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Automatic detection of periods of slow wave sleep based on intracranial depth electrode recordings

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Highlights:

- Method to automatically detect periods of slow wave sleep (SWS) based on intracranial EEG recordings.
- Method is based on the ratio of spectral power of slower to faster frequencies during slow wave sleep.
- Method can be performed in situations where traditional scalp EEG set-up for visual sleep staging is technically difficult.
- Method can be useful research tool when studying human memory consolidation and seizure generation in SWS.

Abstract

Background: An automated process for sleep staging based on intracranial EEG data alone is needed to facilitate research into the neural processes occurring during slow wave sleep (SWS). Current manual methods for sleep scoring require a full polysomnography (PSG) set-up, including electrooculography (EOG), electromyography (EMG), and scalp electroencephalography (EEG). This set-up can be technically difficult to place in the presence of intracranial EEG electrodes. There is thus a need for a method for sleep staging based on intracranial recordings alone.

New Method: Here we show a reliable automated method for the detection of periods of SWS solely based on intracranial EEG recordings. The method is utilizes the ratio of spectral power in delta, theta, and spindle frequencies relative to alpha and beta frequencies to classify 30-second segments as SWS or not.

Results: We evaluated this new method by comparing its performance against visually scored patients (n=9), in which we also recorded EOG and EMG simultaneously. Our method had a mean positive predictive value of 64% across all nights. Also, an ROC