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Reply:

D. Byrne and P.J. MacMahon

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REPLY:

We thank Drs Raz and Shapiro for their interest in our study¹ and appreciate the opportunity to address their comments.

While delayed antegrade filling is a potential mechanism for the delayed vessel sign on multiphase CT angiography, we think that retrograde filling is by far the most common mechanism of delayed enhancement. In our article, we assessed maximum pial collateral enhancement and found that it correlated with the phase of appearance of the delayed vessel sign, which we believe supports this interpretation. In addition, one of the most useful aspects of identifying the delayed vessel is that the precise site of occlusion is nearly always identified by tracing back along the delayed vessel until enhancement abruptly decreases, again suggesting delayed retrograde opacification.

We realize that it is difficult for readers to evaluate the relatively small printed figures from the multiphase CTA study demonstrated in Fig 1 of our article, but we strongly believe that it supports a retrograde mechanism of delayed enhancement. All 3 parts of Fig 1 are from the same intracranial level. If you closely examine the indicated delayed vessel in part C, it is subtly proximal to the delayed vessel in part B (ie, retrograde filling). We have

reviewed the actual DICOM dataset and confirmed that there is proximal occlusion to the delayed vessel in this patient (and a subtle focal hyperdense vessel at the occlusion on the noncontrast CT).

We acknowledge that an antegrade opacification mechanism, due to advancement of a column of contrast between phases proximal to an occlusion, should be considered when the delayed vessel sign is encountered; however, we do not think it is a commonly encountered scenario.

REFERENCE

1. Byrne D, Sugrue G, Stanley E, et al. **Improved detection of anterior circulation occlusions: the “delayed vessel sign” on multiphase CT angiography.** *AJNR Am J Neuroradiol* 2017;38:1911–16 [CrossRef](#) [Medline](#)

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