

EDITORIAL COMMENT

Comprehensive Assessment of Peripheral Artery Disease Using Magnetic Resonance Imaging, Angiography, and Spectroscopy*

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Peripheral artery disease (PAD) is common (1), and 70% of patients with significant stenoses of the abdominal, pelvic, or peripheral arteries also have significant coronary artery disease (2), further limiting their clinical prognosis. PAD affects 12% to 20% of Americans 60 years of age or older (3), and despite its prevalence and impact on cardiovascular risk, only about 25% of PAD patients are treated (4). PAD is also one of the most neglected aspects of cardiovascular imaging.

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While invasive angiography was commonly used in the past to definitively assess the extent of the disease and define treatment strategies (5–7), nowadays its diagnostic role has been taken over in most of the cases by noninvasive angiography performed by either computed tomography (CT) (8,9) or magnetic resonance imaging (MRI) (10), and by ultrasonography (11). Because of its great versatility, MRI cannot only be used to assess the vessels but also to perform an integrative assessment of physiology as well as metabolism in PAD (12,13).

In their elegant study of 85 patients with mild-to-moderate PAD, Anderson et al. (14) in this issue of the *Journal* showed the comprehensive potential of MRI to assess the disease in its entirety. Using their data derived from MRI as well as magnetic resonance spectroscopy (MRS), the authors were able to show that cellular metabolism (indicated by phosphocreatinine recovery in MRS) was uncoupled from calf muscle tissue perfusion (indicated

by MRI perfusion indexes). Cellular metabolism was the parameter that correlated best with the clinically most relevant treadmill exercise results in the PAD patients, whereas muscle perfusion was the best correlate of their 6-min walk distance. The pathophysiological background of these findings remains to be further elucidated. Including magnetic resonance angiography in their multivariable regression analysis, the authors also found that clinical limitations in PAD patients were induced by multiple factors such as plaque burden, stenosis degree, and the aforementioned cellular metabolism and perfusion parameters. This indicates that an optimal treatment strategy should target all of these factors. Also, follow-up imaging studies after treatment, ideally in randomized protocols, should include as many of the MRI parameters, which were identified to be influential, as possible.

The fact that Anderson et al. (14) examined only the most symptomatic leg with MRS is an important limitation of their study. The greater spatial resolution of CT or the use of time-resolved magnetic resonance angiography (15–17) should help to better assess the presence and significance of collaterals in PAD patients noninvasively. In general, the limited robustness and reproducibility of spectroscopic data derived from MRI are often times a cause of concern as expressed in a recent editorial (18). It would be important to study this in greater detail among PAD patients, ideally in multicenter, international studies to also answer the question whether the important findings of the present study can be reproduced in less experienced centers. To assess the variability of the method and especially its potential for detecting changes over time, it would be very valuable to analyze whether the changes seen are larger than the measurement variability of a comprehensive MRI approach in PAD.

Because of its great flexibility, high temporal resolution, and, most importantly, the lack of ionizing radiation, I prefer MRI and would be pleased to see a wider distribution of this diagnostic procedure as compared with other imaging tests. If MRI enabled reliable and accurate coronary angiography noninvasively, it would clearly be the overall preferred cardiovascular imaging modality especially when compared with CT (19). However, current evidence clearly indicates that coronary MRI is inferior to coronary CT angiography if applied to all-comers (20,21). Nevertheless, the study by Anderson et al. (14) highlights the great potential of MRI for comprehensively assessing PAD while also providing new insights into its pathophysiology. I strongly believe that, if the current practical limitations in the coronary vasculature can be overcome, similar work using this study as a role model but focusing on the assessment of coronary artery disease using MRI will be instrumental in also positively influencing the management and outcome of coronary artery disease patients.

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Key Words: magnetic resonance imaging ■ spectroscopy ■ peripheral vascular disease ■ blood flow ■ atherosclerosis.