Low HDL cholesterol and hyperglycemia are metabolic syndrome components associated with plaque progression in patients with chronic coronary syndrome: a PARADIGM study


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Background: The metabolic syndrome (MetS), a cluster of dyslipidemia, hyperglycemia and hypertension predicts future cardiovascular disease and death in general populations.

Purpose: We aimed to assess whether MetS and its components may impact on coronary plaque progression (PP), at serial coronary computed tomography angiography (CCTA), and major adverse cardiovascular events (MACE) in patients with chronic coronary syndrome (CCS).

Methods: A total of 1200 CCS patients (aged 60.9±9.3 years, 55.4% male) who underwent serial CCTA (≥2 years apart) and had available data on glucose/lipid metabolism and outcome, were analysed from the Progression of Atherosclerotic Plaque Determined by Computed TomoGraphic Angiography IMaging (PARADIGM) registry. MetS and its components were categorized according to NCEP ATPIII definition.

Plaque volumes were measured in coronary segments (≥2 mm in diameter) and summed to provide total plaque volume (PV, mm3) and percent atheroma volume (PV/vessel volume*100) (PAV, %) per patient at baseline and follow-up. Rapid PP was defined as annualized PAV increase (ΔPAV) ≥1.0%/year. MACE included non-fatal myocardial infarction, any cause death and unplanned coronary revascularization (>30 days after first CCTA).

Results: MetS was present in 366 patients (31%). The median interscan period was 3.2 years (IQR 1.9) and rapid PP occurred in 341 patients (28%). MetS was associated with a higher total PV (133±183 vs 97±163, P<0.001) and PAV (7.1±9.3 vs 5.4±8.0, P<0.001) at baseline and a higher annual change in both PV (18.5±23.4 vs 13.9±22.5, P<0.001) and PAV (0.9±1.1 vs 0.7±1.0, P<0.001) (Figure 1A). At a multivariable logistic regression analysis, MetS independently predicted rapid PP (OR 1.50, 95%CI 1.11-2.02, p<0.01) after adjustment for other risk factors not included among its components (age, gender, smoking habits, family history, hypercholesterolemia, previous CAD), statin treatment and baseline PAV. Among MetS components, diabetes under treatment or fasting plasma glucose >100 mg/dL (OR 1.37, 95%CI 1.02-1.84, p<0.05) and low HDL cholesterol (<40 mg/dL in males and <50 mg/dL in females) (OR 1.76, 95%CI 1.29-2.39, p<0.001) were independently associated with rapid PP. They had an additive effect on baseline PAV and annualized PAV increase (Figure 1B). The median follow-up duration was 8.23 years (IQR 3.61). MACE occurred in 201 patients (16.8%) (17 death, 11 non-fatal MI, 173 unplanned revascularizations). At multivariable Cox regression analysis, rapid PP was a strong and independent predictor of events (HR 1.72, 95% CI 1.29-2.28, P<0.001) after correction for all risk factors including MetS or its components and baseline PAV.

Conclusions: Independently of other risk factors and treatment MetS is associated with a higher coronary atherosclerotic burden and rapid PP which are in turn strong predictors of MACE in patients with CCS. Among MetS components hyperglycemia and low HDL-C are major determinants of rapid PP.
Figure 1