Clinica Chimica Acta 445 (2015) 93–100

Contents lists available at ScienceDirect

Clinica Chimica Acta

journal homepage: www.elsevier.com/locate/clinchim

Coronary severity score and C-reactive protein predict major adverse cardiovascular events in patients with stable coronary artery disease (from the Taichung CAD study)

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ARTICLE INFO

Article history:
Received 5 October 2014
Received in revised form 27 February 2015
Accepted 17 March 2015
Available online 27 March 2015

Keywords:
Coronary artery disease (CAD)
Diabetes mellitus
High-sensitivity C-reactive protein (hs-CRP)
Gensini score
Jeopardy score
SYNTAX score

ABSTRACT

Background: Whether angiographic coronary severity really predicts future major adverse cardiovascular events (MACEs) in patients with coronary artery disease (CAD) is uncertain. Few studies have compared the efficacy of SYNTAX, Gensini and Jeopardy scores in predicting MACE in stable CAD.
Methods: We collected data of MACE, including all-cause mortality, all strokes, new myocardial infarction and unplanned repeat revascularization, in subjects with stable CAD from our catheterization databank. Coronary severity was graded with SYNTAX, Gensini and Jeopardy scoring systems.
Results: During a median follow-up period of 42 months, 39 out of the 181 subjects developed at least 1 MACE. Those with MACE had a significantly higher baseline high sensitivity C-reactive protein (hs-CRP) ($p = 0.025$). Multivariate analysis showed that coronary severity score, hs-CRP and diabetes mellitus were significant predictors for MACE. Kaplan–Meier estimates showed a significant difference in MACE-free rates between SYNTAX binary scores (≥ 15 vs. <15, $p = 0.043$), Gensini binary scores (≥ 36 vs. <36, $p = 0.048$) and Jeopardy binary scores (≥ 4 vs. <4, $p = 0.001$).
Conclusion: Coronary severity score, hs-CRP and diabetes mellitus independently predicted MACE in patients with stable CAD. The Jeopardy score is simple to calculate and as effective for predicting MACE in stable CAD as the complex SYNTAX score.

1. Introduction

Coronary severity scores were designed to estimate the amount of myocardium at risk and help quantify the complexities of coronary lesions as well as evaluate the potential difficulties for revascularization by percutaneous coronary intervention (PCI) [1–4]. Evaluation of coronary angiographic severity could help physicians devise a revascularization strategy and aid in prediction of future ischemic events [1,2,5–7]. However, previous angiographic studies demonstrated that the majority of myocardial infarctions occur due to occlusion of arteries that previously did not contain angiographically significant (>50%) stenosis [8–11].

The SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery (SYNTAX) score is a comprehensive angiographic scoring system that is derived from the coronary anatomy and lesion characteristics [12]. It was first applied in the SYNTAX trial to quantify the complexity of coronary lesions and is typically categorized in a tripartite fashion (low: 0 to 22, intermediate: 23 to 32, high: >32) [2]. The SYNTAX scoring system has been proved to predict major

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http://dx.doi.org/10.1016/j.cca.2015.03.029
0009-8981/

adverse cardiovascular events (MACEs) after PCI, irrespective of clinical presentation, in patients with multi-vessel [2,13] and/or left main coronary artery disease (CAD) [14].

Jeopardy and Gensini scores were developed in the pre-stent era and are simpler to calculate than the SYNTAX score [1,3]. The Gensini scoring system consists of lesion location (segments) and obstructive severity scores, and the total score equals the sum of the location score times the obstructive severity score for all diseased segments [3,15,16]. In a study that included 10,647 patients with stable and unstable CAD who underwent PCI, Gensini score quartiles were useful estimates of 1-year mortality and presentation as unstable angina [6]. The Jeopardy scoring system is designed to estimate the myocardium at risk or in jeopardy [1]. The coronary arteries are divided into six major segments and all patients with significant coronary stenosis are given a quantitative score ranging from 2 to 12 in angiographic severity. Califf et al. [1] evaluated the severity of CAD with the Jeopardy score in 462 non-surgically treated patients and found that it provided more prognostic information than the number of diseased coronary arteries.

More than a dozen large-scale studies have demonstrated that baseline high-sensitivity C-reactive protein (hs-CRP) levels predict future cardiovascular events in healthy men or women [17,18]. Two studies showed that hs-CRP helped predict outcome in subjects with acute coronary syndromes [19,20]. Our previous study showed that baseline hs-CRP level could be a useful marker for predicting coronary angiographic severity progression as measured by the increments in the modified Gensini score [16]. The PEACE study reported that hs-CRP predicted MACE in stable CAD subjects, who had a 50% prior myocardial infarction and 70% prior revascularization histories [21]. In stable CAD patients who received PCI and statin therapy, hs-CRP was a better predictor of MACE than low density lipoprotein-cholesterol (LDL-C) [22].

Whether angiographic stenosis severity helps predict future coronary events is uncertain. New biomarkers and imaging modalities are needed to identify vulnerable plaques [8,10,11,23]. Moreover, there have not been any comparisons of the predictive ability of SYNTAX, Jeopardy and Gensini scores for MACE in stable CAD with preserved left ventricular (LV) systolic function in an Asian cohort.

2. Materials and methods

2.1. Study population

From January 2010 to February 2011, a total of 2490 cardiac catheterization procedures, including coronary angiograms, percutaneous coronary or peripheral vascular interventions, electrophysiological studies, catheter radiofrequency ablations and pacemaker implantations, were performed at our catheterization laboratories (Fig. 1). Among the patients who underwent these procedures, 830 patients agreed to donate a blood sample for research purposes and signed a written informed consent form. The demographic data of those who agreed to give blood samples for research use and those who did not agree to do so were similar. Subjects with past histories of surgical or percutaneous coronary revascularization before the index admission or who were within 48 h of diagnosis of acute coronary syndrome were excluded (N = 388) (Fig. 1). Subjects with chest pain but with normal or mild coronary atherosclerosis (SYNTAX score = 0), or those with valvular heart disease or arrhythmia who underwent coronary angiograms for preoperative or peri-procedural study (SYNTAX score = 0) were excluded from analysis (N = 223) (Fig. 1). Two-hundred nineteen subjects with significant de novo coronary artery stenosis (SYNTAX score >0) were enrolled for analysis. After 36 cases with LV dysfunction (ejection fraction below 40%) and 2 cases of duplicate enrollment were excluded, the remaining 181 subjects with de novo stable CAD constituted the cohort for this study (Fig. 1). We retrospectively reviewed all patients' angiographic images, catheterization reports, and medical chart records.

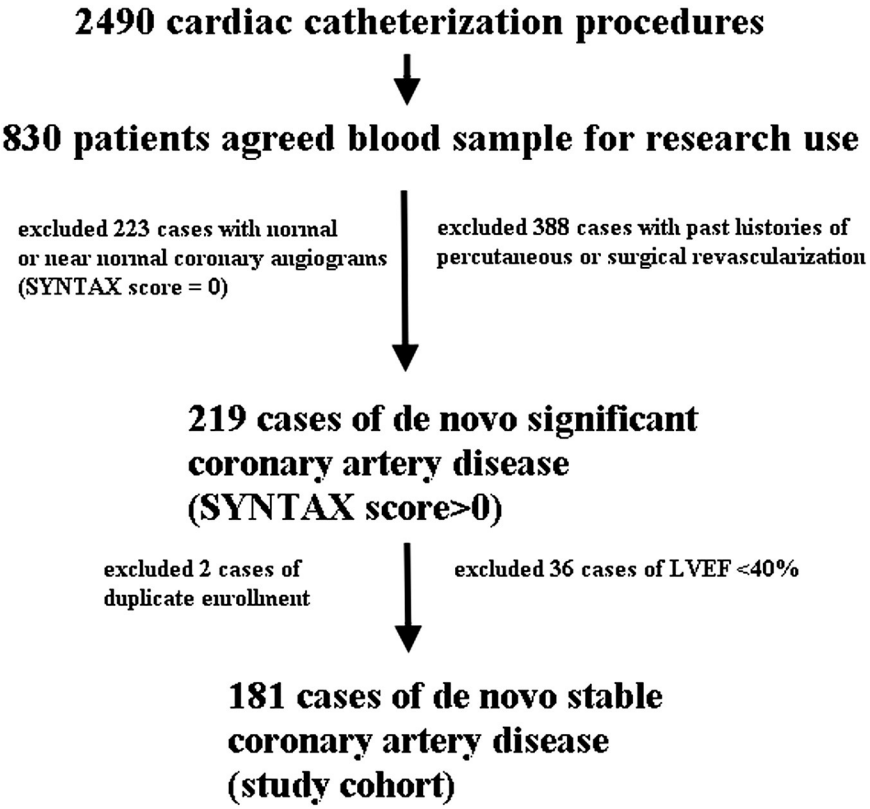

Fig. 1. Flow chart of the study enrollment protocol. LVEF: left ventricular ejection fraction.