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EDITORIAL COMMENT

Editorial comment: Changes in high-resolution vessel wall imaging features before and after PTAS for severe intracranial artery stenosis: predicting clinical outcomes within one year

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Key Points

- *Periprocedural HR-VWI plays an important role in the prediction of one-year outcomes of SICAS patients who underwent PTAS.*
- *The study further expands the application of lesion wall enhancement on HR-VWI as a predictor of RCIS after PTAS.*

Keywords Cerebral arteries · Stenosis · Stents · Follow-up

The recurrent stroke risk with severe symptomatic intracranial stenosis (≥ 70%) may be as high as 23% at one year, despite aggressive medical therapy [1]. Percutaneous transluminal angioplasty and stenting (PTAS) is one of the alternative means of treating ischemic stroke, especially after aggressive medical therapy failure [2]. Clinical and angiographical improvements may be achieved after direct revascularization by PTAS [2]. Stent implantation will exert a radial force on the stenotic lesion of the diseased vessel wall. Clarifying the effect of stent implantation may improve the safety and feasibility of PTAS in the treatment of severe intracranial artery stenosis (SICAS). It is valuable, then, to longitudinally observe the association between the changes in the stenotic lesion before and after PTAS and postoperative clinical outcome.

Accurate non-invasive alternatives to digital subtraction angiography for follow-up imaging after PTAS are desirable. Leaving aside the effects of metal artifacts, luminal evaluation alone is not sufficient to evaluate the severity of the disease because it fails to provide the pathological information within the vessel wall [3]. Whereas high-resolution vessel wall imaging (HR-VWI) may be a reliable non-invasive method for demonstrating the vessel lumen and diagnostic follow-up after endovascular recanalization [4], HR-VWI could directly display the vessel wall structure and reflect the inflammatory activity, the degree of neovascularization, and the permeability of the endothelium by showing the degree of enhancement of the diseased vessel wall [5, 6].

As mentioned in their published work in *European Radiology*, Wu et al [7] measured the imaging changes on HR-VWI in patients before and after PTAS and evaluated their associations with the postoperative clinical outcome within one year. In the study, 24 SICAS patients (14 for atherosclerosis and 10 for dissection) undergoing PTAS with Wingspan Stent were included and had a one-year follow-up. Three HR-VWI sessions (preprocedural, early [within 24 hours], and delayed [approximately 3 months after PTAS] postprocedural) in each subject were performed with 3-Tesla MRI. Patients were separated into 2 groups based on being free of cerebral ischemic symptoms (FCIS) or having the presence of recurrent cerebral ischemic symptoms (RCIS) in the first year after PTAS. The imaging differences between the two groups were retrospectively reviewed after a one-year follow-up.

The study found that patients with RCIS demonstrated no significant loss of enhanced area on contrast-enhanced T1WI of early postprocedural HR-VWI. This finding is partly in line with a previous study showing that plaque enhancement or changes in plaque enhancement characteristics during follow-up predicted stroke recurrence [8]. This result further

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expands the application of lesion wall enhancement as a predictor of RCIS after PTAS.

In the study, the calibrated T1 signals decreased in both groups. The authors speculated that the decreased T1 intensities on early postprocedural HR-VWI may be partially due to the regression or redistribution of intraplaque hemorrhage by direct compression by the stent. Due to the difficult availability of cerebral artery specimens, the mechanism of the decreased T1 intensities on early postprocedural HR-VWI remains to be confirmed in future large sample studies.

The most meaningful finding from this study is that persistently decreased intramural enhanced areas on early and delayed postprocedural HR-VWI after PTAS were associated with FCIS during a one-year follow-up. This result demonstrated that periprocedural HR-VWI plays an important role in the prediction of one-year outcomes of SICAS patients who underwent PTAS. It seems that the stent implantation would alter the pathological features of the stenotic lesion instantly. As previous studies showed, decreased enhancement of the focal stenotic lesion on HR-VWI was described as a hallmark of stabilization of the aneurysm vessel wall after aspirin treatment [9] and regressive inflammation in vasculitis after corticosteroid treatment [10]. Persistently decreased intramural enhanced areas on early and delayed postprocedural HR-VWI after PTAS may also be a sign that the diseased vessel wall has reached stability after PTAS. This finding may suggest an immediate loss of vascularity of the focal stenotic lesion by the mechanical influence of PTAS. Then, how can we identify stent artifacts or reduced enhancement due to the effect of stent implantation on the vessel wall? The authors found that the drop of the enhancement on the early postprocedural HR-VWI in the FCIS group was geographically uneven in the PTAS segments. This may indicate that this change was mostly the result of the mechanical influence after PTAS instead of the metallic artifact itself. On this basis, periprocedural HR-VWI may play an important role in the prediction of one-year outcomes of SICAS patients who underwent PTAS.

Work that collects the longitudinal data of the dynamic changes in the stenotic lesion after PTAS is always welcome and crucial, since it may not only provide insight into the pathophysiologic changes after tolerating stent implantation but also the temporal evolution of the stenotic lesion as potential predictors of RCIS. The merits of this study are as follows: (1) early postprocedural HR-VWI within 24 hours can effectively predict one-year outcome following intracranial stenting; (2) stenotic lesions after stenting without reduced contrast enhancement on HR-VWI within 24 hours may need closer clinical surveillance for potentially higher risk of stroke events within one year. However, these results may need to be interpreted cautiously, due to the small sample size and included patients with atherosclerotic disease or arterial dissection rather than a single entity. We cannot ignore the fact that stenting could damage the arterial endothelium and induce an inflammatory response and intima-media edema at least [4]. Further validation of these results in larger prospective, multicenter trials could strengthen the clinical implications of their preliminary results.

In summary, the study demonstrated that the presence of reduced contrast enhancement immediately after PTAS may indicate fewer recurrent stroke events within one year, which may be an important indicator for predicting the recurrence of cerebrovascular events and could be used in risk stratification and for determining treatment options for recurrent stroke prevention. The study reflects exploration in actual clinical practice.

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Methodology
• Editorial comment

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