

Microalbuminuria and Prediction of Cardiovascular Complications in Patients with Coronary Artery Disease and Type 2 Diabetes Mellitus after CABG Surgery



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Background

This investigation was aimed at assessing the clinical significance of microalbuminuria (MA) in predicting in-hospital adverse outcomes amongst the patients with coronary artery disease (CAD) and type 2 diabetes mellitus (DM) who have undergone coronary artery bypass graft (CABG) surgery.

Methods

We recruited 720 consecutive Caucasian (Russian) patients who underwent CABG surgery during 2011–2012.

Results

Patients with renal dysfunction (RD) and without type 2 DM had significantly higher median serum creatinine seven days after CABG surgery compared to patients without RD and type 2 DM. There were no statistically significant intergroup differences regarding glomerular filtration rate. However, the highest median of urine albumin excretion 24 hours before and seven days after CABG surgery was detected in patients with RD and type 2 DM whilst the lowest median was noted in patients without RD and type 2 DM. Median of urine albumin excretion 24 hours before and seven days after CABG surgery in patients with adverse outcome was significantly higher compared to patients with a favourable outcome.

Conclusions

We suggest that the determination of MA before and after CABG surgery may assist in predicting adverse outcomes after CABG surgery.

Keywords

Coronary artery disease • Coronary artery bypass graft surgery • Complications • Adverse outcomes • EuroSCORE • Microalbuminuria

Introduction

In recent years, there has been a trend towards an increasing incidence of coronary artery disease (CAD) along with type 2 diabetes mellitus (type 2 DM) [1]. The prognosis of CAD amongst patients with type 2 DM is significantly worse

compared to other patients [2], and it does not depend on the type of heart surgery [3]. Prevalence of type 2 DM amongst patients with CAD who undergo coronary artery bypass graft (CABG) surgery varies from 19% to 30% and even to 40% [4,5]. There is evidence that CABG surgery can be a revascularisation method of choice for this patient group [6–8].

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Renal dysfunction (RD) is one of the main complications developing after CABG surgery, and it is the independent predictor of cardiovascular death in patients with CAD. Prevalence of RD amongst patients with CAD and type 2 DM after CABG surgery may reach 20% in the early postoperative period [5]. According to EuroSCORE scale of in-hospital mortality risk assessment in patients after the direct myocardial revascularisation, RD can be assessed only by serum creatinine (sCr) >200 µmol/L; however, it may underestimate risk since sCr increase reflects injury that has already occurred to the kidneys. Application of other biomarkers such as microalbuminuria (MA) may solve this issue since it is more sensitive to early subclinical RD manifestations. It can be particularly important for patients with type 2 DM and high RD risk in the postoperative period. The aim of this investigation has been to assess the clinical significance of MA in predicting in-hospital cardiovascular complications amongst patients with CAD and type 2 DM after CABG surgery.

Materials and Methods

We recruited 720 consecutive Caucasian (Russian) patients (577 males and 143 females) who underwent CABG surgery in the Research Institute for Complex Issues of Cardiovascular Diseases (Kemerovo, Russia) from March 2011 till April 2012. The study was approved by the local ethical committee and written informed consent was provided by all the participants after a full explanation of the study had been given to them.

The age of patients ranged from 33 to 78 (average 59) years. In all patients, sCr and MA along with the glomerular filtration rate (GFR, calculated by MDRD formula) were determined twice (24 hours before the surgery and seven days after the surgery). Urine albumin excretion was determined by enzyme-linked immunosorbent assay (ELISA) using reagents of R&D Systems (USA and Canada). Referent values for MA diagnosis were 0-30 mg/day [5]. Risk of adverse outcome was calculated by EuroSCORE scale [9]. Patients were classified into one of the EuroSCORE risk groups before the operation by a surgeon.

Type 2 DM was diagnosed according to the recent criteria [10]. In all patients with type 2 DM, we measured glycaemic profile and blood glycohaemoglobin (HbA1c) by turbidimetric inhibition immunoassay (TINIA). Chronic kidney disease was defined by the presence of certain kidney injury markers persisting during at least three months or more according to the Russian Guidelines on chronic kidney disease. These markers included: 1) renal structural lesions revealed by ultrasound investigation (abnormalities of renal development, hydronephrosis, kidney cysts, kidney stones); 2) albuminuria/proteinuria; 3) persistent erythrocyturia, cylindruria, leukocyturia; 4) persistent decrease of GFR less than 60 ml/min/1.73m² [11] that were assessed using medical histories. Morphological renal abnormalities included chronic pyelonephritis and kidney stones or cysts found

Table 1 Clinicopathological features of patients who underwent coronary artery bypass graft (CABG) surgery.

Feature	N (%)
Male gender	577 (80.1%)
Median of age, years	59.0 (54.0-64.0)
Arterial hypertension	636 (88.3%)
Dyslipidaemia	347 (48.2%)
Smoking status	249 (34.5%)
Past medical history of myocardial infarction	61 (8.5%)
Past medical history of stroke	57 (7.9%)
Functional class of angina pectoris	
I	22 (3.0%)
II	238 (33.0%)
III	281 (39.0%)
IV	15 (2.0%)
Unstable angina	58 (8.0%)
Functional class of chronic heart failure	
I	27 (3.75%)
II	462 (64.1%)
III	184 (25.5%)
IV	10 (1.4%)
Ventricular arrhythmia	100 (13.8%)
Supraventricular arrhythmia	66 (9.1%)
Type 2 diabetes mellitus (type 2 DM)	126 (17.5%)
Stenosis of lower extremity arteries	217 (30.1%)
<50%	170 (23.6%)
>50%	47 (6.5%)
Stenosis of extracranial arteries	232 (32.2%)
<50%	172 (23.8%)
>50%	60 (8.3%)
Renal structural lesions	309 (42.9%)
Glomerular filtration rate (GFR) <60 ml/min/1.73m ² before CABG surgery	116 (16.1%)

by ultrasound investigation. Arterial hypertension was defined as values >140 mmHg systolic blood pressure and/or >90 mmHg diastolic blood pressure, according to the ESH/ESC Guidelines for the management of arterial hypertension [12]. Dyslipidaemia was defined as high-density lipoprotein cholesterol less than 1 mmol/L, or/and triglycerides more than 2 mmol/L, or/and atherogenic index more than 3, or/and low-density lipoprotein cholesterol more than 4 mmol/L, or/and total cholesterol more than 5 mmol/L, according to ESC/EAS Guidelines for the management of dyslipidaemias [13]. Clinicopathological features of all patients are represented in the Table 1.

Regarding the drugs, 691 (96.0%) patients were treated by beta-blockers, 703 subjects (97.7%) used angiotensin-converting enzyme (ACE) inhibitors, 655 (91.0%) individuals were treated by calcium channel blockers, 259 (36%) patients were

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