

Temporal and extra-temporal perfusion abnormality in mesial temporal lobe epilepsy revealed by arterial spin labeling(ASL)-based MRI

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Introduction

Interictal single-photon emission computed tomography (SPECT) studies have demonstrated that there is hypoperfusion within the extra-temporal structures besides to the temporal lobe in mesial temporal lobe epilepsy (mTLE), which contributes to the proposal of concept of the mesial temporal lobe epilepsy network [1]. The purpose of this study was to determine the feasibility of detecting perfusion abnormalities in mTLE using arterial spin labeling (ASL)-based MRI, which is a noninvasive method for calculating regional cerebral blood flow (rCBF).

Material and Methods

A total of 34 patients with mTLE participated in the study, which included 16 patients with left-sided (7 males, 9 females, age: 26.1 ± 9.3 years) and 18 with right-sided (9 males, 9 females, age: 27.5 ± 9.6 years) mTLE. 20 healthy subjects (9 males, 11 females, age: 26.7 ± 8.2 years) were employed as controls. ASL data were acquired on SIEMENS 3T scanner using sequence of pulse-ASL (TR/TE=2500/11ms, thickness=8mm, 11 slices covering all cerebrum). CBF data of each group of patients were compared with those of the controls using voxel-based analysis in software of SPM8. Furthermore, correlation analysis was performed between epilepsy durations and CBF values in each group of patients.

Results:

Comparison with the controls, the patients with mTLE showed significant CBF decrease ($P < 0.05$, correction with joint height and extent) in the bilateral anterior temporal lobes, thalami and a few of regions of the default-mode network (including the mesial prefrontal cortex and the posterior cingulate cortex); whereas the CBF decrease was predominant in the ipsilateral side to the epileptogenic focus ($P < 0.05$, correction with joint height and extent). No CBF increase was found in the comparison results. Correlation analyses revealed that the temporal lobe ipsilateral to the epileptogenic focus showed negative correlation between epilepsy duration and CBF (Left mTLE: $z=2.52$, $P < 0.01$; right mTLE: $z=3.41$, $P < 0.005$).

Discussion:

The present study used voxel-based analysis to reveal the whole brain perfusion abnormalities in mTLE. The patients with mTLE presented CBF decrease not only in the temporal lobe but also in a few of extra-temporal structures including the thalamus and the default-mode network regions [2]. The CBF decrease in the temporal lobe and thalamus may imply the important role of the cortico-thalamic network in mTLE, which is consistent with findings revealed by SPECT studies [3]; while the CBF decrease in the default-mode network regions may reflect the functional impairment of cognitive process in the patients. The negative correlation between epilepsy duration and CBF implicates that the decreased CBF may be caused by impairment resulting from epilepsy. All the above findings suggest that ASL-based MRI offer a feasible tool to detect perfusion abnormalities within the temporal and extra-temporal structures in mTLE.

References

[1] Spencer SS. 2002. Epilepsia 43, 219 – 227; [2] Pendse N. et al., J. Neuroradiology. 37: 60-63. [3] Nelissen N., et al., 2006 NeuroImage 32, 684 – 695.

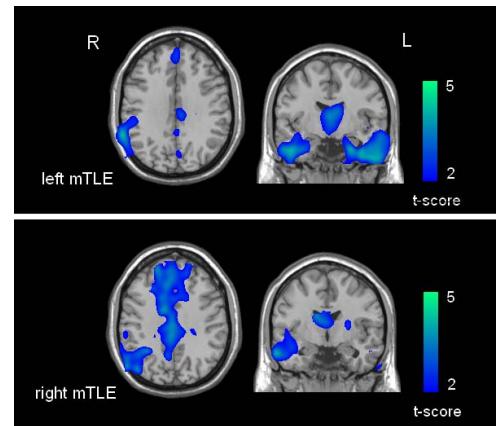


Figure 1. Comparisons of CBF between the mTLE patients and controls. The patients showed significant CBF decrease in the bilateral anterior temporal lobes, thalami and a few of regions of the default-mode network; whereas the CBF decrease was predominant in the ipsilateral side to the epileptogenic focus.