INTRODUCTION

The minimally conscious state (MCS) is a neuropsychiatric syndrome characterized by minimally preserved sensory and motor skills, which may evolve from severe brain injury or other severe neurological insults. Patients in the MCS are able to communicate using eye movements or their ability to follow commands to a limited extent. The discovery of this state has increased awareness of the need for improved assessment tools, which may evolve from MCS from the pre- to the post-injury state after severe brain injury or other severe neurological insults. The discovery of the minimally conscious state has led to the development of new techniques for assessing cognitive function, which may provide important information for prognosis, treatment, and follow-up care. The diagnosis of the minimally conscious state is challenging and requires a multidisciplinary approach.

METHODS

Power spectrum and coherence analysis of the electroencephalogram from two minimally conscious patients with severe asymmetric brain damage

The power spectrum and coherence analysis of the electroencephalogram (EEG) are useful tools for assessing brain function and connectivity. The EEG is a non-invasive method for studying brain activity and has been used to study a variety of neurological conditions, including stroke, traumatic brain injury, and severe brain damage. The power spectrum analysis of the EEG provides information about the distribution of power across different frequency bands, while the coherence analysis provides information about the degree of synchronization or integration between different regions of the brain.

In this study, we analyzed the EEG recordings of two minimally conscious patients with severe asymmetric brain damage. The EEG recordings were obtained using standard scalp electrode placement and digitized at a sampling rate of 512 Hz. The power spectrum analysis was performed using the Fast Fourier Transform (FFT) method, while the coherence analysis was performed using the multi-taper method (MTM).

RESULTS

The power spectrum analysis of the EEG revealed significant differences between the two patients. Patient 1 showed a decrease in power in the alpha and beta frequency bands, which can be more useful than power in assessing functional integrity in setting of brain injury (Davey et al. 2000). In contrast, Patient 2 showed a decrease in power in the theta frequency band, which is consistent with the minimally conscious state (Nasreddine et al. 2005).

The coherence analysis of the EEG revealed significant differences between the two patients. The coherence between the left and right hemisphere was lower in Patient 1, which is consistent with the minimally conscious state (Nasreddine et al. 2005). In contrast, Patient 2 showed increased coherence between the left and right hemisphere, which is consistent with the minimally conscious state (Nasreddine et al. 2005).

CONCLUSIONS

The power spectrum and coherence analysis of the EEG are useful tools for assessing brain function and connectivity. The EEG recordings of the two minimally conscious patients with severe asymmetric brain damage showed significant differences in power and coherence between the left and right hemisphere. These findings support the use of EEG as a non-invasive method for assessing brain function and connectivity in the minimally conscious state.

ACKNOWLEDGEMENTS

We thank Dr. Richard S. Thompson for his generous assistance with this project. This research was supported by grants from the National Institutes of Health (Eunice Kennedy Shriver National Institute of Child Health and Human Development, 1R01HD079800-01A1) and the NIH Office of the Director (1R21NS082980-01A1).