Is CT the Better Angiogram?
Coronary Interventions and CT Imaging*
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Periprocedural myocardial infarction is a potential problem of percutaneous coronary intervention. Even after seemingly uncomplicated, straightforward elective coronary interventions, elevation of cardiac enzymes can be observed and occur in approximately one-third of cases (1). Such enzyme elevations have been shown to be associated with myocardial injury, for example, by magnetic resonance studies (2,3). Both for troponin elevation (1) and for detectable myocardial scar following elective percutaneous intervention (4), substantial prognostic implications have been demonstrated; in a meta-analysis of more than 15,000 patients, Nienhuis et al. (1) found post-interventional troponin release to be associated with a 35% increase in mortality.

Such ischemic complications after percutaneous coronary intervention can be caused by a number of mechanisms. They include abrupt closure of the intervention site, side branch occlusion, and distal embolization of plaque material or thrombus (5,6), and predicting such complications would be of value. Angiographic parameters can be predictive of periprocedural infarction, such as the SYNTAX score, which incorporates the presence of branching vessels, ostial stenosis, vessel tortuosity, lesion length, degree of calcification, and presence of thrombus (7). Also, the volume of atherosclerotic plaque (as quantified by intravascular ultrasound before the intervention [8]) as well as the type of plaque in the treated segment (9,10) are associated with periprocedural infarction. Prior knowledge of the risk of such potential complications may influence the choice of revascularization methods or may prompt initiation of specific measures to lower the rate of this complication, such as the use of embolization protection devices (15) or pre-treatment with statins (11–13). Even a single dose of statins may have a beneficial effect (14).

In this issue of JACC, Uetani et al. (16) present an intriguing study which demonstrates that coronary computed tomography (CT) angiography may help predict periprocedural infarction in patients undergoing elective coronary revascularization by percutaneous stent placement. In a large study of planned elective intervention of single lesions, the authors employed 64-slice CT coronary angiography to quantify plaque volume in the target lesion before the intervention, as well as to quantify the volume of plaque components with low (<50 Hounsfield units), intermediate, and high (>500 Hounsfield units) CT attenuation. After coronary intervention, troponin elevation occurred in one-third of patients. In multivariate analyses, the volume of atherosclerotic plaque with low CT attenuation was independently associated with periprocedural infarction. The association was striking—in patients with troponin increase, the average volume of low-density plaque was twice as high as in patients without troponin elevation. Plaque with low CT attenuation is assumed to be lipid-rich, more likely to embolize during stent placement, lead to downstream ischemia, and at least partially explain the observed findings.

The atherosclerotic plaque at the target lesion is only 1 component that may lead to ischemic complications. In everyday practice, vessel dissection, side branch occlusion, and other mechanisms may also be involved and were not assessed in this study.

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Editorial Comment

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REFERENCES

CT imaging of the coronary arteries offers potentially important information to interventional cardiologists in several ways. The 3-dimensional nature of CT angiography data sets allows an accurate assessment of geometry, and their cross-sectional nature allows combining of imaging of the coronary lumen and, image quality permitting, of the coronary artery wall. For example, these properties have been used for the spatially correct measurement of branching angles—important information for treatment of bifurcation lesions (22,23). Clinically, it has been shown that CT angiography, by depicting the degree of calcification and the length of the occluded segment, is helpful to predict the success of percutaneous treatment of chronic total coronary artery occlusions, one of the major challenges in interventional cardiology (24,25). Wertman et al. (26) demonstrated that CT characteristics were able to predict the complexity of interventional revascularization procedures, including contrast use and fluoroscopy time. A recent report described the ability to perform coronary interventions without even angiography, using magnetic navigation and a previously acquired coronary CT angiogram (27). Uetani et al. (16), with their contribution in this issue of iJACC, add to this body of knowledge. CT imaging may be considered in the preparation of complex revascularization procedures, and if a CT scan has been performed as part of the diagnostic workup in a patient with chest pain, interventionalists should be aware of the information available from the CT data set if percutaneous treatment is planned.

Currently, the temporal and spatial resolution of CT imaging is lower than that of the invasive, catheter-based coronary angiogram. However, the 3-dimensional, cross-sectional nature of CT has the inherent ability to deliver more information than a projectional technique such as fluoroscopic angiography. The technical development of CT imaging continues at an astounding pace, and although many problems remain to be solved there is a good reason to believe that CT angiogram will become a better coronary angiogram in the future.

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