p536 - Loss of network efficiency associated with cognitive decline in chronic epilepsy

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Purpose: The nature of cognitive difficulties in chronic epilepsy ranges from memory deficits to global intellectual decline. With functional MRI, abnormal activation and dysfunctional cerebral networks have been linked to cognitive deficits. Previous investigations have focused on predefined cerebral networks, especially language and default mode networks. With graph theoretical network analysis, the topology of the whole cerebral network can be investigated. To study the relation between possibly altered whole brain topology and intellectual decline in chronic epilepsy, a combined study of neurocognitive assessment, and fMRI with graph theoretical network analysis was performed.

Method: Forty-one adult patients with cryptogenic localization-related epilepsy and 23 healthy controls underwent an intelligence test and fMRI with a silent-word generation paradigm. A set of undirected graphs was constructed by cross-correlating the signal time-series of 893 cortical and subcortical regions. Possible changes in cerebral network efficiency were assessed by performing graph theoretical network analysis.

Results: Healthy subjects displayed efficient small world properties, characterized by high clustering and short path lengths. On the contrary, in patients with epilepsy a disruption of both local segregation (lower clustering) and global integration (higher path length) was found. An association of more pronounced intellectual decline with more disturbed local segregation was observed in the patient group. The effect of antiepileptic drug use on cognitive decline was mediated by decreased clustering.

Conclusion: These findings support the hypothesis that chronic localization-related epilepsy causes cognitive deficits by inducing global cerebral network changes instead of a localized disruption only. Whether this is the result of epilepsy per se or the use of antiepileptic drugs remains to be elucidated. For application in clinical practice, future studies should address the relevance of altered cerebral network topology in prediction of cognitive deficits and monitoring of therapeutic interventions.

Session Details
Session Title: Poster session: neuroimaging I
Session Date: 30 August 2011