Original Article

Early Outcome of Conventional Coronary Artery Bypass Grafting with Peri-operative Hyperglycaemia in Diabetic and Non- Diabetic Patients in NICVD, Dhaka

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Abstract

Background: *Peri-operative hyper glycaemia has been defined as the average of blood glucose test obtained by venous or arterial sampling on the day of and the day after surgery. Here the association between peri-operative hyper glycaemia and outcomes among patients undergoing coronary artery bypass grafting was measured.*

Objectives: *Evaluation of early outcome of conventional coronary artery bypass grafting with perioperative hyperglycemia in diabetic and non-diabetic patients & to compare the outcomes in both the groups.*

Methodology: *The study was a prospective observational analytic study conducted in National Institute of Cardiovascular Diseases, Dhaka from January 2010 to December 2011 in 60 patients having ischaemic heart disease with or without diabetes mellitus.*

Result: *Postoperative ventilation time and ICU stay both were significantly longer in the diabetic group as compared to their non-diabetic counterparts ($p<0.001$). Pneumonia and all other infections and complications were also more in the former group. None in either group died. The diabetic group stayed on an average 4 days more than the non-diabetic group ($p<0.001$).*

Conclusion: *The study concluded that outcome of coronary revascularization in non-diabetic patients with peri-operative hyper glycaemia is better than that in diabetic patients with peri operative hyper glycaemia.*

Key Words:
Conventional Coronary Artery Bypass Grafting, Peri-Operative Hyper Glycaemia.

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Introduction

Coronary artery disease (CAD) is the leading cause of cardiovascular mortality worldwide, with more than 4.5 million deaths occurring in the developing world. Despite a recent decline in developed countries, both CAD mortality and the prevalence of CAD risk factors continue to rise rapidly in developing countries[1].

Fish and associates[2] found that in diabetic patients a blood glucose level less than 11.1 mmol/L carried a 36% higher risk and a blood glucose level of 13.9 mmol/L or more carried a 63% higher risk of infective complications.

A post-operative serum glucose level (250 mg/dl) was associated with a 10 fold increase in complications. Similar findings were reported by McAlister and coworkers[3].

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The detrimental effects of elevated intra operative glucose levels were also reported in a retrospective observational study of 409 cardiac surgical patients by Gandhi and coworkers[4].

The South Asian countries of India, Pakistan, Bangladesh, Srilanka and Nepal contribute the highest proportion of the burden of the cardiovascular diseases compared to any other regions[5].

Coronary artery bypass surgery under CPB and cardioplegic arrest has been considered the gold standard operation for coronary revascularization[6].

Hyperglycemia is commonly present in the peri operative period in patients undergoing cardiac surgery in both diabetic and non-diabetic patients even during administration of insulin. Because of cardio pulmonary bypass induced alterations in insulin secretion and resistance[7].

Furnary and colleagues[8] have made a strong argument that the true risk factor is not diabetes per-se but rather

hyperglycemia with its attendant glycometabolic impairment and relative overutilization of free fatty acids.

Materials and Method

The study was a prospective, observational analytic study done in National Institute of Cardiovascular Diseases, Dhaka, From January 2010 to December 2011.

Inclusion criteria:

1. Patients with known history of diabetes or random blood glucose >= 200mg/dl or 11mmol/l, were considered as diabetics. While, persons with no history of diabetes or random blood glucose level <200mg/dl or <11mmol/l were considered as non-diabetes.
2. Scheduled for on-pump CABG.
3. Age < 60 years, irrespective of sex.

Exclusion criteria:

1. Age> 60 years.
2. Patients having redo surgery.
3. Any concomitant surgery (e.g. CABG with congenital/valve surgery).
4. Patients with low ejection fraction (<35%).

Result

The findings obtained from data analyses are documented below:

Risk factors distribution

Table I

Comparison of risk factors distribution between groups

Risk factors	Group		p-value
	Diabetics (n = 30)	Non-diabetics (n = 30)	
Smoking habit*	16(53.3)	15(50.0)	0.771
HTN*	25(83.3)	21(70.0)	0.222
Dyslipidemia*	26(86.7)	18(60.0)	0.020
Family H/O IHD*	4(13.3)	0(0.0)	0.038
Overweight or obese*	7(23.3)	9(30.0)	0.559

Figures in the parentheses indicate corresponding **%;**
*** Chi-squared Test (c^2)** was done to analyse the data**.**

Baseline biochemical characteristics

Table II

Comparison of baseline biochemical characteristics between groups

Biochemical characteristics	Group		*p-value
	Diabetics (n = 30)	Non-diabetics (n = 30)	
FBS# (mmol/L)	7.8 ± 0.9	5.6 ± 0.6	< 0.001
Blood sugar 2 hrs after breakfast# (mmol/L)	11.8 ± 1.7	7.1 ± 0.7	< 0.001
Hemoglobin# (g/dl)	13.1 ± 1.2	12.8 ± 2.8	0.609

Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD**.

Peroperative variables

Table III

Comparison of Preoperative variables between groups

Peroperative variables	Group		p-value
	Diabetics (n = 30)	Non-diabetics (n = 30)	
XCT# (minute)	99.7 ± 26.2	92.3 ± 21.9	0.206
ECCT# (minute)	176.1 ± 54.3	151.9 ± 37.9	0.229
Ionotropes used	30(100.0)	30(100.0)	—-
Total operative time# (minute)	192.2 ± 35.6	186.7 ± 29.3	0.405
RBS# (mmol/L)	15.4 ± 1.5	12.0 ± 0.6	0.006

Figures in the parentheses indicate corresponding **%;**
Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD**.

Postoperative variables

Table IV

Comparison of postoperative variables between groups

Postoperative variables	Group		p-value
	Diabetics (n = 30)	Non-diabetics (n = 30)	
RBS on the 1st POD# (mmol/L)	15.3 ± 1.4	12.7 ± 0.5	< 0.001
Ionotropes used	25(100.0)	25(100.0)	—-
Ventilation time# (hrs)	12.8 ± 1.1	8.8 ± 1.2	< 0.001
ICU stay# (hours)	35.4 ± 5.5	30.4 ± 2.3	< 0.001
Sternal infection¶	3(10.0)	2(6.7)	0.500
Harvest site infection¶	6(20.0)	2(6.7)	0.127
Pneumonia*	6(20.0)	1(3.3)	0.051
Renal dysfunction*	4(13.3)	2(6.7)	0.335
CVA*	3(10.0)	0(0.0)	0.119
Perioperative MI*	4(13.3)	1(3.3)	0.177
Hospital stay#	11.4 ± 2.1	7.5 ± 1.6	< 0.001

Figures in the parentheses indicate corresponding %;
¶ Chi-squared Test (c^2) was done to analyse the data.
* Fisher's Exact Test was done to analyse the data.
# Data were analyzed using Unpaired t-Test and were presented as mean ± SD.

Discussion

Some of the findings presented in the result section need further explanation to come to a conclusion. The demographic characteristics, co-morbidities, NYHA functional class except dyslipidemia, were almost similar in diabetic group and non-diabetics. The preoperative fasting blood sugar and blood sugar level two hours after breakfast increased on the day of and the day after surgery, but the rise was more pronounced in the non-diabetics indicating that stress played a role in this unusual rise.

Postoperative ventilation time, ICU stay, pneumonia and all other infections and complications were more in diabetic group. Consequently the diabetic group required longer hospital stay after CABG which on an average was 7 days more than the non-diabetic group. As all the baseline characteristics, except dyslipidemia (which might be due to metabolic derangement that usually occurs in the diabetics) were almost identical between diabetic and non-diabetics the better outcome in the non-diabetics could be attributed due to lower perioperative blood glucose compared to the diabetic ones.

In the study of Estrada et al (2003) infections occurred in 6.6% patients (n = 36) with diabetes and 4.1% patients (n = 42) without diabetes ($p = 0.028$). Patients with diabetes stayed in the hospital after surgery 0.97 days longer (95% confidence interval 0.3 to 1.6 days) than patients without diabetes (p = 0.004). These findings are consistent with findings our study[9].

20% of patients have diabetes mellitus that undergo coronary artery bypass grafting (CABG) each year in the United States[10, 11] and perioperative hyperglycemia in patients with diabetes is associated with higher infection rates[12] which compares favorably with our study. Patients with diabetes undergoing cardiac surgery with postoperative glucose greater than 200 mg/dL have a 17 to 86% increased risk of infection[12].

None of the patients died during hospital stay or within 30 days following surgery. Estrada and colleagues (2003) however, showed a 30-day mortality of 3.7% (n = 20) for patients with diabetes and 2.3% (n = 24) for patients without diabetes (p = 0.13). The reason of absence of mortality in our study as compared to Estrada's study might be that the latter study was conducted about a decade ago, since then management strategy of diabetic patients undergoing CABG has been improved. Another reason might be that the sample size in our study was too small compared to Estrada's study (n = 1574) leaving a scope of chance error to play a role[9].

The risk of infection was increased by 78% when the patients were in the highest quartile of blood glucose (253 to 352 mg/dL) and 17% when they were in the lowest quartile (121 to 206 mg/dL)[12].

Thus, from the data of our study and the recent randomized trials, the significance of perioperative glycemic control on outcomes of CABG is evident. Perioperative hyperglycemia is also associated with increased resource utilization both in patients with and without diabetes. Strict glycemic control has, therefore, both medical and economic significance.

Conclusion

From the findings of the study and discussion thereof, it can be concluded that outcome of coronary revascularization in non-diabetic patients with perioperative hyperglycemia is better than that in diabetic patients with perioperative hyperglycemia. Diabetic patients suffer from pneumonia more often than the non-diabetics. Other infections were also considerably higher among the diabetics. Longer hospital stay is also common among them.

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