contrast-enhanced first pass perfusion MR imaging in patients with subclinical hepatic encephalopathy

T. Li[1], and L. Ma[2]

[1]PLA General Hospital, Beijing, Beijing, China, People's Republic of, [2]PLA General Hospital

Introduction

Hepatic encephalopathy (HE) is a neuropsychiatric syndrome that results from severe liver disease. Subclinical hepatic encephalopathy (SHE) indicates that the patients have no obvious clinical symptoms, but characteristic neuropsychological and electrophysiological tests are helpful to diagnose SHE. Early detection of neuropsychological dysfunction in cirrhotic patients without overt encephalopathy is essential to their prognosis and quality of life. Functional neuroimaging is important in the detection of cerebral changes in patients with SHE. This study is designed to investigate the MRI perfusion pattern in the basal ganglion in patients with SHE.

Materials and methods

Twelve patients (9 males, 3 females, the age ranged from 28 to 64 years, mean 50 years) with cirrhosis and SHE diagnosed by neuropsychological tests were investigated. The patients had no history of cerebrovascular disease, diabetes mellitus, hypertension, or chronic pulmonary disease. The cirrhosis was alcoholic in 3 patients and posthepatitis in 9 patients. All patients had stable chronic hepatic disease, which was classified as Child class B (7 patients) and C (5 patients). 12 patients had obvious portosystemic shunting. 10 age and education--matched healthy volunteers (7 males, 3 females, the age ranged from 26 to 62, mean 43.5 years) underwent MRI perfusion examination for comparison. MR examinations were performed on a 1.5T (Twin Speed, GEMS, Milwaukee) system with an 8-channel phase array head coil. Dynamic susceptibility contrast enhanced perfusion MR imaging was performed in all patients and volunteers. GRE-EPI (TR/TE=1500ms/75ms) was used. Acquisition matrix was 128*128. Thickness was 6mm with 0.5mm inter-slice gap. Scanning range was from basal ganglion section to frontal and parietal lobes. Scanning time was 1 minute. Injection dose was 0.1mmol/kg at the speed of 4ml/s. Perfusion data were transferred to the SUN workstation. Using the MGH perfusion software[1], the parameter maps of CBF, CBV, and MTT were created. The head of caudate nucleus, globus pallidus, putamen, thalamus, and ipsilateral white matter in the frontal lobe were selected as the region of interest (ROI), the ratios of basal ganglion and thalamus versus ipsilateral white matter in the frontal lobe were calculated, and comparison was made between the patient group and the control group.

Results

The values of CBF, CBV, and MTT were showed in Table 1. For MTT, the values reached statistical reduction in every ROI. The CBF ratio of every ROI was higher than that of the control group. Statistical increase can be detected in globus pallidus and putamen (P<0.05). CBF increase in thalamus was very close to statistical significance (P=0.055). CBV values had no significant difference in every ROI comparing with those of the control group (P>0.05).

Discussion

In our study, we found decreased MTT and increased CBF in the basal ganglion, including the head of caudate nucleus, globus pallidus, and putamen. Perfusion in thalamus also showed obviously increased CBF. This result is consistent with the previous report[2], which showed widespread CBF impairment in cortex and increased CBF in the basal ganglion and thalamus. Basal ganglion consists of caudate nucleus, globus pallidus, and putamen. Most scholars think there are multiple parallel loops from the cortex through the basal ganglion and back to cortex. Mesial temporal region of the limbic system has similar perfusion as basal ganglion. The perfusion increase may be the results of a compensatory response of premotor, motor, and complex attentional deficits. MRI has higher temporal and spatial resolution, and demonstrates more accurate anatomic locations than PET or SPECT. MTT is the most sensitive perfusion parameter, CBF next to it, and CBV is most insensitive.

Table 1. MTT, CBF, and CBV ratios of every ROI versus white matter

		patients group (n=12)	control group (n=10)	P value
MTT	Head of caudate nucleus	0.82±0.16	0.96±0.17	<0.05
	Pallidus	0.75±0.2	0.91±0.18	<0.05
	Putamen	0.77±0.18	0.94±0.16	<0.05
	Thalamus	0.78±0.15	0.93±0.12	<0.05
CBF	Head of caudate nucleus	1.60±0.54	1.42±0.29	>0.05
	Pallidus	1.50±0.63	1.11±0.32	<0.05
	Putamen	2.06±0.67	1.60±0.56	<0.05
	Thalamus	2.12±0.68	1.73±0.56	>0.05
CBV	Head of caudate nucleus	1.27±0.31	1.35±0.32	>0.05
	Pallidus	1.10±0.43	0.99±0.28	>0.05
	Putamen	1.50±0.27	1.43±0.37	>0.05
	Thalamus	1.61±0.47	1.64±0.47	>0.05

Reference:

[1]Ostergaard L, et al. MRM, 1996, 36: 715-725.

[2]Catafau AM, et al. J. Nucl. Med, 2000, 41: 405-410.