Original scientific paper

PERIOPERATIVE CHARACTERISTICS IN DIABETIC VS. NON DIABETIC PATIENTS UNDERGOING CORONARY ARTERY BYPASS SURGERY

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ABSTRACT

Objectives: This study aims to compare the perioperative clinical, angiographic and operative characteristics and early complications of diabetic patients with non-diabetic patients, undergoing isolated CABG at the University Hospital for Cardiac Surgery in Skopje. Methods: During the period from October 2017 to October 2018, ninety one consecutive patients undergoing CABG were enrolled in this prospective observational study. This population was then divided into those with DM and those without DM. For these groups, preoperative clinical, angiographic, intraoperative characteristics and postoperative complications were evaluated. Results: In our cohort, 48, 4% of the patients were diabetic. Except for smoking, all other risk factor were evenly distributed between the two groups. Patients with DM had similar SYNTAX score like non-diabetic patients (31, 7±5, 5 vs. 30, 3±7, 2, p=0,312). Patients with DM had higher No of diseased vessels (2, 9±0, 7 vs. 2, 5±0, 6, p=0,020), less LM disease (22, 7% vs. 42, 6% p=0,036). There was no statistical difference between the two groups in terms of intubation time (p=0,137), inotropic support (p=0,774) and vasopressor support (p=0,076). Diabetic patients had less re-sternotomies (p=0,066) than non-diabetic patients. Postoperative AF, perioperative MI, stroke, sternal wound infection and leg wound infection were similar in both groups. Length of hospital stay was 9 days in both groups. Conclusion: Our data do not support the conclusions by other authors who found diabetes to be a risk factor for significantly adverse early morbidity following CABG. In our study DM was not risk factor for perioperative complications and preoperative characteristic of diabetic patients were not different than in no diabetic

INTRODUCTION

It is now widely accepted that worldwide diabetes prevalence is surpassing even the most pessimistic projections from the past. For example, in 2004, it was estimated that diabetes prevalence in 2030 would reach 334 million people, whereas the actual prevalence of 387 million people with diabetes was already reached in 2014, and the new projection for 2035 is 592 million, almost double what was estimated only 10 years ago (1,2). In Republic of North Macedonia (RNM), the estimated total diabetes prevalence in 2014 was 180,180 (90,020 men and 90,160 women). RNM has a national diabetes prevalence of 11.44%, which is the third highest in Europe, behind just Turkey and Montenegro, and a comparative (age-adjusted) diabetes prevalence of 9.76%, or the second highest in Europe, after Turkey (2). Clinically, coronary atherosclerosis is worse in every measurable way in patients with diabetes mellitus (DM) as manifested by early and more diffuse atherosclerosis producing a greater disease burden, more frequent left main coronary

stenosis and multivessel disease, more total occlusions, and an impaired ability to develop collateral circulation (3,4). The net clinical effect more than doubles the risk of coronary artery disease (CAD) in patients with DM, and the disease is lethal: ischemic CAD causes three quarters of DM-related deaths (5)

Coronary artery bypass grafting (CABG) is nowadays the preferable revascularization treatment in diabetic patients over percutaneous coronary interventions (PCI) (6, 7). PCI and CABG uncovered the unique biology of diabetic vascular disease and patients with DM continued to face worse outcomes, mortality, and complications than similar patients without DM (8, 9).

Several studies revealed different preoperative clinical characteristics, higher morbidity and perioperative mortality rates among patients with DM vs. non-diabetic patients undergoing CABG (10-12). This finding is probably related to the occurrence of perioperative myocardial infarction, infections, respiratory failure, renal and cerebral complications, all of which prolong hospitalization and worse outcome in these patients. Moreover, the presence of DM is considered to be an independent risk factor for postoperative mortality after CABG (10)

This study aims to compare the perioperative clinical, angiographic and operative characteristics and early complications of diabetic patients with non-diabetic patients, undergoing isolated CABG at the University Hospital for Cardiac Surgery in Skopje – RNM

METHODS

Study patients.

During the period from October 2017 to October 2018, ninety one consecutive patients undergoing CABG were enrolled in this prospective observational study. Patients were included in the database if they fulfilled the following inclusion criteria: they were consecutive patients aged 18 years or older (no restrictions on sex or nationality) and had undergone CABG. All procedures were done on-pump with cardiopulmonary bypass (CPB). We used Thomas crystalloid cardioplegia. Except in 5 patients, left or right internal thoracic artery (LITA or RITA) was used to bypass the left anterior descending artery (LAD). None of the patients had associated surgical procedures such as valve replacement or aortic surgery. This population was then divided into those with DM and those without DM. For these groups, preoperative clinical and angiographic characteristics, intraoperative characteristics and postoperative complications were evaluated. Among the clinical complications that occurred following CABG, the following variables were analyzed: perioperative acute myocardial infarction (AMI), neurological complications, pulmonary complications, renal complications, infectious complications, cardiac arrhythmias and multiple organ failure occurring within 30 days after the surgery. This study was approved by the Medical Ethics Committee of Medical School, University "St.Cyril&Methodius, Skopje, and all patients provided informed consent.

STATISTICAL ANALYSIS

Categorical parameters were summarized as percentages and continuous parameters as mean ±SD. Continuous variables were compared using nonparametric Mann-Whitney test for independent samples and categorical parameters were compared using Pearson's chi square test. All data analysis was performed using SPSS version 25.0 (IBM SPSS, Inc., Chicago, Illinois) and p value ≤ 0.05 was considered significant.

RESULTS

The patients were divided into two subgroups: those with DM (n=44/48, 4%) and those without DM (n=47/51, 6%). The baseline demographic and clinical characteristics of the 91 patients as a whole and divided into subgroups, including preoperative risk factor are shown in Table 1 and were similar in both subgroups. Diabetic patients were 3 years older than non-diabetics (p=0, 07). Except for smoking (more prevalent in the non-diabetic group, 57, 4% vs. 38, 6%, p=0, 05) all other risk factor were evenly distributed between the two groups. Patients with diabetes had slightly higher percent of PVD and CVI, and diabetic patients had slightly higher percentage of significant carotid disease, but this results didn't reach statistical significance. Patients with diabetes had higher Euro SCORE (2, 5 vs. 1, 5).

Table 1. Baseline characteristics in the study population as a whole and comparison of demografic, clinical and echocardiograpfic characteristics of 91 patients divided according to the presence of DM.

Parameter (n/%)	All patients 91	DM 44/48,4	No DM 47/51,6	p
Age (years)	65,4±7,9 43-82	66,9±6,8	63,9±8,6	0,072
Gender (n/%) Male Female	70/76,9 21/23,1	35/79,5 9/20,5	35/74,5 12/25,5	0,931
BMI (kg/m2)	27,5±4,2	28,0±3,9	27,1±4,5	0,308
Euro SCORE	2,0±1,5	2,5±1,6	1,5±1,2	0,003
NYHA (n/%)	2,2±0,5	2,3±0,6	2,1±0,5	0,213
CCS (n/%)	2,3±0,5	2,4±0,5	2,3±0,5	0,228
Angina, stable (n/%)	47/51,6	19/43,2	28/59,6	0,088
Previous MI (n/%)	38/41,8	19/43,2	19/40,4	0,478
Previous PCI (n/%)	17/18,7	9/20,5	8/17,0	0,440
Urgent CABG (n/%)	29/31,9	17/38,6	12/25,5	0,132
Smoking (n/%)	44/48,4	17/38,6	27/57,4	0,056
Hypertension (n/%)	88/96,7	43/97,7	45/95,7	0,525
Dyslipidemia (n/%)	85/93,4	40/90,9	45/95,7	0,307
Preoperative AF (n/%)	10/9,1	4/9,1	4/8,5	0,605
COPD (n/%)	14/15,6	7/15,9	7/15,2	0,578
PVD (n/%)	20/21,1	7/15,9	10/21,3	0,350
Carotid disease	17/18,2	8/17,0	12/13,2	0,405
CKD (n/%)	26/28,6	13/29,5	13/27,7	0,513
CVI (n/%)	12/13,2	5/11,4	7/14,9	0,427

CABG = coronary artery bypass graft surgery; BMI = body mass index; MI=myocardial infarction; PCI=percutaneous coronary intervention; AF=atrial fibrillation; COPD= chronic obstructive pulmonary disease; PVD=peripheral vascular disease; CKD=chronic kidney disease;

Angiographic and intraoperative characteristics in the study population as a whole and divided according to the presence of DM are shown in table 2. Patients with DM had similar SYNTAX score like non-diabetic patients (31, 7±5, 5 vs. 30, 3±7, 2, p=0,312). Patients with DM had higher No of diseased vessels (2, 9±0, 7 vs. 2, 5±0, 6, p=0,020), less LM disease (22, 7% vs. 42, 6% p=0,036), and similar distribution of 1, 2 and 3 vessel disease (p=0,260) like patients without DM.

Patients with DM got more distal anastomoses than non-diabetics (2, 9±0, 7 vs. 2, 5±0, 6 p=0,002), and more diabetic patients got three distal anastomosis (70, 5% vs. 48, 9%). Utilization of type of the grafts (LITA, RITA, venous, RA or NTSVG) was even between two groups. Diabetic patients had slighter longer bypass time and cross clamp time than non-diabetics, but that didn't reach statistical significance (p=0,263 and p=0,142)

Table 2. Angiographic and intraoperative characteristics in the study population as a whole and divided according to the presence of DM.

Parameter (n/%)	All patients 91	DM 44/48,4	No DM 47/51,6	p
SYNTAX score	31,0±6,4	31,7±5,5	30,3±7,2	0,312
No of diseased vessels	2,8±0,4	2,9±0,7	2,5±0,6	0,020
Left main disease	30/33,0	10/22,7	20/42,6	0,036
LAD proximal disease	69/75,8	34/77,3	35/74,5	0,474
1 vessel disease 2 vessel disease 3 vessel disease	1/1,1 15/16,5 75/82,4	0 5/11,4 39/88,6	1/2,1 10/21,3 36/76,6	0,260
Number of distal anastomosis	2.7±0.7	2,9±0,7	2,5±0,6	0,002
Number of distal anastomosis per patient (n/%) 1 2 3 4 5	 4/44 25/27,5 54/59,3 6/6,6 2/2,2	 2/4,5 6/13,6 31/70,5 3/6,8 2/4,5	 2/4,3 19/40,4 23/48,9 3/6,4 0	0.043
LITA/RITA (n/%) Only venous (n/%) RA (n/%) NTSVG (n/%)	86/94,5 5/5,5 6/6,7 18/19,8	41/93,1 3/6,8 4/9,1 8/18,2	45/95,7 2/4,2 2/4,3 11/23,4	0,367 0,450 0,307 0,362
CPB time (min)	107,1±28,1	110,4±29,6	103,7±26,4	0,263
Ischemic time (min)	61,5±18,1	64,4±18,3	58,7±17,7	0,142

AF=atrial fibrillation; CPB=Cardio Pulmonary Bypass; LAD=Left Anterior Descending; PCI=percutaneous coronary intervention; LITA=left internal thoracic artery; RITA=right internal thoracic artery; RA=radial artery; NTSVG=no touch saphenous vein graft; SYNTAX= SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery;

The most important early postoperative parameters and complications are shown in table 3. There was no

statistical difference between the two groups in terms of intubation time (p=0,137), inotropic support (p=0,774), vasopressor support (p=0,076) and levels of high sensitive troponin after surgery. In terms of complications, diabetic patients had less re-sternotomies (p=0,066) than non-diabetic patients. Postoperative AF, perioperative MI, stroke, sternal wound infection and leg wound infection were similar in both groups and didn't reach statistical significance. Length of hospital stay was 9 days in both groups

Table 3. Postoperative course and early postoperative complications

Parameter (n/%)	All patients 91	DM 44/48,4	No DM 47/51,6	p
Intubation time (n/%) < 24 hours 24-72 hours > 72 hours	75/82,4 9/9,9 7/7,7	37/84,1 2/4,5 5/11,4	38/80,9 7/14,9 2/4,3	0.137
Inotropic support (n/%) No support <72 hours after CABG > 72 hours after CABG	50/54,9 33/36,3 8/8,8	24/54,5 17/38,6 3/6,8	26/55,3 16/34,0 5/10,6	0,774
Vasopressor support (n/%) No support First 72 hours More than 72 hours	34/37,3 50/54,9 7/7,8	19/45,2 22/52,4 3/6,8	13/27,7 28/59,6 5/10,6	0.076
hs-cTnT first post op day	4145,5±8219,6	4668,1±9947,9	3536,3±6061,2	0,542
Postoperative complications (n/%) AF Perioperative MI Stroke Revision (re-sternotomy) Sternal wound infection Leg wound infection Hemodialysis Reintubation	 33/36,3 2/2,2 3/3,3 7/7,8 2/2,2 4/4,4 1/1,1 9/10,0	 17/38,6 0 1/2,3 1/2,3 1/2,3 2/4,5 0 5/5,6	 16/34,0 2/2,2 2/4,3 6/12,8 1/2,1 2/2,2 1/2,1 4/4,4	 0,406 0,264 0,517 0,066 0,736 0,512 0,516 0,471
Length of hospital stay (days)	9,1±5,4	9,1±0,5	9,2±0,5	0,931

CABG=coronary artery bypass grafting; hs-cTnT=high sensitive troponin T; AF=atrial fibrillation

DISCUSSION

Almost half of the patients in our cohort were diabetics. Prevalence of diabetic patients in the largest CABG series in the literature varies between 11, 8% in the UK in 2000, to 40, 0% in the USA until 2009 (13, 14). Taking into account that diabetes prevalence of 9.76% in RNM is the second highest in Europe, after Turkey (2) it is no surprise that our cohort had more diabetic patients than the results in the literature. Despite our expectations that diabetic patients will have more preoperative risk factors in our study group, we didn't find any significant difference between the two groups. In their study Yamaguchi et al. (15) compared the perioperative characteristics, in-hospital outcomes and long-term outcomes between diabetic (n = 1110) and non-diabetic patients (n = 1508). They found that obesity, hypertension, dyslipidemia, peripheral artery disease and chronic kidney disease were significantly more prevalent in diabetic patients than in non-diabetic patients.

Mean SYNTAX score was insignificantly different between the two groups (31, 7 vs. 30, 3 p=0,312), and although this result seems unusual because of the diffuse nature of the atherosclerosis in diabetic patients, this finding was confirmed in other studies (16, 17). Triple-vessel disease was more prevalent in the diabetes group than in the non-diabetes group. As a consequence, the number of distal anastomoses was significantly higher in the diabetes group. Higher number of distal anastomoses in diabetic vs non-diabetic patients was confirmed in other studies (18, 19) and the reason for that is the need for complete revascularization in more diffusely diseased coronary arteries.

Although many previous studies have documented a higher incidence of postoperative adverse events (20) and poorer long term survival in diabetic patients than in non-diabetic patients, CABG has been regarded as the preferred revascularization strategy for diabetic patients with multivessel coronary artery disease, owing to a demonstrable survival advantage and reduced need for repeat revascularization (21). In this series, the incidence of morbidity events analyzed were similar in the two groups by univariate analysis, with only re-sternotomy showing higher incidence in non-diabetic patients. This finding is also in accordance with those of some recent studies (22). In contrast with the previously published studies of Rajakaruna, Kubal and their co-workers (23, 24), we could not identify diabetes as an independent predictor of acute renal failure or prolonged length of stay. Additionally, diabetes was also not associated with the rate of postoperative myocardial infarction, with increased requirement for inotropic or mechanical support and the occurrence of atrial arrhythmia. The

independent influence of diabetes in the development of a cerebrovascular accident has been described by some authors (23, 25). We didn't show higher incidence of cerebrovascular accidents by univariate analysis in our diabetic patients. This finding is also in accordance with those of some recent studies (24, 26).

LIMITATIONS

The limitation of this study is that it was an observational analysis, although the data were collected prospectively. At the time of data collection, this analysis had not been planned. It is possible that the differences or similarities observed between the groups were a result of unforeseen confounders. Also, this study was based on a small cohort of patients from a single institution, which limits its power. Hence, our data do not support the conclusions by other authors who found diabetes to be a risk factor for significantly adverse early outcome following CABG.

CONCLUSION

In conclusion, in our experience diabetic patients could be surgically revascularized with low morbidity rates, comparable to those of non-diabetic patients. Our data do not support the conclusions by other authors who found diabetes to be a risk factor for significantly adverse morbidity following CABG. In our study DM was not risk factor for perioperative complications and preoperative characteristic of diabetic patients were not different than in no diabetic

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