Resting state fMRI is increasingly revealing the potential impact on diagnosis for severely brain-injured patients with disorders of consciousness. Investigating the changes in spatial patterns and temporal behavior of spontaneous brain activity for these patients becomes very important. Modeling the structure-function relationship in the human brain can offer us a new tool of investigation. They help us to understand how the fiber bundle distribution can predict the observed functional connectivity patterns and how possible fiber lesions in these patients could affect the functional patterns. Preliminary results from the application of a generalized Ising model to the structure-function relationship in the human brain will be presented together with the possible implications of these studies for the understanding of altered states of consciousness as induced by a severe injury or anesthesia.