Predicting Coronary Atherosclerotic Plaque Burden From Clinical Parameters: Bringing Old Knowledge in the Game

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The SYNTAX (SYNergy between PCI with TAXus and cardiac surgery) score was developed more than a decade ago as an angiographic and more recently computed tomography angiography (CTA)-derived tool, grading the complexity of coronary artery disease (CAD).[1,2] Aiming to assist in patient selection and risk stratification of patients with extensive CAD undergoing revascularization, it has been established as one of the most rigorously implemented scores and can facilitate the management of CAD patients in need of revascularization either as coronary intervention or as coronary artery bypass graft operation.[3] By grading the complexity of the lesions, the SYNTAX score can predict mortality and is related to major cardiovascular events.[4]

Aside imaging scores, several approaches have evaluated clinical features that have been also implemented into scoring systems.[5-7] The clinical SYNTAX score was shown to have increased predictive accuracy for long-term all-cause mortality compared with its anatomical-only equivalent.[5,7] Similarly, the SYNTAX score II has been shown to be superior to the angiographic score, with regards to 4-year mortality in patients with complex CAD.[6] Both scores have combined the invasively assessed SYNTAX score with clinical variables such as age, creatinine clearance, left ventricle ejection fraction and later, with the addition of gender, presence of peripheral arterial disease, chronic obstructive pulmonary disease (plus unprotected left main disease). Notably, vital parameters such as resting heart rate (HR), blood pressure, and/or body mass index (BMI) are not taken into account.

In this issue of *Angiology*, Zhang et al[8] investigated the predictive value of resting HR and BMI on the extent of coronary atherosclerosis burden as assessed by the angiographic SYNTAX score in patients with stable angina. They evaluated 312 Chinese patients with stable angina and sinus rhythm who underwent coronary angiography. Patients were divided into 4 groups based on HR, and a number of demographic characteristics and laboratory parameters were correlated with the SYNTAX score for each patient. Meticulous statistical analysis of all factors that could have influenced the extent and burden of coronary plaque allowed for clarity in the results. High resting HR and high BMI were independent predictors of coronary atherosclerotic plaque burden. The results are not unexpected and agree with a background of compelling evidence from other studies that illustrated the association of resting HR with coronary atherosclerosis burden. By evaluating 420 patients with stable angina and sinus rhythm undergoing coronary angiography, Yilmaz et al showed that resting HR is associated with SYNTAX score.[9] It was also demonstrated that resting HR is a powerful and independent predictor of the severity and complexity of coronary plaques evaluated by the SYNTAX score in patients with stable CAD.

Resting HR is correlated with cardiovascular risk factors and is positively associated with hypertension and obesity.[10] It is also well-known that resting HR is related to the prevalence of CAD and adverse cardiovascular events. Several large prospective studies have illustrated the strong and independent association of resting HR with long-term cardiovascular disease mortality.[11,12] The natural history and pathophysiology of coronary atherosclerosis is tightly correlated with HR.[13] Mechanisms include primarily alterations in the local biomechanical environment. More specifically, an elevated HR increases the pulsatile heart motion and the frequency of the periodically changing geometry of the coronary arteries, directly affecting the local hemodynamic environment.[14] By increasing the magnitude and frequency of the arterial wall stress, the exposure of coronary endothelium to the low and oscillatory shear stress is prolonged.[13] The latter has direct

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implication on plaque formation and progression as it holds a proatherogenic role evident in human and animal research.[15-18]

The association of BMI with the prevalence and extent of CAD has been debated. Although obesity is considered to be an all-cause mortality risk factor, obese patients were shown to have superior short-term outcome post-revascularization and in some studies lower prevalence of high-risk coronary anatomy.[19-21] This *obesity paradox* can probably be explained by a potential selection "bias" as severely obese patients may have been infrequently referred for invasive coronary evaluation. Recently, a prospective multicenter study of patients referred for noninvasive coronary imaging revealed that overweight and obese individuals had greater prevalence, extent, and severity of CAD.[22] The study by Zhang et al[8] brings new evidence supporting these findings with a quantitative and invasive metric of the extent and complexity of coronary atherosclerosis.

Evaluation, management, and prognostic scores are widely available and have been incorporated into clinical practice. The majority are subject to intra- and interobserver variability. For example, the angiographic SYNTAX score has moderate intraobserver variability, with scoring of bifurcation lesions being the main reason for discrepancies.[23] The CTA-derived SYNTAX score has been shown to have unsatisfactory agreement with the standard reference angiographic score, at least with older generation (64-slice) scanners.[24] There are certainly more scores to come and to be evaluated. Nonetheless, there is a need to simplify scores. Incorporating, old, simply assessed clinical parameters into the evaluation of cardiovascular patients is more than welcomed. Modern biomedical and medical advances and technology allow for rapid assessment of multimodality, multifactorial scores; by focusing more on scores, there is a rather appalling feeling that the touch with the patient is lost. Planning the future interdisciplinary management of patients with stable CAD, we should also think of simple clinical parameters that could represent not only a predictive tool but also a more aggressive treatment goal.

Declaration of Conflicting Interests

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