Active Brain Regions during Sleep using Electroencephalography-Functional Magnetic Resonance Imaging

Duan, Grace

Malhotra, Sameeksha

With techniques allowing the simultaneous acquisition of electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) data, active brain regions during different stages of the human sleep cycle were determined. This allows a greater understanding of sleep and its role in processing information. The oscillations of the EEG data determined the duration of each sleep stage. The respective MR images, visualized using Mango software, were analyzed separately to create brain networks with regions of interest (ROI). Using MATLAB, we created correlation matrices displaying neuronal activity. Results suggest that brain activity is localized in the ROI's during the second stage of sleep. In rapid eye movement (REM) sleep, brain activity associated with the selected ROI is also present in most other brain regions. Hippocampal activity is most prevalent in all investigated stages, followed by thalamus, posterior cingulate, and amygdala activity. Brain activity in stage one and REM is similar, although REM activity is less concentrated to the ROI. Stage two is considered deeper sleep than stage one, showing diminished brain activity. REM sleep, showing most neuronal connectivity, involves consolidating memories and dreaming. EEG-fMRI data can lead to an improved understanding of brain activity during sleep, which may help in diagnosing sleep disorders.