Distruption of functional connectivity networks in patient before tumor remove

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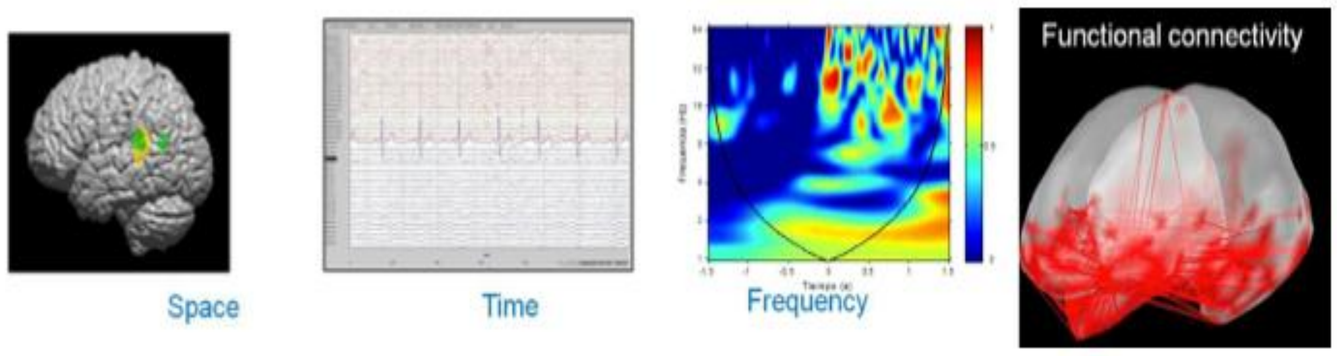
Objective: Oscillatory activity power changes in brain tumors, reporting abnormality in slow waves (i.e., delta and theta bands) affecting regions close to the tumor and the surrounding edema. Little is know about how neural networks are disrupted in patients with brain tumors, and how they reorganize it. The aim of our study was to characterize the pattern of network disorganization of patients with glial tumors.

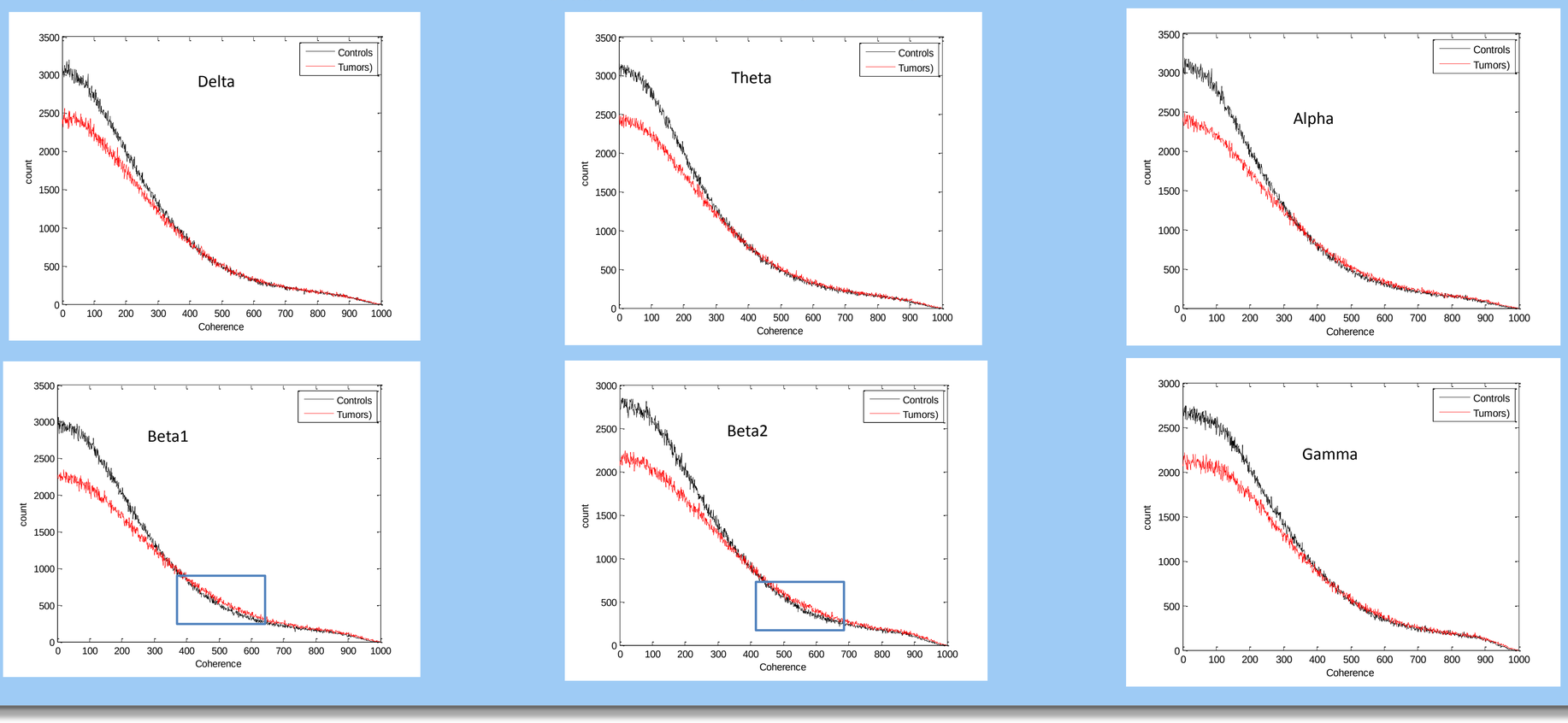
Materials and Methods: the MEG activity from 15 patients with LGG and 17 age-matched controls were recorded during a 10 minutes of resting state with eyes opened. The patients were measured before tumor removal. After artifact trials were selected, spectral coherence between the 338 sources was calculated, resulting in a functional connectivity matrix in standard frequency bands. Functional connectivity was estimated in the source space.

Results: Our findings revealed a general hyper-synchronization pattern (increase of global coupling strenght) in patients with respect to controls, in Theta, Beta and Gamma bands.
The number of links, however, was found to be higher in controls, in Alpha and Beta bands.



A complex process, as brain plasticity, should be addressed from a multi dimensional perspective: spatial, temporal, spectral and interactional.

Global distribution of connections



Conclusion: functional networks in controls are characterized by a higher number of connections with low strenght, a pattern of hyper-connectivity in patients with LGG is likely due to the loss of low strenght functional connections. Patients lost low couplings connecting more distant sources, whereas links with higher strenght connected more local sources. Overall findings indicate that the trace of a local tumor affects the global topology of the functional network. Disruption of functional networks are seen even before tumor removal, mainly characterized by a decrease of shortest path-lenght and an increase in clustering. A cortical hyper-synchronization phenomenon resulting from the loss of the weakest functional connections appears to be particulary sensitive to the brain insult.

References:

1. J Neurooncol. 2008 May;88(1):77-85. The influence of low-grade glioma on resting state oscillatory brain activity: a magnetoencephalography study. I. Bosma, C. J. Stam, L. Douw, F. Bartolomei, J. J. Heimans,1 B. W. van Dijk, T. J. Postma, M. Klein, and J. C. Reijneveld
2. Phys Rev E Stat Nonlin Soft Matter Phys. 2010 Aug;82(2 Pt 1):021924. Effect of tumor resection on the characteristics of functional brain networks. Wang H, Douw L, Hernandez JM, Reijneveld JC, Stam CJ, Van Mieghem P.
3. Neuroimage Clin. 2012 Nov 2;2:1-7. Connectivity in MEG resting-state networks increases after respective surgery for low-grade glioma and correlates with improved cognitive performance. van Dellen E, de Witt Hamer PC, Douw L, Klein M, Heimans JJ, Stam CJ, Reijneveld JC, Hillebrand A.

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