The Entire Coronary Arterial System Rather Than Just the Culprit Lesion Should be Evaluated in Patients With Acute Coronary Syndrome

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The extent of coronary artery narrowing has been considered a primary and readily available determinant of survival in patients with coronary artery disease. Despite continuous refinement in antithrombotic therapy and intracoronary stents, the extent and complexity of coronary artery disease remain major determinants of short- and long-term prognosis in patients undergoing percutaneous coronary intervention (PCI). The American College of Cardiology/ The American Heart Association (ACC/AHA) lesion classification scheme is still the most commonly employed lesion classification system worldwide. In addition, the development of computer-based quantitative coronary angiographic analysis could provide more precise information of lesion profiles, especially for decision making in PCI. Although angiographic assessments focus on individual lesions (mainly the target lesion), a number of patients free from target-lesion revascularization develop major adverse cardiovascular event (MACE), and their prognosis depends on the non-target lesions as well as the target lesions. Therefore, we should evaluate the atherosclerotic burden of the entire coronary arterial system. Based on coronary angiography, several methods have been proposed to score the extent and severity of stenotic lesions of the entire coronary arterial system. These scoring systems have been used not only as a tool for risk stratification but also to evaluate biomarkers for atherosclerosis or to predict cardiovascular events.

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In this issue of the Journal, Huang et al report a very interesting study that compared the predictive value of 3 methods to score coronary lesions in the entire coronary arterial system: the Gensini score, the Leaman score and the ACC/AHA score. In their study, 958 patients with acute coronary syndrome (ACS) were followed-up until MACE that included cardiac death, stroke, heart failure, non-fatal myocardial infarction and rehospitalization for angina pectoris. A Cox regression analysis showed that the Gensini score was associated with 90-day MACE (RR 1.094, 95% CI 1.019–1.174, P=0.014), 6-month MACE (RR 1.098, 95% CI 1.035–1.165, P=0.002) and 1-year MACE (RR 1.074, 95% CI 1.018–1.134, P=0.009), but not with MACE throughout follow-up. However, the ACC/AHA score was not associated with MACE at any time during follow-up. Although all of these 3 scores were associated with cardiac death in logistic regression analysis, the predictive power was strongest with the Gensini score (odds ratio 1.037, 95% CI 1.014–1.080, P<0.05). These results suggest that the Gensini score provides the most valuable prognostic information on cardiovascular risk in patients with ACS compared with the other 2 scores. The 3 scores are calculated as the sum of all segment scores, with the value assigned to a coronary segment multiplied by a weighting factor based on the specific percentage luminal diameter reduction in that segment. In addition, there are different weighting methods used in the 3 scoring systems depending on the location of the lesions. The Gensini and Leaman scores place more weight on the coronary arteries involved, not only major coronary arteries but also branches of major arteries. Both the Gensini and Leaman scores place more weight on the left main coronary artery, and proximal left anterior and mid-left anterior descending arteries. These arteries are assigned relatively higher weighting factors than the other arteries. With the ACC/AHA score, all arteries are weighted the same. With the Gensini and Leaman scores, arteries are weighted differently according to the relative volume of blood flow they deliver to the myocardium. In contrast, the weighting factor for stenosis severity is greater with the Gensini score than those with the Leaman and ACC/AHA scores. Based on the results of Huang et al, we can envision that both stenosis severity of pan-coronary arteries and the presence of the left main and/or left anterior descending coronary artery involvement are closely associated with the occurrence of MACE in ACS patients.

Recently, a novel coronary scoring system for the entire coronary arterial system, the SYNTAX score, has been established. The SYNTAX score was developed as a comprehensive angiographic scoring system to evaluate patients with extensive coronary artery disease undergoing contemporary revascularization. Each coronary lesion producing ≥50% luminal narrowing in a vessel ≥1.5 mm is separately scored. With the SYNTAX score, lesions are assigned to a coronary segment multiplied by a weighting factor based on the specific percentage luminal diameter reduction in that segment. The SYNTAX score takes into account the number of lesions in the coronary arterial system, the complexity of the lesions, the location of the lesions and the volume of blood flow they deliver to the myocardium. In contrast, the weighting factor for stenosis severity is greater with the Gensini score than those with the Leaman and ACC/AHA scores. Based on the results of Huang et al, we can envision that both stenosis severity of pan-coronary arteries and the presence of the left main and/or left anterior descending coronary artery involvement are closely associated with the occurrence of MACE in ACS patients.

The opinions expressed in this article are not necessarily those of the editors or of the Japanese Circulation Society.

Received January 14, 2010; accepted January 14, 2010; released online February 9, 2010
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ber of lesions with their specific weighting factors based on the amount of myocardium distal to the lesion according to the Leaman score, and the morphologic features of each single lesion, as previously reported. The Arterial Revascularization Therapies Study II (ARTS II)16 assessed the predictive value of the SYNTAX score in patients undergoing PCI for 3-vessel coronary artery disease. In ARTS II, the SYNTAX score was applied to 1,292 lesions in 306 patients and predicted the rate of MACE (hazard ratio 1.08, 95%CI 1.05–1.11, P<0.0001) after a median of 370 days (range 274–400). The study found that patients in the highest SYNTAX score tertile had a significantly higher event rate than patients in the lowest tertile (27.9% vs 8.7%, hazard ratio 3.5, 95%CI 1.7–7.4, P=0.001). By multivariate analysis, the SYNTAX score independently predicted outcome with an almost 4-fold adjusted increase in the risk of MACE in patients with high vs low scores based on the discrimination provided by classification and regression-tree analysis. The SYNTAX trial16 was a large randomized trial with complete monitoring of MACE and compared PCI and coronary artery bypass graft surgery in 1,800 patients with left main or 3-vessel coronary artery disease; non-randomized patients were followed in a registry. The reliability of the SYNTAX score was assessed with 100 diagnostic angiograms from the SYNTAX trial randomly selected by 2 independent observers. The SYNTAX score is a visual coronary score with an acceptable core-laboratory reproducibility that has an impact on 1 year-MACE in patients receiving PCI.18 The SYNTAX score is likely to be useful in a wide range of patients with complex coronary disease.

The study of Huang et al17 assessed coronary disease severity scores, especially focusing on patients with ACS. Their study suggested that we should pay attention not only to culprit lesions, but also to the other coronary arteries, because patients with ACS frequently have vulnerable plaque in the remote coronary arteries, suggesting that ACS is part of the pan-coronary disease process. Although angiographic coronary scoring systems are useful to assess the extent of atherosclerosis in the entire coronary artery system, they are limited to luminal information only. To evaluate plaque vulnerability in patients with ACS, observation of the vessel wall is more important. For this purpose, intravascular ultrasound (IVUS) is the predominant modality that can detect plaque structure (eg, lipid core as echo-lucent area). Recent IVUS observations have consistently demonstrated that the majority of patients with ACS have previously ruptured coronary artery plaque in non-culprit coronary arteries in addition to the infarct-related culprit arteries.11 In addition, virtual histology-IVUS, in which spectral analysis of IVUS radiofrequency data is color coded, can provide detailed qualitative information on coronary plaque composition.12 Optical coherence tomography can more precisely characterize plaque anatomy and can provide important information on fibrous cap thickness; thus, it might be the best modality to detect rupture-prone plaques.13 However, these catheter-based modalities require invasive procedures and focus on local lesions but not the entire coronary arterial system. In contrast, multislice computed tomography (MSCT) allows non-invasive detection of not only coronary arterial stenoses, but also vulnerable plaques characterized by low-density areas. In addition, MSCT can provide non-invasive information on the entire coronary arterial system.14 We can envision that future coronary scoring systems using MSCT will consider the burden of atherosclerosis in the entire coronary arterial system and coronary plaque vulnerability.

References


