Cardiovascular Magnetic Resonance for Early Atherosclerosis Detection
Fiction or Reality?

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Atherosclerosis is a chronic inflammatory disease, characterized by a long, slow, clinically silent phase. It is the leading cause of cardiovascular death because of its high prevalence and the coexistence of other risk factors, such as diabetes mellitus, obesity, dyslipidemia, genetic predisposition, and smoking. Furthermore, sudden cardiac death is the first manifestation of coronary artery disease in 50% of men and 64% of women. The only strategy to reduce mortality in high-risk population is primary prevention using accurate screening techniques.

Arterial wall thickening (AWT) is an early sign of atherosclerosis, associated with the incidence of cardiovascular disease. However, the rate of change in AWT among middle-aged and older adults and the relationship between AWT and aortic stiffness, taking under consideration the cardiovascular risk factors, have not been previously identified.

In this study, Hundley et al assessed the presence of age, sex, and time-dependent changes in AWT and evaluated cross-sectional associations between AWT and arterial stiffness in older adults. The innovation in the study of Hundley et al is focused on 2 points:

1. Using standardized cardiovascular magnetic resonance (CMR) methods, it was demonstrated longitudinally from the Multiethnic Study of Atherosclerosis that thoracic aortic wall thickens in a yearly rate of 0.032 mm over mid to late adulthood. This change was greater in older individuals with asymptomatic atherosclerotic disease compared with that in young individuals in 5-year evaluation. It is interesting that although older age was associated with increased AWT, the rate of increase peaked in those aged 45 to 55 years and then reached the plateau with the advancement of age. Sex analysis showed that although men had greater AWT than women, AWT increase ≥10 years was similar between sex.

2. Aortic structural change is primarily related to age, race, and body mass index. However, in a hypertensive population, the aorta stiffens without necessarily affecting AWT.

CMR measurements have already documented that atherosclerosis and plaque deposition can increase AWT, which, combined with alterations in blood pressure, may lead to progressive increases in stiffness. It is interesting that in the study by Hundley et al, although higher diastolic blood pressure was related with increased AWT and aortic stiffness was associated with hypertension, there were no overt cardiovascular symptoms in the study population. These findings are of tremendous value for cardiovascular risk assessment of asymptomatic high-risk patients and emphasize the role of CMR as an important screening tool for early atherosclerosis detection.

Another important point is the clinical value of sophisticated CMR parameters, such as arterial stiffness, distensibility, and pulse wave velocity (PWV). Arterial stiffness is considered as a major determinant of increased systolic and pulse pressure with aging; therefore, it is a major determinant of stroke, heart failure, and ischemic heart disease. Distensibility measures local stiffness, whereas PWV is considered as an integrated marker of arterial stiffness, predicting fatal and nonfatal cardiovascular events. In the study by Hundley et al, those with hypertension demonstrated greater aortic stiffness, expressed by reduced distensibility and increased PWV, than those without hypertension. In subjects without hypertension, AWT was associated more strongly with distensibility than with PWV. However, PWV was not related to AWT in both groups and this might suggest that AWT has greater impact on local stiffness in late adulthood. The contrast between the findings of Hundley et al and those of Brandts et al, in which AWT was significantly related to PWV, regardless of blood pressure status, can be potentially explained by significant differences in patients’ age in 2 studies.

Various noninvasive techniques, including measurement of intima-media thickness, arterial stiffness, and flow-mediated vasodilatation, have been successfully used to early detect the effect of atherosclerosis on the arterial remodeling, before clinically overt disease appears. CMR is an innovative imaging technique that has been recently applied for early detection of atherosclerosis. CMR allowed the evaluation of different regions of arterial stiffness, providing additional information about vascular changes. It has emerged as a versatile imaging modality for the in vivo assessment of blood vessels morphology and wall composition. By virtue of its noninvasive, nonradioactive nature and the ability to provide high resolution in vivo images, CMR has become the method of choice for many clinical applications, including atherosclerosis evaluation; however, the lack of availability expertise and the high cost resulted in serious limitations for its routine application in high-risk populations.

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In any case, what should we recommend to clinicians for routine evaluation of early atherosclerosis? Currently, echocardiography is the most popular approach for aorta evaluation, because it is reliable, inexpensive, and widely available. However, it is an operator-dependent technique and limited by patient’s acoustic window. CMR, although it is more expensive and not widely available, can offer accurate measurements with excellent reproducibility, ideal for serial evaluation. In our days, Medicine is an expensive business, unsustainable by most national health systems. Under these circumstances, the next question raised is Can the reliability of CMR measurements counterbalance the cost of a serial CMR evaluation? Thousand years ago, Hippokrates recommended prevention is preferable to treatment. The tremendous diagnostic ability of CMR and the extremely high cost of cardiovascular disease treatment will promote its application in early diagnosis of asymptomatic patients with atherosclerosis. In the meantime, CMR should become inexpensive and more widely available to be incorporated in the routine assessment of these patients. However, it is still lengthy path to transform fiction to reality.

Disclosures

None.

References

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