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A Clinical Model to Identify Patients With High-Risk Coronary Artery Disease

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ABSTRACT

OBJECTIVES This study sought to develop a clinical model that identifies patients with and without high-risk coronary artery disease (CAD).

BACKGROUND Although current clinical models help to estimate a patient's pre-test probability of obstructive CAD, they do not accurately identify those patients with and without high-risk coronary anatomy.

METHODS Retrospective analysis of a prospectively collected multinational coronary computed tomographic angiography (CTA) cohort was conducted. High-risk anatomy was defined as left main diameter stenosis ≥50%, 3-vessel disease with diameter stenosis ≥70%, or 2-vessel disease involving the proximal left anterior descending artery. Using a cohort of 27,125, patients with a history of CAD, cardiac transplantation, and congenital heart disease were excluded. The model was derived from 24,251 consecutive patients in the derivation cohort and an additional 7,333 nonoverlapping patients in the validation cohort.

RESULTS The risk score consisted of 9 variables: age, sex, diabetes, hypertension, current smoking, hyperlipidemia, family history of CAD, history of peripheral vascular disease, and chest pain symptoms. Patients were divided into 3 risk categories: low (≤7 points), intermediate (8 to 17 points) and high (≥18 points). The model was statistically robust with area under the curve of 0.76 (95% confidence interval [CI]: 0.75 to 0.78) in the derivation cohort and 0.71 (95% CI: 0.69 to 0.74) in the validation cohort. Patients who scored ≤7 points had a low negative likelihood ratio (<0.1), whereas patients who scored ≥18 points had a high specificity of 99.3% and a positive likelihood ratio (8.48). In the validation group, the prevalence of high-risk CAD was 1% in patients with ≤7 points and 16.7% in those with ≥18 points.

CONCLUSIONS We propose a scoring system, based on clinical variables, that can be used to identify patients at high and low pre-test probability of having high-risk CAD. Identification of these populations may detect those who may benefit from a trial of medical therapy and those who may benefit most from an invasive strategy. (J Am Coll Cardiol Img 2015;8:427–34) © 2015 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

CAD = coronary artery disease

CTA = computed tomographic angiography

HRA = high-risk anatomy

ICA = invasive coronary angiography

ROC = receiver operating characteristic

The diagnosis and subsequent stratification of patients with suspected coronary artery disease (CAD) are important to management. Traditionally, patients with CAD are categorized according to the presence and absence of high-risk coronary anatomy because those patients with high-risk CAD often derive the greatest mortality benefit with revascularization (1–3). Conversely, a trial of optimal medical therapy may be appropriate for those patients with non-high-risk CAD (4).

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The current standard for the anatomic diagnosis of CAD is invasive coronary angiography (ICA); however, ICA is expensive and has associated procedural hazards (5). Therefore, it would be desirable to identify patients at greatest probability of high-risk CAD who require further investigations and those patients with low probability of high-risk CAD in whom a trial of optimal medical therapy may be appropriate. Current clinical models estimate a patient's pre-test probability for obstructive CAD, but they do not accurately predict the presence or absence of high-risk CAD (left main coronary artery diameter stenosis ≥50%, 3-vessel disease [diameter stenosis ≥70%] or 2-vessel disease involving the proximal left anterior descending artery). Previous models have defined significant CAD as ≥1 vessel with a ≥50% or ≥75% lesion (6–8). To our knowledge, no studies have examined models to ascertain likelihood of 'high-risk coronary anatomy'. This is most relevant given recent evidence that optimal medical therapy is a reasonable treatment option in patients with CAD.

Using a large, prospective international registry of patients referred to coronary computed tomographic angiography (CTA) for suspected CAD, this study sought to develop a clinical model to identify the presence and absence of high-risk CAD.

METHODS

PATIENTS AND EXCLUSION CRITERIA. Patients referred to coronary CTA for suspected CAD were included in the study. Patients with documented CAD or a history of myocardial infarction, coronary revascularization, cardiac transplantation, and congenital heart disease were excluded from analysis. Between 2005 and 2009, 27,125 consecutive adult patients ≥18 years old who were undergoing ≥64-detector row coronary CTA were prospectively enrolled into the CONFIRM (Coronary CT Angiography Evaluation for Clinical Outcomes: An International Multicenter) registry and were used for the derivation cohort (9). Using the same inclusion and exclusion criteria, an additional nonoverlapping cohort (comprising the CONFIRM validation cohort and the University of Ottawa Heart Institute Cardiac CT Registry) of 7,333 patients was used as a validation cohort.

Each center obtained approval from the Institutional Review Board, and all patients provided informed consent for study participation.

CLINICAL DEFINITIONS. At the time of coronary CTA, medical history and available laboratory results were recorded for all patients (6,10). A detailed description of the methods has been previously published (9). Symptoms were analyzed according to the criteria for angina pectoris, in which patients with typical angina exhibited all 3 characteristics (chest pain, onset with exertion, improvement with rest) and atypical angina with any 1 or 2 characteristics (6).

Hypertension was defined as a known history of systolic blood pressure >140 mm Hg or treatment with antihypertensive medications. Diabetes mellitus was defined as a previous diagnosis of diabetes or use

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