JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 6, NO. 12, 2013

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcin.2013.08.006

The Anatomic- and Clinical-Based NERS (New Risk Stratification) Score II to Predict Clinical Outcomes After Stenting Unprotected Left Main Coronary Artery Disease

Results From a Multicenter, Prospective, Registry Study

Shao-Liang Chen, MD,* Ya-Ling Han, MD,† Yao-Jun Zhang, PhD,‡ Fei Ye, MD,* Hai-Wei Liu, MD,† Jun-Jie Zhang, PhD,* Bo Xu, MBBS,§ Tie-Min Jiang, MD,‖ Yu-Jie Zhou, MD,¶ Shu-Zheng Lv, MD¶

Nanjing, Shenyang, Beijing, and Tianjin, China

Objectives The present study aimed to establish a risk score using a simple calculation with an enhanced predictive value for major adverse cardiac events (MACE) in patients with unprotected left main coronary artery (UPLMCA) disease after the implantation of a drug-eluting stent (DES).

Background The anatomic-, clinical-, and procedure-based NERS (New Risk Stratification) score was superior to the SYNTAX (Synergy Between Percutaneous Coronary Intervention With TAXUS and Cardiac Surgery) score in predicting MACE after stenting UPLMCA. The complexity of the calculation was its major limitation.

Methods The NERS score II was derived from our previous 2 studies and externally compared with the NERS and SYNTAX scores in 1,463 patients with UPLMCA disease who underwent implantation of a DES in a prospective, multicenter registry trial. The primary endpoint was MACE at 1 year after the index procedure, including myocardial infarction, cardiac death, and target vessel revascularization.

Results The NERS score II system consisted of 16 (7 clinical and 9 angiographic) variables. A NERS score II $\geq$19 demonstrated enhanced MACE sensitivity and specificity of 84.0% and 76.0% (MACE as the state variable), respectively, which were similar to the NERS score but significantly higher compared with the SYNTAX score. A NERS score II $\geq$19 was the only independent predictor of cumulative MACE (hazard ratio: 3.27; 95% confidence interval [CI]: 1.86 to 5.23; $p \leq 0.001$) and stent thrombosis (odds ratio: 22.15; 95% CI: 12.47 to 57.92; $p \leq 0.001$) at follow-up.

Conclusions The NERS score II, similar to the conventional NERS score, is more predictive of MACE than the SYNTAX score in UPLMCA patients after implantation of a DES. (J Am Coll Cardiol Intv 2013;6:1233–41) © 2013 by the American College of Cardiology Foundation

From the *Cardiology Department, Nanjing First Hospital, Nanjing Medical University, Nanjing, China; †Cardiology Department, Shenyang Northern Hospital, Shenyang, China; ‡Cardiology Department, Nanjing Heart Center, Nanjing, China; §Cardiology Department, Beijing Fuwai Hospital, Beijing, China; ‖Cardiology Department, Tianjin Armed Policemen Hospital, Tianjin, China; and the ¶Cardiology Department, Beijing Anzhen Hospital, Beijing, China. Dr. Shao-liang Chen is a fellow at the Collaborative Innovation Center for Cardiovascular Disease Translational Medicine of Jiangsu Province, China. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Manuscript received May 2, 2013; revised manuscript received July 1, 2013, accepted August 1, 2013.

Risk stratifications for patients with unprotected left main coronary artery (UPLMCA) disease have been established as important tools to predict clinical events after stenting UPLMCA (1–3). Our previous study has shown that, with the combination of clinical and procedural variables, the NERS (New Risk Stratification) score is more predictive of major adverse cardiac events (MACE) than the SYNTAX (Synergy Between Percutaneous Coronary Intervention With TAXUS and Cardiac Surgery) score (2). However, the complex calculation of the NERS score limits its routine use in everyday practice.

The purpose of the present study was to enhance the anatomic- and clinical-based NERS score to create the NERS score II. The NERS score II should provide the equivalent power to the conventional NERS score in the prediction of clinical outcomes after stenting UPLMCA, thus aiding appropriately individualized decision making.

Abbreviations and Acronyms

AUC = area under the curve
CABG = coronary artery bypass graft surgery
CI = confidence interval
CTO = chronic total occlusion
DES = drug-eluting stent(s)
eGFR = estimated glomerular filtration rate
IVUS = intravascular ultrasound
LM = left main coronary artery
MACE = major adverse cardiac event(s)
MI = myocardial infarction
PCI = percutaneous coronary intervention
ROC = receiver-operating characteristic
ST = stent thrombosis
TVR = target vessel revascularization
UPLMCA = unprotected left main coronary artery
VD = vessel disease

Methods

Patient population. Between March 19, 2003, and December 30, 2011, 2,060 patients with UPLMCA who underwent percutaneous coronary intervention (PCI) with implantation of a drug-eluting stent (DES) were prospectively studied at 6 tertiary centers. Of these patients, 597 patients—260 in the DISTAL (Drug-Eluting Stent for the Treatment of Left Main Disease) study (3) and 337 in the NERS study (2)—were excluded from the current study. Finally, 1,463 patients were enrolled in this study. The study protocol was approved by the ethics committee of each participating center.

The revascularization strategy for each patient with UPLMCA was jointly formulated by cardiologists and cardiac surgeons, based upon clinical and angiographic features. UPLMCA patients undergoing stent implantation were consecutively enrolled, and all data were entered into a dedicated database.

NERS Score II. The NERS score (2) was derived from 260 UPLMCA patients included in the DISTAL study (3) and was externally tested in 337 patients in the NERS study. Of 54 variables (including 17 clinical, 4 procedural, and 33 angiographic variables) in the NERS score, several variables remained repeatedly calculated. For example, "requiring an intra-aortic balloon pump" overlapped with "cardiogenic shock" and "lower left ventricular ejection fraction," "not taking a statin" overlapped with "a higher low-density lipoprotein level." Similarly, lesions in non-left main (LM) vessels were grouped according to chronic total occlusion (CTO) and non-CTO lesions, respectively, and lesions specificities in the right coronary artery and the left circumflex coronary artery had similar predictive value of MACE. Therefore, the 54 variables included in the NERS score were regrouped into 7 clinical variables, 5 angiographic variables for LM, and 4 angiographic variables for non-LM vessels. These new variables and the conventional 54 variables were put into the model and analyzed in 597 patients by logistic regression, and the probability score for each variable was then calculated. Variables with a p value <0.01 were considered significant predictors and formed the NERS score II. Finally, the NERS score II consisted of 16 variables (7 clinical, 5 lesion variables for LM, and 4 lesion variables for non-LM vessels) (Table 1). Similar to the NERS score, for ostial and shaft or distal LM stenosis, the highest score for distal LM lesions was considered the final score for the LM. Similarly, tandem stenoses within 1 vessel, such as CTO with bifurcation, were scored as the highest score of any lesion (i.e., CTO).

Table 1. Variables in the NERS Score II

	Definition(s)	Score
Clinical (n = 7)		
Age, ≥75 yrs	Plus 1 score per 5-year increment	1.34
LVEF, ≤40%	Plus 1 score per 10% reduction	2.03
AMI, <12 h	AMI within 12 h	3.65
Cardiogenic shock	By AHA/ACC criteria	4.17
Diabetes	Diagnostic diabetes	1.47
eGFR, ≤60 ml/min	Plus 1.5 score per 10 ml/min reduction	1.82
Peripheral artery disease, DS >70%	DS >70%	1.74
LMT lesions (n = 5)		
Ostial LM or body shaft	Lesion at ostium or at the body of LM	1.18
Distal bifurcation*/trifurcation†	Bifurcation/trifurcation lesions	12.90
Distal nonbifurcation	Medina 1,1,0; 0,0,1	8.67
LMT-CTO	CTO ≥3 month in LM	13.73
Severe LM calcification	Needing rota (balloon failed to work)	6.13
Downstream lesions (n = 4)		
RCA‡/LCX§ non-CTO lesion	TIMI flow grade ≥2	1.27
LAD, non-CTO lesions	TIMI flow grade ≥2	5.21
CTO in either LCX§ or RCA‡	TIMI flow grade 0-1, ≥3 months	3.27
CTO in LAD	TIMI flow grade 0-1, ≥3 months	5.49

*Medina 0,1,1 or 1,1,1. †Medina 0,1,1,1 or 1,1,1,1. ‡Right dominance. §Left dominance.

AHA/ACC = American Heart Association/American College of Cardiology; AMI = acute myocardial infarction; CTO = chronic total occlusion; DS = diameter stenosis; eGFR = estimated glomerular filtration rate; LAD = left anterior descending coronary artery; LCX = left circumflex coronary artery; LM = left main coronary artery; LMT = left main trunk; LVEF = left ventricular ejection fraction; NERS = New Risk Stratification; RCA = right coronary artery; rota = rotational atherectomy; TIMI = Thrombolysis In Myocardial Infarction.