Intracranial EEG Atlas of Human Brain

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**Background:** Intracranial EEG (iEEG) signal characteristics vary, and depend on anatomical location, brain state, electrode-tissue interface, pathology, and possibly even patient specific physiology. This is often ignored in iEEG studies, mostly because of the absence of normal controls or standard iEEG values in specific anatomical brain structures. For future studies, especially those which compare different brain regions, an ‘iEEG atlas’ based on a large set of intracranial patient recordings would be desirable.

**Methods:** The preliminary, limited, data set presented here consists of iEEG recordings during quiet wakefulness from 10 patients (30 minutes each) with intractable focal epilepsy, implanted with multiple intracranial depth electrodes targeting a range of anatomical structures. The electrode locations were determined by clinical need and the recordings performed with wide bandwidth acquisition systems. Average iEEG signal characteristics were analyzed in 38 cortical and limbic, non-pathological, structures. Data was recorded with 25 and 32 kHz sampling rate and down-sampled to 5 kHz. For iEEG signals in each structure we evaluated: spectral power mean, median, standard deviation, 25 and 75 percentile. We also determined the dominant frequency band in each structure.

**Results:** Our results show increased amplitude of activity in healthy hippocampus, compared to other brain structures over a wide range of frequency bands (delta – fast ripples). Increased values of spectral power were also detected in temporal neocortex, especially in alpha and beta range. Some patients showed cingulate and precentral cortex as structures with dominant iEEG activity.

**Conclusions:** The preliminary results demonstrate the feasibility of creating a quantitative iEEG atlas of local field potential characteristics in different brain structures. In the future we will make publically available iEEG from 80 patients undergoing iEEG, from two different epilepsy centers (Brno Epilepsy Center in Czech Republic and Mayo Clinic Rochester MN, USA). The 'EEG atlas' should be useful as a reference for future iEEG studies, when comparing iEEG values from different brain regions, or healthy structures to structures affected by pathology.