Moyamoya disease: visualization of dilated medullary vessels by flow-compensated gadolinium-enhanced MRI

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Introduction

Moyamoya disease is a rare cerebrovascular occlusive disease of unknown etiology, characterized by stenosis or occlusion of both internal carotid arteries (ICAs) at the supraclinoid portion and an abnormal vascular network (moyamoya vessels)(1). 3-T MR angiography clearly shows moyamoya vessels at the base of the brain (2). Gadolinium-enhanced MRI depicts dilated pial vessels (ivy sign) (3-5). There are also a few case reports regarding dilated medullary vessels demonstrated on gadolinium-enhanced MRI (5). Harada et al. (6) reported transverse lines in the white matter (medullary streaks) demonstrated on T2-reversed MRI at 3-T and speculated that these medullary streaks may represent dilated medullary vessels with stagnant flow. However, to our knowledge, dilated medullary vessels on moyamoya disease have not been investigated in detail nor completely understood. Flow-compensation (FC) is a way to rephase the MR signals of moving spins and is useful to visualize small vessels on gadolinium-enhanced MRI. In this study, we investigated frequency of visualization of dilated medullary vessels in moyamoya disease and the effect of FC technique on the visualization of dilated these vessels.

Materials and Methods

Thirteen patients with idiopathic moyamoya disease were randomly entered into this prospective study. Six men and 7 women ranging in age from 7 to 66 years (mean, 36 years) were evaluated. The diagnosis was established by clinical findings, conventional angiography, according to the criteria proposed by a research committee on spontaneous occlusion of the circle of Wills. MRI was performed using a 1.5T magnet. All patients underwent T1-weighted (SE, TR/TE=600/20), T2-weighted (FSE, TR/TE=6600/100), FLAIR (TR/TE/TI=10000/130/2200) and gadolinium-enhanced T1-weighted (SE, TR/TE=600/20) images with/without FC. Gadolinium was injected at a rate of 0.1 mmol/kg. Visibility of medullary vessels on the contrast-enhanced images were assessed and scored by two neuroradiologists according as follows; 2: visible, 1: scarcely visible, and 0: not visible. Cross-sectional areas of medullary vessels at the level of centrum semiovale were also quantitatively analyzed by using ImageJ software. Wilcoxon matched-pair signed-rank test and paired t-test were used for statistical analysis.

Results

Gadolinium-enhanced MRI showed dilated medullary vessels in 11 patients (84.6%) with FC (Fig.1) and 8 patients (61.5%) without FC (Fig. 2) (Table). Visibility scores were significantly different (P=0.008) between the enhanced images with FC and those without FC. Average of cross-sectional areas of the medullary vessels was 117.5 mm^2 on enhanced image with FC and 46.7 mm^2 on enhanced image without FC. In this analysis as well there was significant difference (P= 0.002).

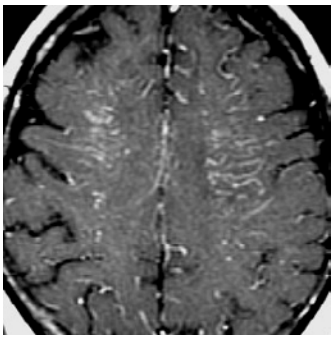

Fig. 1. Gadolinium-enhanced MRI with FC.

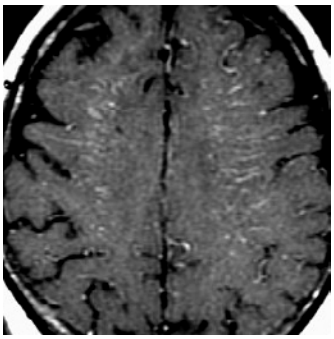

Fig. 2. Gadolinium-enhanced MRI without FC.

Visibility of medullary vessels	with FC	without FC
Visible	8 (61.5%)	2 (15.4%)
Scarcely visible	3 (23.1%)	6 (46.2%)
Not visible	2 (15.4%)	5 (38.5%)

Table. Visibility of dilated medullary vessels on gadolinium-enhanced MRI with and without FC.

Conclusion

Dilated medullary vessels are frequently observed on gadolinium-enhanced MRI in moyamoya disease, which are better visualized with use of flow-compensation technique.

References

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