Utility of DSC-MRI indices as predictors of cerebral perfusion changes after carotid angioplasty with stenting

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INTRODUCTION

Carotid angioplasty with stent placement (CAS) is an optional treatment for significant carotid stenosis.

Hyper-perfusion syndrome, including unilateral headache, seizures, and intracerebral hemorrhage [3], has been reported as a complication after CAS.

This study aimed to assess hemodynamic status of patients with unilateral stenosis of internal carotid artery (ICA) using dynamic susceptibility contrast (DSC) MRI indices, including cerebral blood flow (CBF), time to peak (TTP), mean transit time (MTT) and Tmax (the time to maximum of the residue function obtained by deconvolution).

PURPOSES

This study aimed to investigate the cerebral hemodynamic changes in patients with carotid stenosis and the utility of DSC-MRI indices for predicting hyper-perfusion phenomenon after carotid angioplasty with stenting (CAS).

MATERIALS & METHODS

Subjects data and Data acquisition

Fifty-four patients with unilateral ICA stenosis and who underwent CAS (Left side stenosis : 29 patients, Right side stenosis: 25 patients) participated in this study.

The CBF, TTP, MTT and Tmax were assessed by DSC-MRI before and one-week after CAS.

DSC-MRI were acquired using a T2*-weighted single-shot gradient-echo EPI sequence (TR/TE/FA = 1500ms/40ms/90 degrees, in-plane matrix = 128 x 128, slice thickness = 5mm, 20 slices, 60 dynamics ) at a 1.5T clinical scanner.

Data processing and Data analysis

Perfusion images were analyzed by using the Perfusion Mismatch analyzer (PMA)(http://assist.unimj.jp/index-e.htm). For each patient, an arterial input function was chosen from the MCA for the deconvolution calculation using the block-circulant singular value decomposition algorithm.

The regions of interest (ROI) were manually placed in bilaterally symmetric regions of the MCA territory by an experienced neurologist. In addition, a ROI was also placed in the occipital white matter for reference.

normalized CBF (nCBF) value: The relative CBF obtained in the MCA regions were then divided by the mean value of the ipsilateral occipital white matter region.

CBF index: (nCBF after CAS) / (nCBF before CAS).

A CBF index value of >1 represented increased blood flow after CAS.

REFERENCES


RESULTS

Figure 1 demonstrated relative CBF maps from a patient before (A) and after (B) CAS (CBF index = 1.4). Before CAS, the CBF on the stenotic (right) side was lower than that on the left side. After CAS, CBF on the right side increased and was higher than that on the left side.

Table 1 listed the pre-CAS nCBF, Tmax, TTP and MTT for the ipsilateral side of the stenosis and the normal side.

Table 2 The patients were then divided into two groups with an CBF index = 1.2(CBF index>1.2, n=8; CBF index ≤1.2, n=46).

CONCLUSION

The perfusion changes after CAS were significantly correlated with the pre-CAS ipsilateral nCBF, Tmax and MTT.

The pre-CAS ipsilateral Tmax and MTT were significantly longer for the hyper-perfusion group as comparing to the other patients.