Generic Contrast Agents
Our portfolio is growing to serve you better. Now you have a *choice*.
FRESENIUS KABI
VIEW CATALOG

AJNR

The Possible Difference of Underlying Pathophysiologies between "Ivy Sign" on Contrast-Enhanced MRI and FLAIR

N. Mori and S. Mugikura

AJNR Am J Neuroradiol published online 15 July 2021
http://www.ajnr.org/content/early/2021/07/15/ajnr.A7176

This information is current as of May 12, 2025.

Published July 15, 2021 as 10.3174/ajnr.A7176

The Possible Difference of Underlying Pathophysiologies between "Ivy Sign" on Contrast-Enhanced MRI and FLAIR

We read with interest the article by Wang et al[1] titled "Ivy Sign in Moyamoya Disease: A Comparative Study of the FLAIR Vascular Hyperintensity Sign Against Contrast-Enhanced MR Imaging." The results of the study carried out by Wang et al are agreeable, which show that the ivy sign score on contrast-enhanced MR imaging was statistically significantly correlated with the amount of leptomeningeal collateral from the posterior cerebral artery on digital subtraction angiography, while the ivy sign score on FLAIR was not. A previous report also speculated that the ivy sign score on contrast-enhanced MR imaging may correspond to angiographic cortical microvascularization via leptomeningeal collaterals.[2]

Although the authors did not clearly mention it, their results revealed different underlying pathophysiologies between the ivy sign on contrast-enhanced MR imaging and FLAIR. Moreover, the ivy sign on contrast-enhanced MR imaging may not be an alternative to that on FLAIR, based on the following opinions derived from their results. First, the ivy sign score on contrast-enhanced MR imaging before surgery was significantly correlated with the postoperative revascularization grade. The study speculated that the more leptomeningeal collaterals present before surgery, the better the outcome of the revascularization operation would be. The ivy sign on contrast-enhanced MR imaging may be angiographic cortical microvascularization via leptomeningeal collaterals. However, the ivy sign on FLAIR before surgery was not significantly correlated with the postoperative revascularization grade. This result indicates that the ivy sign on FLAIR may not reflect leptomeningeal collaterals, but the slow flow of maximally dilated pial vasculature (microscopic cortical microvascularization) compensates for the decreased perfusion.[3]

The ivy sign may be observed in the posterior MCA region on FLAIR if the ivy sign on FLAIR reflects leptomeningeal collaterals from the posterior cerebral artery similar to the ivy sign on contrast-enhanced MR imaging. However, it was more frequently observed in the anterior MCA region than in the posterior MCA region on FLAIR in our previous study.[3] Did the distribution of ivy signs in the study population of Wang et al[1] differ between contrast-enhanced MR imaging and FLAIR? The ivy sign on FLAIR was significantly correlated with the cerebrovascular reserve on SPECT, suggesting that it may reflect the slow flow of maximally dilated pial vasculature.[3] The postoperative decrease in ivy signs on FLAIR in the operative side with an increase in cerebrovascular reserve on SPECT supports the current hypothesis.[4]

Second, they showed that the ivy sign score on contrast-enhanced MR imaging was negatively correlated with CBF in the MCA region in the late Suzuki stage. Their speculation was that it was because of the imbalance between leptomeningeal collaterals and abnormal ICA and Moyamoya vessels; however, posterior circulation (posterior cerebral artery stenosis or occlusion) was often involved in this phase, and various amounts of leptomeningeal collaterals may be present on a case-by-case basis. Therefore, the ivy sign on contrast-enhanced MR imaging in the late Suzuki stage may be attributable to maximally dilated pial vasculature, as well as leptomeningeal collaterals. Further study with the ivy sign distribution and cerebrovascular reserve assessment will be needed to confirm the different underlying pathophysiologies between the ivy sign on contrast-enhanced MR imaging and FLAIR.

REFERENCES

1. Wang LX, Wang H, Hao FB, et al. **Ivy sign in Moyamoya disease: a comparative study of the FLAIR vascular hyperintensity sign against contrast-enhanced MRI.** *AJNR Am J Neuroradiol* 2021;42:694–700 CrossRef Medline
2. Mugikura S, Fujimura M, Takahashi S. **Cortical microvascularization and leptomeningeal collaterals in Moyamoya disease.** *Eur Neurol* 2015;73:351–52 CrossRef Medline
3. Mori N, Mugikura S, Higano S, et al. **The leptomeningeal "Ivy Sign" on fluid-attenuated inversion recovery MR imaging in Moyamoya disease: a sign of decreased cerebral vascular reserve?** *AJNR Am J Neuroradiol* 2009;30:930–35 CrossRefMedline
4. Kawashima M, Noguchi T, Takase Y, et al. **Decrease in leptomeningeal ivy sign on fluid-attenuated inversion recovery images after cerebral revascularization in patients with Moyamoya disease.** *AJNR Am J Neuroradiol* 2010;31:1713–18 CrossRef Medline

N. Mori
Department of Diagnostic Radiology
Tohoku University Graduate School of Medicine
Sendai, Japan

S. Mugikura
Department of Diagnostic Radiology
Tohoku University Graduate School of Medicine
Sendai, Japan

Department of Image Statistics
Tohoku Medical Megabank Organization, Tohoku University
Sendai, Japan

http://dx.doi.org/10.3174/ajnr.A7176

Copyright 2021 by American Society of Neuroradiology.