

ASYMMETRIC DILATATION OF VIRCHOW-ROBIN SPACE IN UNILATERAL INTERNAL CAROTID ARTERY STENOSIS

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Purpose

To test the hypothesis that chronic ischemia followed by white matter atrophy is associated with Virchow-Robin spaces (VRSs) dilatation by determining the relationship between unilateral internal carotid artery (ICA) stenosis and asymmetric dilatation of VRSs on the same side.

Introduction

The mechanism of dilatation of VRSs is still unclear, but brain atrophy has been considered as one of etiologies. To clarify this hypothesis, we presumed that chronic ischemia due to ICA stenosis causes nerve fiber degeneration, white matter atrophy and subsequent ipsilateral VRSs dilatation. We recruited patients with unilateral ICA stenosis and compared the degree of VRSs dilatation between ipsilateral and contralateral cerebral white matter. We optionally assessed the pre- and post-central gyri and corona radiata, along the corticospinal tract (CST) pathway on the basis of the fact that CST is a collection of large-caliber nerve fibers, vulnerable to ischemic degeneration and in easily identifiable locations.

Methods

We retrospectively reviewed axial T2-weighted (TR/TE 5250/120, 4mm thickness, FoV 21x21) and diffusion weighted (TR/TE 9000/82, b=1000, 4mm thickness, FoV 24x24) MR images (GE Signa Excita 3-T) of 46 patients with severe unilateral ICA stenosis (>70%), diagnosed by carotid contrast MRA and carotid digital subtraction angiography (DSA) between Feb. 2007 and Sep. 2009. Cases with contralateral ICA stenosis more than 50% were excluded. Hyperintense lesions in the pre- and post-central gyri and corona radiata along CST pathway in the high convexity white matter on T2WI without diffusion restriction were included as VRSs. All lesions were graded into score 0 (None), score 1 (linear hyperintensity not extending to the corona radiata), score 2 (linear hyperintensity extending to the corona radiata) and score 3 (round or oval hyperintensity larger than 2mm). We statistically analyzed the difference of VRSs score between bilateral hemispheres, the correlation between VRSs score and severity of ICA stenosis, the correlation between VRSs score and age, and the difference of ipsilateral VRSs scores according to existence of infarction.

Results

13 of all 46 MR images (28.3%) showed higher VRSs scores on the side with ICA stenosis than the contralateral side. The mean VRSs scores were 2.57 and 2.17 on the ipsilateral and contralateral sides, resulting statistical significance ($p < 0.01$). The relationship between the patient's age and VRSs score showed positive correlation ($p < 0.01$ for ipsilateral and < 0.001 for contralateral). However, there was no significant correlation between VRSs score and severity of ICA stenosis. The ipsilateral VRS scores were significantly higher in the cases with infarction than without infarction ($p < 0.05$).

Discussion

Our results suggest that chronic ischemic process and subsequent white matter degeneration and atrophy is a factor of VRSs dilatation. The presence of infarction is also associated with VRSs dilatation. Therefore, if we detect the unusual VRSs dilatation on brain MR, it is worth considering the possibility of ischemic condition and necessity of further workup.

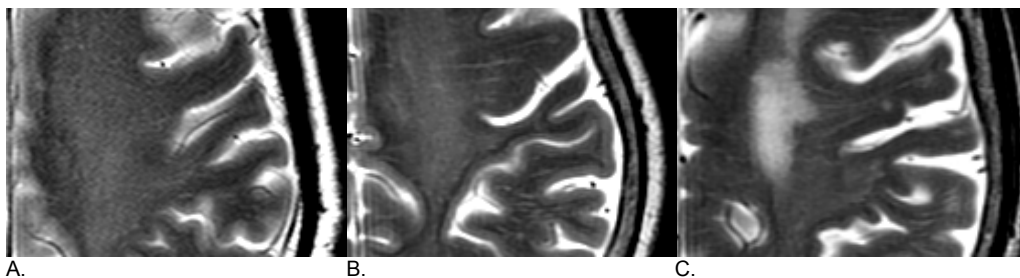


Fig. 1. Grades of VRSs dilatation.
A: Score 1 - linear hyperintensity not extending to the corona radiata.
B: Score 2 - linear hyperintensity extending to the corona radiata.
C: Score 3 - round or oval hyperintensity larger than 2mm.

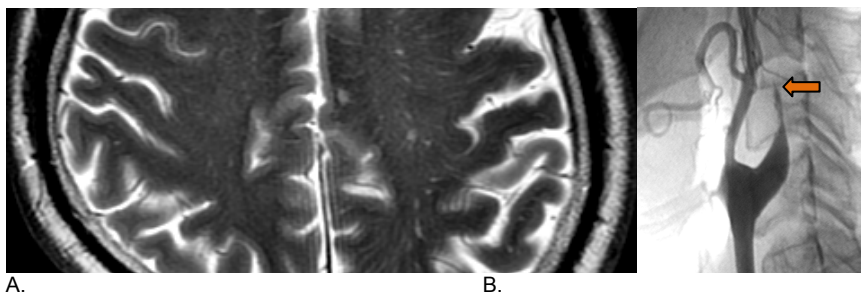


Fig. 2. A 57 year-old male with Lt. ICA occlusion. Axial T2WI(A) shows VRSs dilatation, Score 2 on the Rt. side and score 3 on the Lt. side. Carotid DSA (B) shows 100% occlusion of the Lt. cervical ICA.