Calcified plaque: the Achilles’ Heel of present computed tomography coronary angiography for the elderly?

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Nine percent to 27% of cardiac catheterizations today showed either angiographic normal coronary arteries or minimal atherosclerosis. Given the expense of cardiac catheterization and the desire to use this valuable resource for therapeutic rather than diagnostic purpose, there is a strong impetus to develop non-invasive means of accurately detecting significant coronary artery stenosis. Although echocardiography is the most common non-invasive cardiac procedure, nuclear cardiology, more recently cardiac computed tomography angiography (CTA) and cardiac magnetic resonance (CMR) play more important roles in detecting significant coronary artery disease. While CMR had great promise as a radiation-free and contrast-free ‘one-stop’ procedure, its technology currently lags behind CTA in the non-invasive imaging of coronary artery.

The sensitivity, specificity, and positive and negative predictive values of CTA for detecting significant coronary stenoses on a segment-by-segment analysis were 99%, 95%, 76%, and 99%, respectively in patients in sinus rhythm and presenting with atypical chest pain, stable or unstable angina, or non-ST-segment elevation myocardial infarction. Coronary 320-MDCTA accurately excludes ≥50%-stenoses in patients with advanced (CAD) and high calcium scores, showing an overall diagnostic accuracy of 91%.1

Unfortunately, the elderly patients have high incidence of coronary artery disease and coronary calcium deposits.2 In an article of Chan et al.3 published in this issue of the Journal of Geriatric Cardiology, the high calcium scores limit the accuracy of CTA in detecting significant coronary lesion in the elderly population. Dense calcification could result in overestimating the severity of the lesion (false positive) or prevent assessment of the lesion (considered as underestimation or false negative by the authors).4,5 The false positive results might lead to unnecessary invasive coronary angiography and the underestimated results gives false assurance to the patient who might need coronary interventions. Moreover, the patient radiation exposure to CT angiography is higher than coronary angiography alone and the amount of contrast used in a false positive CTA plus invasive coronary angiography could be prohibitive for the elderly patients with borderline renal function.

Thus, as suggested by Berman et al.11 in patients with suspected CAD, the pretest likelihood of disease, a clinical assessment, becomes the most important determinant of the initial test. If the likelihood is very low, no testing is needed. However, even if the likelihood is low, recent data suggest provocatively that assessment of early atherosclerosis is likely to be the most useful and cost-effective test because the majority of acute myocardial infarction is caused by mild plaques without calcification. In patients who have an intermediate likelihood of CAD, nuclear cardiology with myocardial perfusion SPECT (MPS) gives highly valuable quantitative and prognostic information. In this situation, coronary CT angiography (CTA) emerges as the most favourite initial test of choice. MPS would be used if the CTA result is inconclusive or if there is a need to assess the functional significance of a borderline stenosis discovered by CTA. In the elderly patients with high likelihood of CAD, MPS may be the initial test of choice, since a high proportion of these patients has too much coronary calcium deposits to allow accurate assessment of coronary stenoses.

PET/CT or SPECT/CT could emerge as important modalities combining the advantages of each modality. Conventional coronary angiography may be more preferable in case of surgical revascularized patients, who have been already evaluated for both coronary and peripheral vascular distributions and may benefit from a non-invasive control of graft patency: CT angiography has shown to be effective in assessing aorto-coronary vein grafts with good sensitivity and specificity.12

In the frenzy race for installing a new CTA in as many hospitals as possible, technology companies are not afraid of pull all the stops for a faster, stronger, and larger CTA. Software for 124 slice MDCTs are being developed, tested and tried in pilot centers. In the next 5 years, 240 slice MDCTs would be normal standard of care for detecting coronary artery stenoses. Now, the dense calcium deposit in the coronary artery of the elderly population is the Achilles’ heel of the present generation of MDCT. With PRESENT development at a dizzy speed from information technology companies, the calcium problem will
References


5. Schussler JM, Grayburn PA. CT imaging of the coronary arteries. Heart 2005 Dec 30; [Epub ahead of print]

6. Rigatelli G. Renovascular disease imaging: Today more than ever the invasive cardiologist may make the difference. Int J Cardiol 2006 Jan 3; [Epub ahead of print]


