

# ROLE OF RESTING STATE FUNCTIONAL CONNECTIVITY MRI IN PRESURGICAL INVESTIGATION OF MESIAL TEMPORAL LOBE EPILEPSY

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## OBJECTIVE:

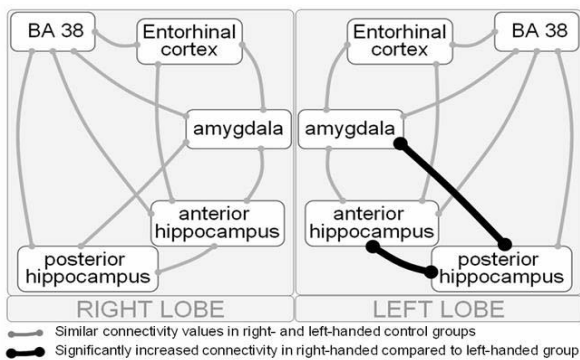
In a recent resting state fMRI study we have demonstrated, at the group level, basal functional connectivity (BFC) alterations within temporal lobe networks in patients presenting with medial temporal lobe epilepsy (MTLE) (Bettus et al. HBM 09). We showed a significant decreased BFC in the epileptogenic lobe and a compensatory significant contralateral increased connectivity. **Here, we aimed at determining the sensitivity and specificity of the method to localize at the individual level, the epileptogenic zone in MTLE patients.**

## METHODS:

Basal functional connectivity (BFC) was evaluated in each hemisphere of 22 MTLE patients. Two hundred volumes were acquired using a single shot GE-EPI sequence during a resting period of 10 min at 1.5T. Signal time-course was extracted from 10 regions of interest (5 ROIs in each hemisphere) usually involved in epileptogenic networks of MTLE. Normalized correlation coefficients between pairs of ROIs signal time-courses were computed to reflect BFC. Based on normative BFC values obtained from 36 controls, the number of BFC decreases and increases were determined in each hemisphere for each patient.

## RESULTS:

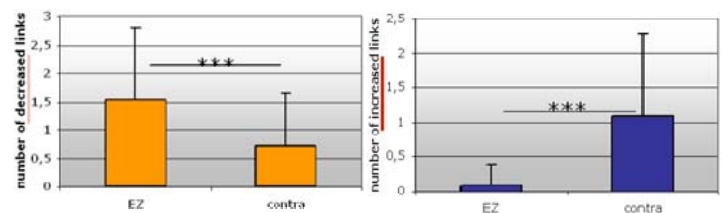
Right-handed controls showed significantly higher basal functional connectivity in the left temporal lobe for the links amygdala-posterior hippocampus and anterior-posterior hippocampi (Wilcoxon rank test, corrected  $p < 0.005$ ). BFC decreases were found bilaterally although the number of decreased links was significantly higher in the epileptogenic side ( $p = 0.025$ ). Conversely, BFC increases were found almost exclusively in the contralateral lobe leading to a strong test effect for locating the non-epileptic lobe with a sensitivity of 64% and a specificity of 91% ( $p < 0.001$ ). The most frequently disconnected areas were the entorhinal cortex and the anterior hippocampus in the epileptic lobe, while contralateral BFC increases involved preferentially hippocampus and amygdala.



**Fig. 1: Differences of basal functional connectivity in controls within mesial temporal lobes depending on handedness:** Connecting lines: significant basal functional connectivity. Grey lines : links that are not significantly different between right- and left-handed controls. Bold lines : links significantly different between right and left handed controls.

Patient	Decreased BFC										Increased BFC										
	EZ					Contra EZ					EZ					Contra EZ					
	EC	Amy	TP	AH	PH	EC	Amy	TP	AH	PH	EC	Amy	TP	AH	PH	EC	Amy	TP	AH	PH	
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**Fig. 2: Bilateral regional occurrence of abnormal pair-wise basal functional connectivity in MTLE patients:** Columns correspond to decreased and increased links in patients, relative to controls (above or below 2 standard deviations) in EZ and in the contralateral lobe and for each pair of ROI. BFC: Basal Functional Connectivity; EC: Entorhinal Cortex; Amy: Amygdala; TP: Temporal Pole (BA38); AH: Anterior Hippocampus; PH: Posterior Hippocampus.



**Fig 3: Group analysis of altered basal functional connectivity prevalence in epileptogenic zone lobe (EZ) and contralateral lobe (contra).** a) number of decreased links is significantly higher in the EZ compared to the contralateral hemisphere (Wilcoxon signed rank  $p = 0.025$ ). b) number of increased links is significantly higher in the contralateral temporal lobe to EZ compared to EZ temporal lobe (Wilcoxon signed rank  $p < 0.001$ ).

## CONCLUSIONS:

This study demonstrates that the presence of BFC increases in the non-epileptic side was paradoxically the most specific marker of EZ localization; and suggests that a single resting-state fMRI could be useful in the presurgical assessment of MTLE at an individual level.

## BIBLIOGRAPHY:

Bettus G. et al., Decreased basal fMRI functional connectivity in epileptogenic networks and contralateral compensatory mechanisms. Hum Brain Mapp 2009; 30:1580-1591.