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ORIGINAL ARTICLE

Short-term Outcome of Coronary Artery Bypass Graft Surgery in Diabetics at Ibrahim Cardiac Hospital & Research Institute

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ABSTRACT

Background & objective: Patients with diabetes are at increased risk for coronary artery disease (CAD) and frequently require coronary artery bypass grafting (CABG). Whether the risks of morbidity and mortality following CABG are higher in patients with diabetes is still a debatable issue. The present study is to test the hypothesis if diabetics are at a higher risk of developing morbidity and mortality following CABG.

Method: This retrospective review was done on medical records of 1030 patients who underwent CABG surgery in the Department of Cardiac Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka between September 2006 and July 2010. Patients with known diabetes or preoperative fasting blood sugar ≥ 6.4 mmol/L or random blood sugar ≥ 11.1 mmol/L were considered as diabetics (n= 691) and the rest were non-diabetics (n=339). Early outcome was evaluated in terms of complications like wound infection, sepsis, bleeding, reopening for bleeding, pneumonia, pleural effusion, acute respiratory distress syndrome (ARDS), arrhythmia, cerebrovascular accident (CVA), heart failure etc. Mortality was defined as death occurring from any cause within the first 30 postoperative days.

Result: Diabetics were more likely to be older (p=0.006), female (p=0.018) and dyslipidaemic (p < 0.001). Presence of hypertension, tobacco use and renal impairment were no different between the groups. The hepatic dysfunction and 30-day mortality were higher in the diabetic group although the differences did not reach the level of statistical significance.

Conclusion: Although the present study failed to show any adverse short-term outcomes among diabetics in a significant proportion, the mortality and hepatic dysfunctions were a little bit higher in diabetics compared to their non-diabetic counterparts.

Key words: *Coronary artery bypass graft (CABG), diabetes, 30-day outcome (morbidity and mortality).*

INTRODUCTION

Diabetes mellitus, is a major determinant of cardiovascular events. It carries an adverse prognosis in patients with coronary artery disease regardless of the treatment strategy.[1] Investigators have suggested several possible mechanisms for the association between diabetes and heart disease. These include abnormalities in lipid metabolism, nitric oxide activity, platelet function, coagulation and autonomic function.[2-4] Not only is diabetes a risk factor for CAD, but observational studies have also linked it with worse outcomes after revascularization via CABG surgery.[5-7]

The patients with diabetes are at increased risk for coronary artery disease and frequently require CABG. In fact, 16% of all patients undergoing CABG in Canada have diabetes.[8] The in-hospital mortality rate for Canadian diabetic patients undergoing CABG is 4%, and the rate of

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nonfatal cardiovascular events or wound infection is substantially higher-approaching 21% at the time of hospital discharge in 14,689 Canadian diabetic patients who underwent CABG between 1993 and 1998.[8] Diabetes (and stress hyperglycemia in non-diabetic individuals) is an independent predictor of morbidity and/or mortality in patients admitted to the hospital with myocardial infarction or unstable ischemic syndromes, as well as those undergoing a variety of surgical procedures.[9-15] A number of studies have also demonstrated increased short-term morbidity and mortality in diabetics compared to their non-diabetic counterparts.[12-15]

We, in the Ibrahim Cardiac Hospital & Research Institute, have not yet evaluated the outcome of CABG between patients with and without diabetes. The present study is one such step to investigate the short-term results of CABG surgery in patients with and without diabetes.

METHOD

We conducted a retrospective review of medical records of 1030 patients who underwent coronary CABG surgery in the Department of Cardiac Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka between September 2006 and July 2010. Patients with known diabetes or preoperative fasting blood sugar ≥ 6.4 mmol/L or random blood sugar ≥ 11.1 mmol/L were considered as diabetics (n=691) and the rest were non-diabetics (n=339).

All patients received short-acting anesthetic drugs to facilitate early extubation. Extracorporeal circulation was performed via a hypothermic nonpulsatile flow. Cold crystalloid cardioplegia ('St. Thomas solution') was used according to the surgeon's preference to induce and maintain cardioplegic arrest. Early outcome was evaluated in terms of complications like wound infection, sepsis, bleeding, reopening for bleeding, pneumonia, pleaural effusion, acute respiratory distress syndrome (ARDS), arrhythmia, cerebrovascular accident (CVA), heart failure etc. Mortality was defined as death occurring from any cause within the first 30 postoperative days.

RESULT

Around half of the patients in both diabetic (53.5%) and non-diabetic (47.2%) groups were in their 5th decades of life with mean age of the patients being 56.2 and 54.7 years respectively (p=0.006). Males were predominant in both groups, but their presence was significantly less in the diabetic group (84.2%) than that in the non-diabetic group (89.7%) (p=0.018) (table I). Hypertension was common in both diabetics (70.7%) and non-diabetics (72.8%) with no significant intergroup difference (p=0.538).

TABLE I : Comparison of demographics between patients with DM and non-DM.

Demographic variables	Group		p-value
	Diabetic (n = 691)	Non-diabetic (n = 339)	
Age# (yrs)			
< 50	131(19.0)	95(28.0)	
50-60	370(53.5)	160(47.2)	
≥ 60	190(27.5)	84(24.8)	
Mean±SD	56.2±8.2	54.7±8.1	0.006
Sex*			
Male	582(84.2)	304(89.7)	0.018
Female	109(15.8)	35(10.3)	

Figures in the parentheses denote corresponding percentage.
#Data were analysed using Student's t-Test and were presented as mean±SD.
** Data were analysed using Chi-square (χ^2) Test.*

TABLE II : Distribution of co-morbidities / risk factors between groups.

Co-morbidities/ Risk factors	Group		p-value
	Diabetic (n=691)	Non-diabetic (n=339)	
Hypertension#	162(70.7)	573(72.8)	0.538
Dyslipidemia#	443(64.1)	173(51.0)	<0.001
Smoking#	285(41.2)	133(39.6)	0.611
Renal impairment#	48(6.9)	23(6.8)	0.942
Renal stenosis*	10(1.4)	4(1.2)	0.951
Past history of CABG*	3(0.4)	2(0.6)	0.531

Figures in the parentheses denote corresponding percentage.
*#Data were analysed using Chi-square (χ^2) Test; *data were analysed using Fisher's Exact Test.*

Dyslipidemia was significantly higher among the diabetics (64.1%) than that among the non-diabetics (51.0%) (p < 0.001). Around 40% of

the patients in both groups were smoker. All other co-morbidities like renal impairment, renal stenosis and past history of CABG were almost identically distributed between groups ($p > 0.05$) (table II). Complications developed within 30-days following CABG are depicted in table III. None of these complications was significantly different between the groups ($p > 0.05$). However, hepatic dysfunction and death were comparatively high in the diabetic group.

Table III. Comparison of outcome/complications between groups.

Complications developed	Group		p-value
	Diabetic (n=691)	Non-diabetic (n=339)	
Arrhythmia*	2(0.3)	1(0.3)	0.698
Wound infection#	21(3.0)	5(1.5)	0.133
Bleeding#	73(10.6)	43(12.7)	0.312
Reopening for bleeding#	48(6.9)	28(8.3)	0.449
Heart failure*	3(0.4)	5(1.5)	0.158
Cardiac arrest*	7(1.0)	4(1.2)	0.516
Pleural effusion#	16(2.3)	8(2.4)	0.965
Pneumonia#	12(1.7)	6(1.8)	0.969
ARDS*	4(0.6)	0(0.0)	0.202
Prolonged ventilation#	79(11.4)	40(11.8)	0.863
CVA*	5(0.7)	3(0.9)	0.522
Hepatic dysfunction#	25(3.6)	7(2.1)	0.177
Septicemia#	23(3.3)	9(2.7)	0.558
Multi-organ failure*	9(1.3)	3(0.9)	0.781
Death#	30(4.3)	12(3.5)	0.352

Figures in the parentheses denote corresponding percentage;
*#Data were analysed using χ^2 Test; *data were analysed using Fisher's Exact Test.*

DISCUSSION

Compared to non-diabetics, diabetics were more likely to be older, female and dyslipidemic. Presence of hypertension, tobacco use and renal impairment were no different between the groups. The outcome derived from the surgery did not differ between groups indicating that diabetes produce no deleterious effect on the short-term outcome of CABG surgery. Data from the BARI (Bypass Angioplasty Revascularization Investigation) registry[16] and the Duke database[17] clearly demonstrated that careful clinical selection of patients for revascularization strategy results in comparable outcomes between diabetics and non-diabetics. Mathew and Holmes[18] in an attempt to compare the outcome of CABG and Percutaneous Coronary Intervention (PCI) in diabetic patients acknowledged that the worse outcome of patients undergoing CABG was not due to procedure-related, but patients referred for CABG had more advanced atherosclerosis and reduced ventricular function compared to PCI patients.

Contrary to these findings, several investigators demonstrated variable influence of diabetes on operative risk, with some studies reporting excess mortality in diabetics[19,20] and others reporting comparable short-term survival in non-diabetics[21,22] although the independent effect of diabetes on short-term survival is less clear. Several studies, however, demonstrate increased perioperative morbidity among diabetics, including neurologic complications,[20] renal dysfunction[19] and wound infection.[19,23]

Carson and associates[12] performed an analysis of 146,786 patients undergoing isolated CABG operations from the 1997 Society of Thoracic Surgeons Registry (41,663 diabetics and 105,123 nondiabetics) to determine the effect of diabetes on 30-day operative mortality. Absolute mortality rate was higher in diabetics (3.74% vs. 2.7%), which remains to be higher even after adjustment for multiple differences in baseline characteristics with models that included demographic, clinical, procedural and periprocedural treatment variables, diabetes was independently correlated with 30-day mortality [odds ratio (OR) 1.23; 95% confidence intervals (CI) 1.15 to 1.32]. Although we did not perform multiple regression analysis to find the independent predictors of 30-day mortality, the mortality rate in diabetics is quite consistent with unadjusted mortality data of Carson *et al.*

Carson[12] also demonstrated that the increased mortality effect was greatest among diabetics treated with insulin (OR 1.39; 95% CI 1.27 to 1.52) and less pronounced, but still significant, in patients treated with oral hypoglycemic agents (OR 1.13; 95% CI 1.04 to 1.23). Importantly, although death was attributable to cardiac causes (which generally includes ischemia due to graft failure, left ventricular failure and dysrhythmia) in approximately two-thirds of all patients, neurologic events led to 9.64% of nondiabetic perioperative deaths and 12.14% of diabetic

perioperative deaths. This suggests that the excess short-term mortality in diabetics undergoing CABG is largely due to increased noncardiac mortality, including neurologic, renal, infectious and perhaps other causes. Whether careful vigilance and awareness of these issues in the perioperative period can reduce morbidity and mortality in diabetics is not clear. In our setting postoperative glycemic control was strictly monitored and managed and probably for that reason the mortality and morbidity in diabetics were not significantly higher than those in the non-diabetic patients.

CONCLUSION

The outcome of CABG patients with diabetes is fairly comparable with those without diabetes, although mortality and morbidity were a little bit higher in the diabetics in the present study. However, strict monitoring of perioperative glucose in diabetics does not seem to produce any deleterious effect on the short-term outcome of CABG surgery. A prospective study to see the impact of strict control of perioperative glycemia in these patients on their mortality and morbidity is recommended.

REFERENCES

1. Grundy SM, Benjamin IJ, Burke GL, *et al.* Diabetes and cardiovascular disease: a statement for healthcare professionals from the American Heart Association. Circulation. 1999;100:1134-46.
2. Garber AJ. Vascular disease and lipids in diabetes. Med Clin North Am. 1998;82:931-48.
3. Honing MLH, Morrison PJ, Banga JD, Stroes ESG, Rabelink TJ. Nitric oxide availability in diabetes mellitus. Diabetes Metab Rev 1998;14:241-9.
4. Raman M, Nesto RW. Heart disease in diabetes mellitus. Endocrinol Metabol Clin North Am. 1996;25:425-38.
5. Herlitz J, Wognses GB, Emanuelsson H, *et al.* Mortality and morbidity in diabetic and nondiabetic patients during a two-year period after coronary artery bypass grafting. Diabetes Care 1996;19:698-703.
6. Thourani V, Weintraub W, Stein B, Gebhart SS, Craver JM, Jones EL, Guyton RA: Influence of diabetes mellitus on early and late outcome after coronary artery bypass grafting. Ann Thorac Surg 1999;67:1045-52.
7. Smith RL, Harrell FE, Rankin JS, *et al.* Determinants of early versus late cardiac death in patients undergoing coronary artery bypass graft surgery. Circulation 1991; 84 (Suppl III):III245-53.
8. Ghali WA, Quan H, Brant R: Coronary artery bypass grafting in Canada: national and provincial mortality trends, 1992-1995. Can Med Assoc J 1998;159:25-31.
9. Capes SE, Hunt D, Malmberg K, Gerstein HC: Stress hyperglycemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. Lancet 2000; 355:773-8.
10. Malmberg K, Yusuf S, Gerstein HC, Brown J, Zhao F, Hunt D, Piegas L, Calvin J, Keltai M, Budaj A: Impact of diabetes on long-term prognosis in patients with unstable angina and non-Q-wave myocardial infarction: results of the OASIS Registry. Circulation 2000;102:1014–9.
11. Wahab NN, Cowden EA, Pearce NJ, Gardner MJ, Merry H, Cox J: Is blood glucose an independent predictor of mortality in acute myocardial infarction in the thrombolytic era J Am Coll Cardiol 2002;40:1748-54.
12. Carson JL, Scholz PM, Chen AY, Peterson ED, Gold J, Schneider SH: Diabetes mellitus increases short-term mortality and morbidity in patients undergoing coronary artery bypass graft surgery. J Am Coll Cardiol 2002;40:418-23.
13. Rady MY, Ryan T, Starr NJ: Perioperative determinants of morbidity and mortality in elderly patients undergoing cardiac surgery. Crit Care Med 1998;26:225-35.
14. Roghi A, Palmieri B, Crivellaro W, Faletra F, Puttini M: Relationship of unrecognized myocardial infarction, diabetes mellitus and type of surgery to postoperative cardiac outcomes in vascular surgery. Eur J Vasc Endovasc Surg 2001;21:9-16.
15. Yamamoto T, Hosoda Y, Takazawa K, Hayashi I, Miyagawa H, Sasaguri S: Is diabetes mellitus a major risk factor in coronary artery bypass grafting? The influence of internal thoracic artery grafting on late survival in diabetic patients. Jpn J Thorac Cardiovasc Surg 2000;48:344-52.
16. Detre K, Guo P, Holubkov R, *et al.* Coronary revascularization in diabetic patients: a comparison of the randomized and observational components of the Bypass Angioplasty Revascularization Investigation (BARI). Circulation 1999;99:633-40.
17. Barsness G, Peterson E, Ohman E, *et al.* Relationship between diabetes mellitus and long-term survival after coronary bypass and angioplasty. Circulation 1997;96: 2551-6.
18. Mathew V and Holmes DR. Outcomes in diabetics undergoing revascularization. J Am Coll Cardiol 2002; 40:424-7.
19. Salomon N, Page U, Okies J, Stephens J, Krause A, Bigelow J. Diabetes mellitus and coronary artery bypass. J Thorac Cardiovasc Surg 1983;85:264-71
20. Herlitz J, Wognsen G, Emanuelsson H, *et al.* Mortality and morbidity in diabetic and nondiabetic patients during a 2-year period after coronary artery bypass grafting. Diabetes Care 1996;19:698-703
21. Lawrie G, Morris G, Gleser D. Influence of diabetes mellitus on the results of coronary bypass surgery. JAMA 1986;256:2967-71
22. Risum O, Abdelnoor M, Svennevig J, et al. Diabetes mellitus and morbidity and mortality risks after coronary artery bypass surgery. Scand J Thorac Cardiovasc Surg 1996;30:71-5
23. Fietsam RJ, Bassett J, Glover J. Complications of coronary artery surgery in diabetic patients. Am J Surg 1991;57:551-7