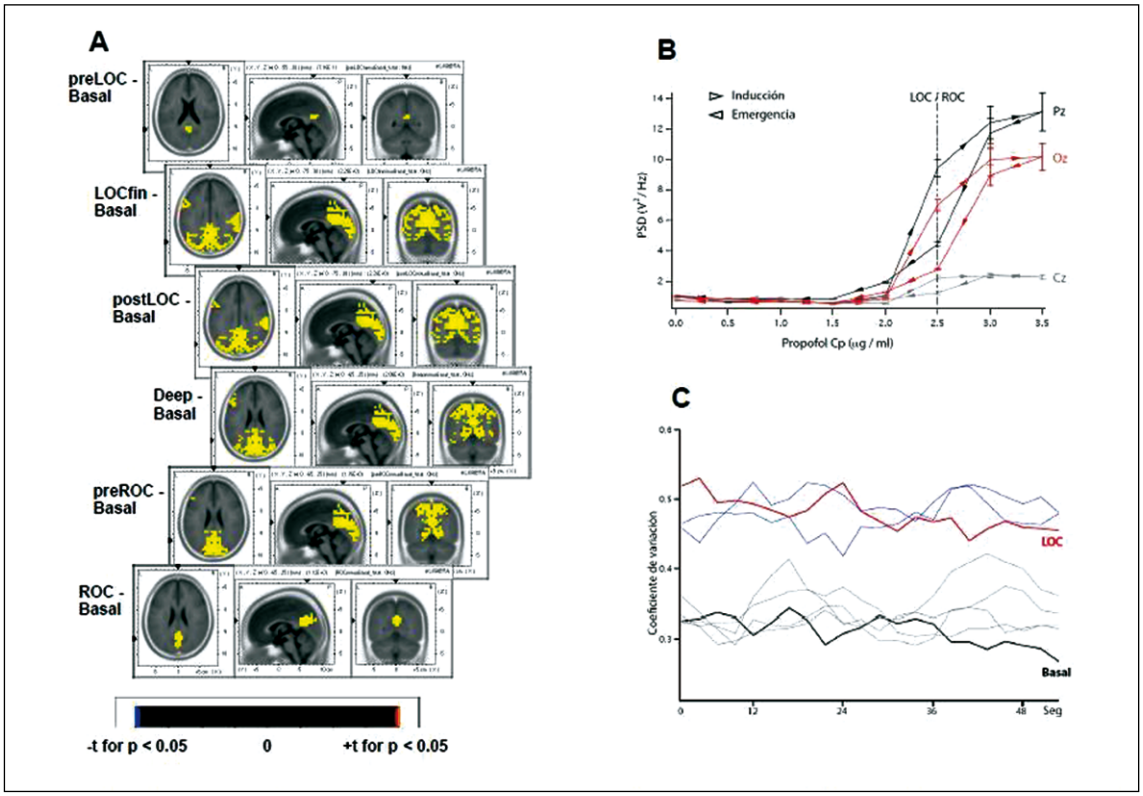

Figure 1. Analysis for 8 to 15 Hz EEG ban. **A)** eLORETA source analysis (n = 9) showing activation and deactivation of precuneus, cuneus and posterior cingulate cotices between anesthetic LOC an ROC (scale shows colors only for differences with p < 0.05 between condition-Basal). **B)** PSD curves 8n = 1, example) for midline electrodes (Oz, Pz, Cz) showing a clearer differentiation between pre and post LOC conditions in posterior midline. **C)** CV analysis (n = 1, example) shows a jump from approx.. 0.3 to 0.5 once LOC occurs.

steps (Deep condition); emergence phase consisted of a 0.5 μg·mL-1 stepwise decrease of propofol Cp after induction until 0 $\mu g \cdot mL^{-1}$. Venous blood samples for propofol measurement were obtained at baseline and end of every step. EEG signals were obtained using a 38 Ag/AgCl surface electrode cap (Laplacian reference, 128 Hz acquisition rate). Recordings were analyzed off-line using custom scripts in Igor Pro (WaveMetrics Inc) and eLORETA[2]; all epochs for analysis were bandpass filtered (0.01-30 Hz) and artifact-free. Twenty epochs of 1sec duration were used for eLORETA analysis and one 60sec epoch was used to calculate Power Spectral Density (PSD) and Coefficient of Variation (CV)[3].

Resultados: Quality recordings were obtained for 9 volunteers and 19 common low impedance electrodes; frequency bands for EEG source analysis were determined by changes observed using PSD analyses for all electrodes. All propofol TCI steps were compared to Basal and Deep conditions, and LOC and ROC (return of command/consciousness) steps were each compared to their previous steps. The frequency bands which better followed the processes of LOC and ROC were the 8-15 and 16-21 Hz bands (both compared to basal conditions, Figure 1), with increasing (induction) and decreasing (emergence) activation in precuneus, cuneus and posterior cingulate cortices. The <2Hz and 3-7Hz bands showed different source analysis profiles for the induction and emergence processes. Both PSD and CV analysis of the 8-15 and 16-21 Hz bands were able to differentiate preLOC/LOC and preROC/ROC conditions; PSD showed clearer differences in posterior midline electrodes (Oz/Pz better than Cz/Fz), while CV differentiated conditions independent of electrode position (Figure 1).

Conclusiones: (a) EEG source analysis confirms the involvement of precuneus, cuneus and posterior cingulate cortices (described by imaging literature) in the propofol LOC/ROC processes; (b) Two different signal analysis techniques allow to differentiate preLOC/LOC and preROC/ROC conditions; (c) It is necessary to consider scalp EEG consciousness monitoring techniques using posterior midline electrodes, which may better capture the main changes in large-scale brain dynamics associated to anesthetic LOC/ROC.

Referencias

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