MDCTA. Moreover, because heart rhythm and frequency control devices such as ICDs and permanent pacemakers are becoming increasingly more common in patients with advanced CAD and traditionally constitute an absolute contraindication to magnetic resonance imaging, 32 × 0.5-MDCTA emerges as an alternative to tomographic imaging of these patients with high temporal and spatial resolution, even though we have noticed limitations in the evaluation of the RCA in a few patients in this study.¹⁷

We conclude that coronary 32 × 0.5-MDCTA reliably excludes ≥ 50% and ≥ 70% stenoses in vessels with a luminal diameter ≥ 1.5 mm in a population with complex and advanced atherosclerotic disease regardless of calcification degree and territory location (left main, LAD, LCx, or RCA). Such results highlight the possibility of its present use in the follow up of patients with established chronic CAD, as well as, in the future, in the risk stratification of patients with chest pain and an intermediate likelihood of CAD.

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REFERENCES

- 1 Keane D, Haase J, Slager CJ, *et al.* Comparative validation of quantitative coronary angiography systems: results and implications from a multicenter study using a standardized approach. *Circulation* 1995;**91**:2174–83.
- 2 Nieman K, Oudkerk M, Rensing BJ, *et al.* Coronary angiography with multislice computed tomography. *Lancet* 2001;**357**:599–603.
- 3 Nieman K, Cademartiri F, Lemos PA, *et al.* Reliable noninvasive coronary angiography with fast submillimeter multislice spiral computed tomography. *Circulation* 2002;**106**:2051–4.
- 4 Ropers D, Baum U, Pohle K, *et al.* Detection of coronary artery stenoses with thin-slice multi-detector row spiral computed tomography and multiplanar reconstruction. *Circulation* 2003;**107**:664–6.
- 5 Dewey M, Laule M, Krug L, *et al.* Multisegment and halfscan reconstruction of 16-slice computed tomography for detection of coronary artery stenoses. *Invest Radiol* 2004;**39**:223–9.
- 6 Hoffmann U, Moselewski F, Cury RC, *et al.* Predictive value of 16-slice multidetector spiral computed tomography to detect significant obstructive coronary artery disease in patients at high risk for coronary artery disease: patient-versus segment-based analysis. *Circulation* 2004;**110**:2638–43.
- 7 Leschka S, Alkadhi H, Plass A, *et al.* Accuracy of MSCT coronary angiography with 64-slice technology: first experience. *Eur Heart J* 2005;**26**:1482–7.
- 8 Leber AW, Knez A, von Ziegler F, *et al.* Quantification of obstructive and nonobstructive coronary lesions by 64-slice computed tomography: a comparative study with quantitative coronary angiography and intravascular ultrasound. *J Am Coll Cardiol* 2005;**46**:147–54.
- 9 Raff GL, Gallagher MJ, O'Neill WW, *et al.* Diagnostic accuracy of noninvasive coronary angiography using 64-slice spiral computed tomography. *J Am Coll Cardiol* 2005;**46**:552–7.
- 10 Eggen DA, Strong JP, McGill HC Jr. Coronary calcification: relationship to clinically significant coronary lesions and race, sex, and topographic distribution. *Circulation* 1965;**32**:948–55.
- 11 Rumberger JA, Brundage BH, Rader DJ, *et al.* Electron beam computed tomographic coronary calcium scanning: a review and guidelines for use in asymptomatic persons. *Mayo Clin Proc* 1999;**74**:243–52.
- 12 Agatston AS, Janowitz WR, Hildner FJ, *et al.* Quantification of coronary artery calcium using ultrafast computed tomography. *J Am Coll Cardiol* 1990;**15**:827–32.
- 13 Cordeiro MAS, Lardo AC, Brito MSV, *et al.* CT angiography in highly calcified arteries: 2D vs. modified automated 3D approach to identify coronary stenoses. *Int J Cardiovasc Imaging* (in press).
- 14 Guthaner DF, Robert EW, Alderman EL, *et al.* Long-term serial angiographic studies after coronary artery bypass surgery. *Circulation* 1979;**60**:250–9.
- 15 Hammermeister KE, DeRouen TA, Dodge HT. Variables predictive of survival in patients with coronary disease: selection by univariate and multivariate analyses from the clinical, electrocardiographic, exercise, arteriographic, and quantitative angiographic evaluations. *Circulation* 1979;**59**:421–30.
- 16 Detrano RC, Anderson M, Nelson J, *et al.* Coronary calcium measurements: effect of CT scanner type and calcium measure on rescan reproducibility. MESA study. *Radiology* 2005;**236**:477–84.
- 17 Niehaus M, Tebbenjohanns J. Electromagnetic interference in patients with implanted pacemakers or cardioverter-defibrillators. *Heart* 2001;**86**:246–8.

IMAGES IN CARDIOLOGY

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Permanent pacemaker lead thrombosis leading to recurrent pulmonary embolism

Clinically apparent pulmonary embolism is a rare complication of permanent transvenous pacing catheters. Here we report an unusual case of a 65 year old woman who developed recurrent pulmonary embolism two years after a permanent transvenous pacemaker implantation in the absence of any patient related predisposing factor. Transoesophageal echocardiography (TOE) showed a fibril strand thrombus within the right atrium closely attached to the pacemaker lead (panels A and B: LA, left atrium; RA, right atrium; T, thrombus). The patient was treated with warfarin and discharged.

In patients with permanent pacemakers where pulmonary embolism is suspected, TOE may prove beneficial for determining whether there is lead thrombosis.

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