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INTRACORONARY IMAGING IN SPECIAL POPULATIONS

Plaque Composition and Clinical Outcomes in Acute Coronary Syndrome Patients With Metabolic Syndrome or Diabetes

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OBJECTIVES The goal of this study was to characterize the extent and composition of coronary atherosclerosis in patients with diabetes mellitus or the metabolic syndrome (Met Syn) presenting with acute coronary syndromes (ACS).

BACKGROUND Diabetes and Met Syn patients have increased rates of major adverse cardiac events (MACE), yet a systematic description of nonculprit lesions for these high-risk groups is incomplete.

METHODS In the PROSPECT (Providing Regional Observations to Study Predictors of Events in the Coronary Tree) study, ACS patients underwent 3-vessel quantitative coronary angiography, grayscale, and radiofrequency intravascular ultrasound after successful percutaneous coronary intervention (PCI). Subsequent MACE (cardiac death or arrest, myocardial infarction, or rehospitalization for unstable or progressive angina) were adjudicated to the originally treated culprit versus untreated nonculprit lesions in 3 patient groups: 1) diabetes; 2) Met Syn; and 3) neither. Median length of follow-up was 3.4 years.

RESULTS Of 673 patients, 119 (17.7%) had diabetes and 239 (35.5%) had Met Syn. The cumulative 3-year MACE rate was 29.4% in patients with diabetes, 21.3% with Met Syn, and 17.4% with neither ($p = 0.03$). MACE adjudicated to untreated nonculprit lesions occurred in 18.7%, 11.7%, and 9.7% of patients, respectively ($p = 0.06$). Nonculprit lesions in diabetes and Met Syn patients were longer and had greater plaque burden, smaller lumen areas, with greater necrotic core and calcium content. Diabetes and Met Syn patients with future MACE had greater necrotic core and calcification compared with the normal cardiometabolic group.

CONCLUSIONS In this PCI ACS population, patients with diabetes and Met Syn had higher 3-year MACE rates. Lesion length, plaque burden, necrotic core, and calcium content were significantly greater among nonculprit lesions of patients with diabetes and Met Syn, but only necrotic core and calcium were significantly greater in the nonculprit lesions of patients with a future MACE in this exploratory analysis. (J Am Coll Cardiol Img 2012;5:S42–52) © 2012 by the American College of Cardiology Foundation

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Diabetes mellitus and metabolic syndrome (Met Syn) are global concerns (1). Nearly 26 million adults in the United States have diabetes, and 79 million have Met Syn (2). By 2050, as many as 1 in 3 individuals in the United States will have diabetes (3). Cardiovascular mortality (4–6) is higher in diabetes and Met Syn patients, and 24% to 30% of U.S. patients admitted

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for acute coronary syndromes (ACS) have diabetes (7,8), a major predictor of mortality (9–13). Retrospective studies have demonstrated that patients with diabetes have more extensive coronary artery disease (14,15), and atherosclerotic plaque morphology in diabetes patients may be predisposed to rupture and thrombosis (16).

The PROSPECT (Providing Regional Observations to Study Predictors of Events in the Coronary Tree) study, a prospective natural history study of atherosclerosis, used multimodality coronary imaging in patients at high risk for future cardiac events following intervention for ACS (17). This report from the PROSPECT study describes the angiographic, grayscale, and radiofrequency (RF)-intravascular ultrasound (IVUS) characteristics of nonculprit lesions according to patients' cardiometabolic profiles.

METHODS

Patients. The PROSPECT study was conducted at 37 centers in the United States and Europe. The protocol (17,18) and main results have been described (17,19–24). Briefly, ACS patients were enrolled after successful and uncomplicated percutaneous coronary intervention (PCI) of all coronary lesions responsible for the index event and remaining angiographically significant stenoses. Angiography and grayscale and RF-IVUS of the left main and proximal 6 to 8 cm of each major epicardial coronary artery was performed. Baseline angiograms and IVUS images were prospectively analyzed offline at an independent core laboratory (Cardiovascular Research Foundation, New York, New York) using previously validated methodologies (25,26) by technicians blinded to future events.

Quantitative and qualitative coronary angiography. Angiographic quantitative and qualitative coronary angiography (QCA) measures of the entire length of the coronary tree included each epicardial vessel and side branch >1.5 mm in diameter using methodology modified from Medis CMS software version 7.0 (Leiden, the Netherlands). QCA measures including reference diameter, minimal lumen diameter, and diameter stenosis (percentage of cross-sectional diameter lost to stenosis) were obtained every 1.5 mm along the distance of the coronary artery. Nonculprit lesions were defined according to QCA or IVUS criteria. Culprit and nonculprit lesions were defined as ≥30% visual diameter stenosis on angiography, with their locations recorded in relation to the corresponding coronary artery ostium and daughter side branches.

Grayscale and RF-IVUS analyses. Grayscale and RF-IVUS analyses were performed using: 1) QCU-CMS (Medis) for contouring; 2) pcVH 2.1 (Volcano Corporation, Rancho Cordova, California) for contouring and data output; and 3) proprietary software (qVH, the Cardiovascular Research Foundation) for segmental qualitative and quantitative output (27,28). External elastic membrane (EEM) and lumen borders were contoured for each frame with a median interslice distance of 0.40 mm. Quantitative IVUS measurements included EEM cross-sectional area (CSA), lumen CSA, plaque and media (EEM minus lumen) CSA, plaque burden (plaque and media CSA divided by EEM CSA), and minimum

ABBREVIATIONS AND ACRONYMS

ACS = acute coronary syndromes
CSA = cross-sectional area
EEM = external elastic membrane
IVUS = intravascular ultrasound
MACE = major adverse cardiovascular events
Met Syn = metabolic syndrome
MI = myocardial infarction
MLA = minimum luminal area
PCI = percutaneous coronary intervention
QCA = quantitative and qualitative coronary angiography
RF = radiofrequency
TCFA = thin-cap fibroatheroma
VH = virtual histology

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