Impact of Extracoronary Calcification and Pericardial Fat Volume on Extent of Coronary Artery Disease in Patients with Type 2 Diabetes Mellitus

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Abstract

Background:Type 2 diabetes mellitus (T2DM) isnowconsidered a coronary artery disease (CAD) equivalent. We hypothesized that coronary artery calcium score (CACS), extracoronary calcium score (ECCS) and pericardial fat volume (PFV) may represent useful additional markers for risk assessment in diabetic patients.

Methods:This prospective study was conducted on 1032 patients. They included 402 patients with T2DM. Using multidetector computed tomography (MDCT), we assessed PFV, CACS and ECCS.The severity of CAD was quantified using the Gensini Score. Correlation between CACS, ECCS and PFV and severity of CAD was studied.

Results: Diabetic patients with ECCS > 0 in comparison with diabetic patients with ECCS=0 had higher CACS (163 ± 239 vs. 72 ± 176, $p< 0.000$), higher Gensini score (22.3 ± 31.6 vs. 9.7 ± 16.3, $p< 0.000$) and higherprevalence of patients with Gensini score > 0 ($p< 0.000$). There was a significant linear correlation between ECCS and Gensini score (r=0.328, p<0.001). Comparing diabetic patients with PFV ≥ 100 cm^3 with diabetic patients with PFV < 100 revealed that prevalence of patients with Gensini score>0 was not significantly higher in patients with PFV≥100 cm^3 ($p = 0.205$). Gensini score also was not significantly different between the 2 groups (13.9 ± 25.1 vs. 12.8 ± 21.3, $p = 0.370$). Logistic regression analysis was applied to detect possible association between age, male gender, hypertension, diabetes mellitus duration, CACS, ECCS, PFV and Gensini score >0. Male gender (OR = 3.021, $p = 0.007$, 95% CI: 1.352-6.750), and CACS (OR=1.021, $P< 0.000$, 95% CI: 1.011-1.031) were the only independent predictors of Gensini score > 0.

Conclusion: In T2DM, neither ECCS > 0 nor PFV≥ 100 cm^3were predictors of Gensini score>0. Male gender and CACS were independent predictors of Gensini>0

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Abbreviations

AAC	Ascending aorta calcium
AC	Aortic calcification
ACE	Angiotensin converting enzyme
AD	Aortic distensibility
ADVANCE	Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation
ARC	Aortic root calcification
ATP	Adult treatment panel
AU	Agatston units
AVC	Aortic valve calcium
AVF	Abdominal visceral fat
AVS	Aortic valve sclerosis
AWT	Aortic wall thickness
BMI	Body mass index
BMP	Bone morphogenic proteins
CABG	Coronary artery bypass grafting
CAC	Coronary artery calcification
CACS	Coronary artery calcium score
CAD	Coronary artery disease
CAG	Conventional coronary angiography
CAP	Calcified atherosclerotic plaque
CHD	Coronary heart disease
CKD	Chronic kidney disease
CMR	Cardiovascular magnetic resonance
CRP	C reactive protein
CT	Computed tomography
CTCA	Computed tomographic coronary angiography
CVD	Cardiovascular disease
CVE	Cardiovascular events
DAC	Descending aorta calcium
DHS	Diabetes Heart Study
DM	Diabetes mellitus

EAT	Epicardial adipose tissue
EBCT	Electron beam computed tomography
ECCS	Extracoronary calcium score
ESRD	End-stage renal disease
EVASCAN	Medical Evaluation of Scanner in Coronary Syndrome
FFAs	Free fatty acids
FPG	Fasting plasma glucose
FRS	Framingham Risk Score
HDL	High density lipoprotein
HOMA-IR	Homeostasis model assessment of insulin resistance
HU	Hounsfield units
HVC	Heart valve calcium
ICAM	Intercellular adhesion molecule
IDF	International diabetes federation
IFG	Impaired fasting glucose
IL-6	Interleukin-6
LDCT	Low-dose ungated chest CT
LDL	Low density lipoprotein
MAC	Mitral annulus calcification
MACE	Major adverse cardiovascular events
MCAP	Mixed coronary atherosclerotic plaque
MCP-1	Monocyte chemoattractant protein-1
MDCT	Multidetector computed tomography
MESA	Multiethnic Study of Atherosclerosis
MetS	Metabolic syndrome
MI	Myocardial infarction
MPS	Myocardial perfusion scintigraphy
NDR	National Diabetes Register
NCAP	Noncalcified coronary atherosclorotic plaque
NFG	Normal fasting glucose
PAI-1	Plasminogen activator inhibitor-1
PDHS	The Penn Diabetes Heart Study
PET	Positron emission tomography
PF	Pericardial fat
PFT	Pericardial fat thickness
PFV	Pericardial fat volume

PREDICT	Prospective Evaluation of Diabetic Ischaemic Disease by Computed Tomography
ROS	Reactive oxygen species
RV	Right ventricle
SEAS	Simvastatin and Ezetimibe in Aortic Stenosis
SIS	Segment involvement score
SPECT	Single-photon emission computed tomography
sPLA2-IIA	Secretory type II phospholipase A2
SS	Shear stress
SSS	Segment stenosis score
T2DM	Type 2 diabetes mellitus
TAC	Thoracic aortic calcification
TFV	Intrathoracic fat volume
TNF-α	Tumor necrosis factor alpha
UKPDS	United Kingdom Prospective Diabetes Study
VADT	Veterans Affairs Diabetes Trial
VAT	Visceral abdominal fat
VC	Valve calcification
VPF	Pericardial fat volume indexed by body surface area
VSMCs	Vascular smooth muscle cells
WC	Waist circumference
WHR	Waist to Hip ratio
WHtR	Waist to Height ratio

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Introduction