CT angiography; no collateral damage

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Published online: 22 January 2009

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Nowadays, coronary computed tomographic angiography (CTA) enables accurate assessment of the presence of coronary stenoses in selected patient populations. Several studies have shown that CTA is able to detect coronary artery stenoses with high sensitivity and specificity in the major epicardial coronary arteries using advanced multislice CT [1–21]. However, only few studies have determined the sensitivity and specificity of CTA to detect the presence and extent of coronary collaterals. The presence and extent of coronary collateralization often determines the need for revascularization of occluded vessels as well as the method of revascularization i.e., percutaneous coronary intervention (PCI) versus coronary artery bypass surgery (CABG). Consequently, the degree of collateralization has significant impact on the further therapeutic strategy and patient outcome.

It is still not fully clear whether coronary CTA has the potential to replace invasive coronary angiography as a tool to assess a patient's suitability for revascularization as determined by the characterization of

lesion morphology in patients with significant coronary artery disease. Sheth et al. [22] (from the group of Hoffmann) evaluated the accuracy of CTA for the detection of complex lesion morphology, total occlusions, and ostial or bifurcation location. Coronary CTA (i.e., 64-slice computed tomography) was performed before invasive coronary angiography in 29 patients. On CTA, 10 of 69 lesions (15%) were not evaluable for any feature of complex lesion morphology. Of the evaluable lesions, the sensitivity of CTA was 93% for total occlusions, and 60 and 80% for the detection of ostial and bifurcation lesions, respectively. The specificity was high (97%) for total occlusions, 97% for ostial lesions, and 100% for bifurcations. It was concluded that invasive selective coronary angiography remains the cornerstone to assess a patient's suitability for revascularization given the high proportion of non-evaluable segments that precluded adequate revascularization planning on CTA.

However, recent studies have shown that 64-slice multidetector CTA will impact revascularization in multiple areas such as (1) pre-PCI patient selection; (2) identification of significant lesions; (3) in-stent restenosis; (4) procedure planning: stent sizing, choice of intervention, and equipment, chronic total occlusions, 3D-CTA in the catheterization laboratory; (5) plaque evaluation and identification of high-risk lesions; (6) post-catheterization decisions, (7) post-CABG strategies, and (8) structural heart disease [23–34]. Therefore, multidetector CTA coronary angiography

Editorial comment to the article of Rieber et al. (doi: 10.1007/s10554-008-9384-3)

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may provide essential information as an adjunctive tool after catheter-based angiography, expanding the indications for multislice CTA in order to accommodate these clinical necessities.

Along those lines, Mollet et al. [35] performed multislice CTA in 45 patients who had chronic total occlusions and were scheduled for percutaneous recanalization. Multivariate analysis identified a blunt stump by conventional angiography, occlusion length >15 mm, and severe calcification as independent predictors of procedural failure. Kinohira et al. [36] showed that coronary arterial plaque characterized by multislice CT can predict intervention-related complication which may be important for the risk stratification of the patients scheduled to undergo PCI to investigate plaque configuration by multislice CT. In symptom-free patients more than 5 years after CABG, Anand et al. [37] showed that CTA allowed reliable identification of bypass graft stenoses and occlusions.

In the current issue of the *International Journal of Cardiovascular Imaging*, Rieber et al. [38] (also from Hoffmann's group) showed that CTA was helpful in managing patients with chronic coronary occlusions. The aim of the study was to determine the sensitivity and specificity of CTA in 26 patients with total occlusions to detect the presence and extent of coronary collaterals as compared to invasive coronary angiography. CTA was performed using a 64-slice multidetector CT scanner. CTA accurately identified the presence and location of all 26 total occlusions. The presence of any collaterals was accurately detected in 21/23 patients (sensitivity 91%) and the absence in three patients (specificity 100%). The origin of the 35 collateralizations was correctly identified by CTA in 25 (71%) cases. However, in 6 (17%) cases CTA was not able to detect the collaterals and in 4 (11%) cases the collaterals were allocated to the wrong origin. Overall, it was shown that CTA was highly sensitive for the detection of coronary collaterals on a patient basis, but only moderate accurate for the detection of individual collaterals.

Recognized limitations of the study were: (1) retrospective analysis of routine clinical CTA, (2) delayed collateral filling, due to timing of the contrast injection, which might have led to underestimation of the extent of the coronary collateralization, (3) inability to assess the sensitivity in detecting total occlusions as patient selection was based on the

presence of total occlusions by invasive angiography, and (4) suboptimal temporal resolution as newer CT-scanners might have increased temporal resolution potentially improving the detection of collaterals.

To summarize, although coronary CTA is currently limited in the assessment of individual collaterals and smaller vessels, it may be helpful in the management of patients with total occlusions. Thus, coronary CTA provides incremental diagnostic information to invasive coronary angiography and may have the potential to more accurately guide the management of patients with total occlusions.

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