Determination of measurement noise, conductivity errors and electrode mislocalization effects to somatosensory dipole localization.

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Abstract

Calculating the spatial locations, directions and magnitudes of electrically active sources of human brain by using the measured scalp potentials is known as source localization. An accurate source localization method requires not only EEG data but also the 3-D positions and number of measurement electrodes, the numerical head model of the patient/subject and the conductivities of the layers used in the head model. In this study we computationally determined the effect of noise, conductivity errors and electrode mislocalizations for electrical sources located in somatosensory cortex. We first randomly selected 1000 electric sources in somatosensory cortex, and for these sources we simulated the surface potentials by using average conductivities given in the literature and 3-D positions of the electrodes. We then added random noise to measurements and by using noisy data; we tried to calculate the positions of the dipoles by using different electrode positions or different conductivity values. The estimated electrical sources and original ones are compared and by this way the effect of measurement noise, electrode mislocalizations and conductivity errors to somatosensory dipole localization is investigated. We conclude that for an accurate somatosensory source localization method, we need noiseless measurements, accurate conductivity values of scalp and skull layers and the accurate knowledge of 3-D positions of measurement sensors.