

# Enhanced Synchronization of Local Hemodynamic Activity in Mesial Temporal Epilepsy Network

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## Introduction

Regarding the electrophysiological characteristic of increased local neural synchronization in epilepsy [1], the current study aims to investigate the alteration of the local hemodynamic synchronization in mesial temporal lobe epilepsy (mTLE) using fMRI.

## Material and Methods

Fifty two patients with unilateral mTLE [27 right mTLE (gender: 14 males, 11 females, age: 23.3±7.7) and 25 left mTLE (gender: 16 males, 11 females, age: 25.8±7.1)] and 26 healthy subjects (17 males, 9 females; ages: 25.3±5.8 years) participated in the present study. Resting-state fMRI data were collected from a 1.5 Tesla MRI scanner (GE-signa). Hemodynamic synchronization was measured with a regional homogeneity (ReHo) analysis on fMRI data [2]. Then the changes of hemodynamic synchronization in mTLE were detected by comparing the ReHo values of each patient group and those of controls using 2-sample t-test ( $P<0.05$ , correction with joint height and extent). Furthermore, six subjects out of the mTLE patients underwent simultaneous fMRI and electroencephalogram (EEG), their ReHo values were correlated to the numbers of interictal epileptiform discharges ( $P<0.05$ ).

## Results

The patients showed increased ReHo in the mesial temporal lobe, thalamus, insula, cingulate cortex with a predominance at the ipsilateral side to epileptogenic focus (see Fig. 1, warm color). The brain structures with increased ReHo were mostly overlapped with the mesial temporal epilepsy network proposed by Spencer [3]; while the decreased ReHo was located at the the default-mode network regions<sup>4</sup>, including the mesial prefrontal cortex and post cingulate cortex (Fig. 1 cold color).

Positive correlation was found between the numbers of epileptic discharges and the ReHo values in the regions involved in mesial temporal epilepsy network (Fig. 2 and Fig 3).

## Discussion

The present study has shown that the epileptic activity can increase local hemodynamic synchronization. The current findings indicate that the ReHo-based fMRI can map the mesial temporal epilepsy network, and has a potential to detect epileptic activity in mTLE patients without requirement of simultaneous EEG.

## References

- [1] Bettus G, Wendling F, Guye M, et al. Enhanced EEG functional connectivity in mesial temporal lobe epilepsy. *Epilepsy Res* 2008;81(1):58-68.
- [2] Zang Y, Jiang T, Lu Y, et al. Regional homogeneity approach to fMRI data analysis. *Neuroimage* 2004;22(1):394-400.
- [3] Spencer SS. Neural networks in human epilepsy: evidence of and implications for treatment. *Epilepsia* 2002;43(3):219-227.

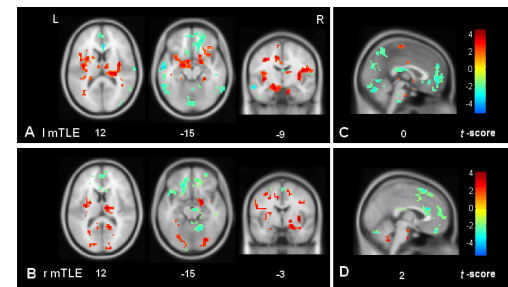


Fig.1. Comparisons of ReHo between the mTLE patients and controls.

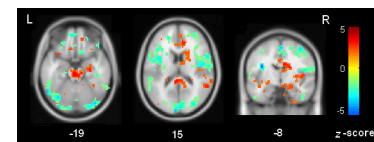


Fig.2. Correlation between the number of IEDs and ReHo.

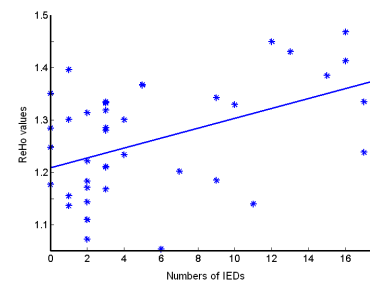


Fig3. The result of correlation analysis between the IEDs number (x-axis) and ReHo (y-axis) in the right mesial temporal lobe (x=22, y=-8, z=-19, the voxel showing significant positive correlation between the IEDs number and ReHo) in mTLE patients ( $P<0.05$ ).