

REPLY:

We appreciate Dr. Nabavizadeh's interest and comments on our article, "Application of 3D Fast Spin-Echo T1 Black-Blood Imaging in the Diagnosis and Prognostic Prediction of Patients with Leptomeningeal Carcinomatosis."¹ We agree that poorly suppressed blood vessels often mimic leptomeningeal enhancement on the black-blood imaging; in particular, slow-flowing blood in leptomeningeal veins, dilated arteries, or leptomeningeal collaterals can be incompletely suppressed using a variable flip angle refocusing pulse sequence.² However, we evaluated the consecutive sections of the images rather than the 1 image section, allowing anatomic differentiation between leptomeningeal vessels and leptomeningeal enhancement because the floating curvilinear enhancement pattern of leptomeningeal vessels is somewhat different from that in leptomeningeal carcinomatosis. The use of multiplanar reconstruction images may also be helpful in avoiding this kind of misinterpretation.

As Dr. Nabavizadeh has mentioned, among the various techniques for blood suppression on T1-weighted imaging, other methods such as the double inversion recovery technique may be an alternative to avoid this pitfall. However, the double inversion recovery technique requires longer acquisition times because of the time needed for spins to reach the null point.^{3,4} This disadvantage becomes more problematic as spatial coverage increases, and it can be difficult to use routinely in clinical practice. However, we agree that further investigation is warranted to determine the best technique for blood suppression to avoid the above-mentioned pitfall.

Our alternative suggestion is that 3D gradient-echo T1-weighted MPRAGE images can be used with black-blood imaging for better differentiation between leptomeningeal vessels and lep-

tomeningeal enhancement than with a single application of black-blood imaging, which also needs further study.

REFERENCES

1. Oh J, Choi SH, Lee E, et al. **Application of 3D fast spin-echo T1 black-blood imaging in the diagnosis and prognostic prediction of patients with leptomeningeal carcinomatosis.** *AJNR Am J Neuroradiol* 2018; 39:1453–59 CrossRef Medline
2. Kato Y, Higano S, Tamura H, et al. **Usefulness of contrast-enhanced T1-weighted sampling perfection with application-optimized contrasts by using different flip angle evolutions in detection of small brain metastasis at 3T MR imaging: comparison with magnetization-prepared rapid acquisition of gradient echo imaging.** *AJNR Am J Neuroradiol* 2009;30:923–29 CrossRef Medline
3. Mandell D, Mossa-Basha M, Qiao Y, et al; Vessel Wall Imaging Study Group of the American Society of Neuroradiology. **Intracranial vessel wall MRI: principles and expert consensus recommendations of the American Society of Neuroradiology.** *AJNR Am J Neuroradiol* 2017; 38:218–29 CrossRef Medline
4. Park J, Kim EY. **Contrast-enhanced, three-dimensional, whole-brain, black-blood imaging: application to small brain metastases.** *Magn Reson Med* 2010;63:553–61 CrossRef CrossRef

 J. Oh

Department of Radiology
Seoul National University Hospital
Seoul, Korea

 S.H. Choi

Department of Radiology
Seoul National University Hospital
Seoul, Korea

Department of Radiology
Seoul National University College of Medicine
Seoul, Korea

Institute of Radiation Medicine
Seoul National University Medical Research Center
Seoul, Korea

Center for Nanoparticle Research
Institute for Basic Science
Seoul, Korea

<http://dx.doi.org/10.3174/ajnr.A5850>