

Neurovascular Networks May Serve as Potential Targets for Identifying Disorders of Consciousness: A Synchronous EEG-fNIRS Study

Nan Wang¹, Juanning Si², Xiaoke Chai¹, Yi Yang^{1*}, Zhao JiZong^{1*}

¹ Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University, Beijing, China

² School of Instrumentation Science and Opto-Electronics Engineering, Beijing Information Science and Technology University, Beijing, China

Email: zhaojizong@bjth.org

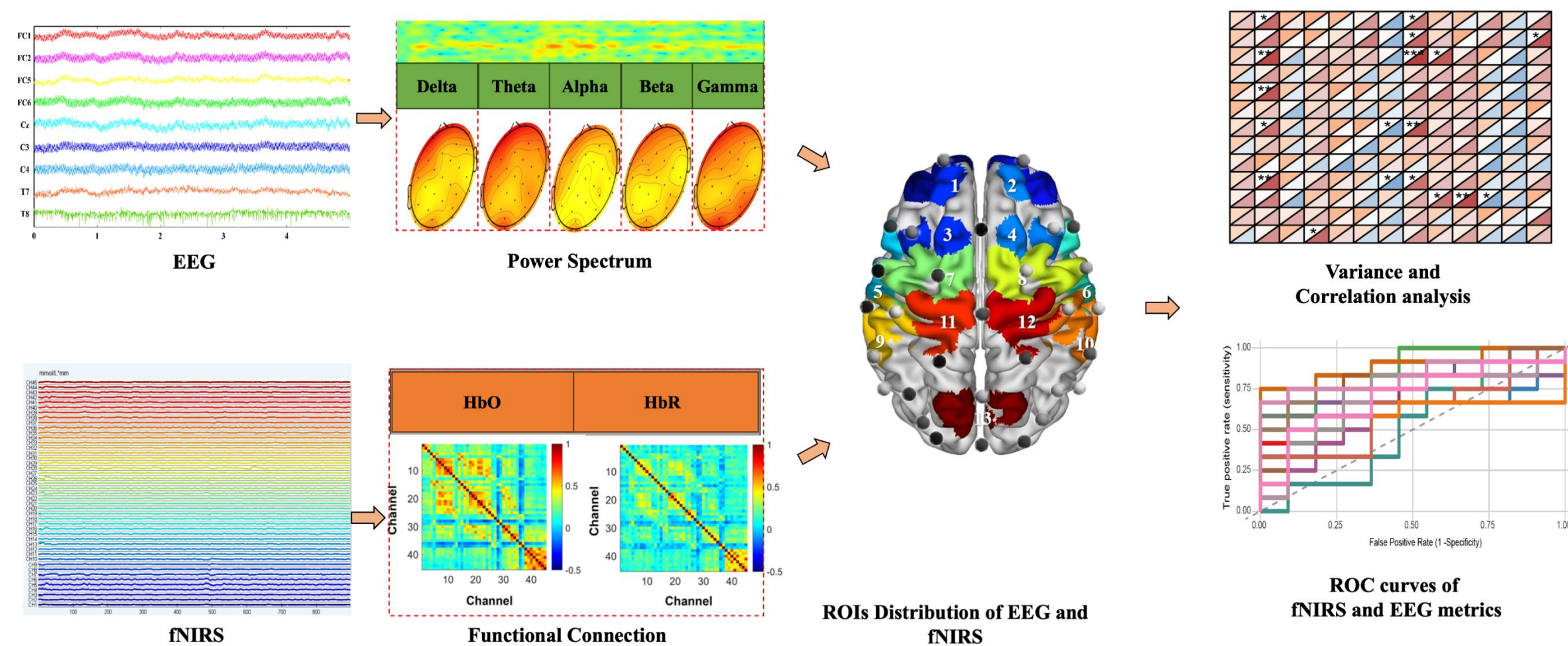


Introduction

Accurate diagnosis of disorders of consciousness (DoC), including minimally conscious state (MCS) and unresponsive wakefulness syndrome (UWS), remains challenging, with a misdiagnosis rate approaching 41% when using behavioral scales. [1] Resting-state studies reveal widespread disruption of intrinsic and frontoparietal networks in DoC patients. [2-4] A multimodal technique based on electroencephalography (EEG) and functional near-infrared spectroscopy (fNIRS) combines the spatiotemporal complementary strengths of both modalities and is non-invasive, portable, and ecologically valid, making it well suited for longitudinal monitoring of neuronal and hemodynamic activities simultaneously for patients with DoC. This study aimed to investigate the differences in neuronal and hemodynamic activities and to characterize neurovascular coupling relationship between healthy control (HC), MCS and UWS using EEG-fNIRS.

Methods

- Resting-state EEG-fNIRS data were acquired over the 13 regions of interest (ROIs) in patients with DoC.
- EEG: Spectral power in delta, alpha, beta, theta, and gamma bands was extracted to characterize the neuronal activities.
- fNIRS: Functional connectivity (FC) based on oxygenated hemoglobin (HbO) and deoxygenated hemoglobin (HbR) were calculated to investigate the hemodynamic activities.
- EEG-fNIRS: Correlation and classification were conducted.



Results and Figures

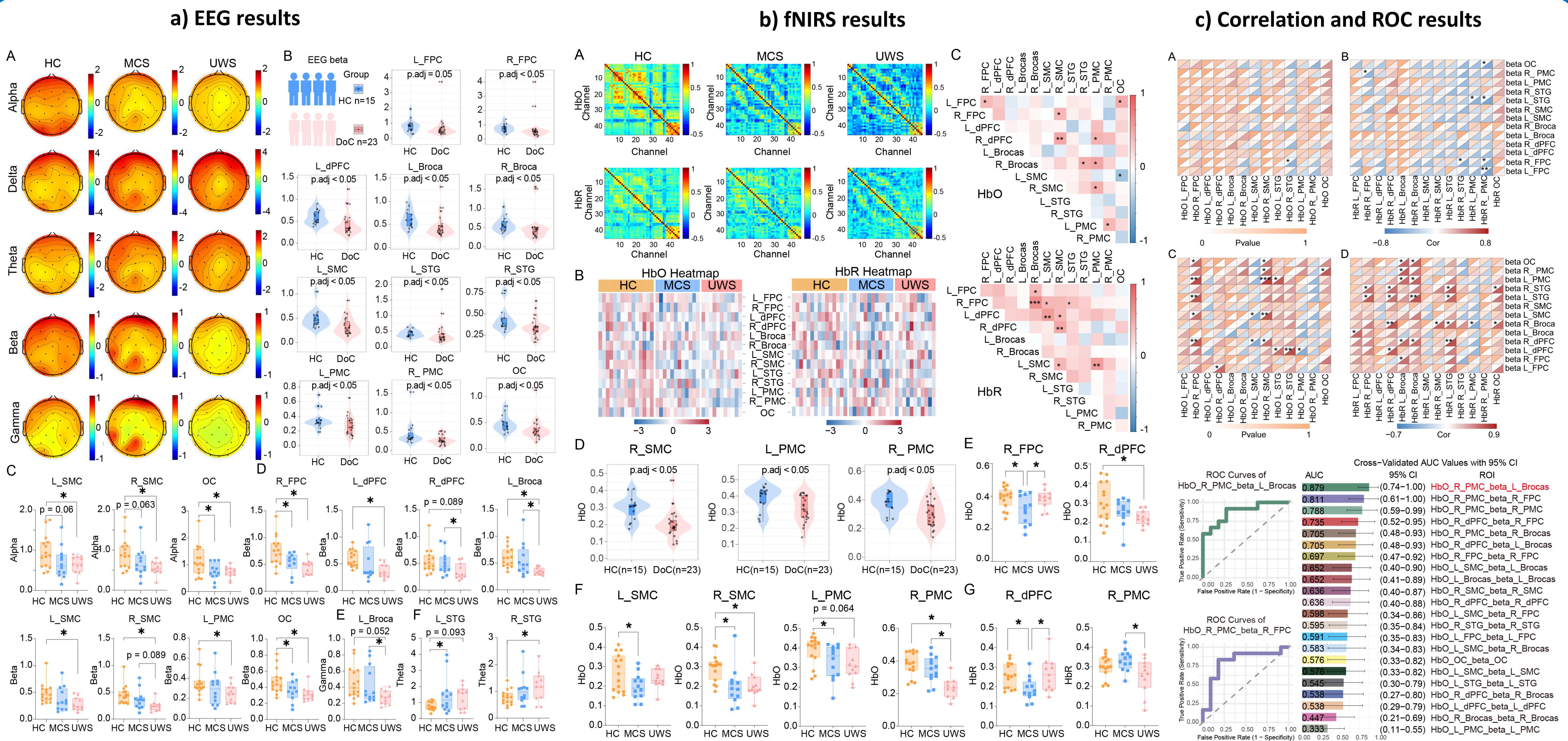


Fig1. a) EEG results. b) fNIRS results. c) Correlation and ROC results for EEG-fNIRS.

Conclusions

- The results demonstrated significantly stronger neurovascular coupling of hemodynamic and beta-band power of neural activity in premotor and Broca's areas.
- A multimodal classifier achieved an accuracy of 87.9% in distinguishing between MCS and UWS.
- The noninvasive, bedside-suitable nature of EEG-fNIRS underscores its potential for routine monitoring and prognostic assessment in DoC.

References

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