Original Research Article

Implication of preoperative glycosylated hemoglobin level on short term outcomes in diabetic patients undergoing coronary artery bypass grafting

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ABSTRACT

Background: Diabetes mellitus is one of the significant risk factors for adverse outcomes after coronary artery bypass surgery. The glycosylated haemoglobin i.e. HbA1c is a reliable diagnostic test to know the long-term glycemic status. The objective of the study is to investigate the implication of preoperative HbA1c level on short term outcomes after coronary artery bypass grafting (CABG).

Method: Total 218 patients were studied, and the data were collected retrospectively. Patients are distributed into group 1 with HbA1c≤7 (good glycemic control) and group 2 with HbA1c>7 (poor glycemic control). The parameters studied for short term outcomes were revision due to bleeding, duration of mechanical ventilation, cerebrovascular accident (CVA), atrial fibrillation (AF), renal failure requiring dialysis, infective complications like sternal and leg wound infection, mediastinitis, pneumonia, urinary tract infection (UTI), sepsis; length of ICU stay and in-hospital mortality.

Result: In comparison to group 1, patients of group 2 showed statistically significant more morbidity in view of short-term outcomes in this study.

Conclusion: HbA1c>7 is associated with statistically significant adverse short-term outcomes after CABG.

Keywords: HbA1c, Diabetes mellitus, CABG, Outcomes

INTRODUCTION

The post-operative morbidity and mortality are increased by five-to-ten folds in diabetics.[1] The glycosylation of the red blood cells is regulated by blood glucose level; considering the life span of RBC (90-120 days) the circulating blood glucose level and continuous cell turn-over lead to formation of HbA1c. Thus, the HbA1c level indicates about the glycemic status of the patient over a period of previous three to four months. In fact, HbA1c gives more information than a blood sugar reading taken at a single time that may change depending on the metabolic demand and short-term dietary changes.

Currently, HbA1c is considered gold standard to monitor the glycemic control in diabetics.[2]

The objective of the study was to depict the implication of preoperative HbA1c level on short term outcomes after CABG in two groups (HbA1c≤7 and HbA1c>7) of the diabetic patients.

METHODS

We studied 218 diabetic postoperative CABG patients retrospectively after having approval from the institutional ethical committee. It was an observational

analytic study. Among 218 patients,136 were male and 82 were female. There were 96 patients in group 1 (HbA1c≤7) and 122 in group 2 (HbA1c>7). The parameters studied for short term outcomes were revision due to bleeding, duration of mechanical ventilation, CVA, AF, renal failure requiring dialysis, infective complications like sternal and leg wound infection, mediastinitis, pneumonia, UTI, sepsis; length of ICU stay and in-hospital mortality. Certain preoperative factors and demographic data were taken into consideration in this study and those were shown in Table 1.

Study design: Retrospective observational analytic study.

Study place: The place of study was at Department of CTVS, G.B. Pant Institute of Postgraduate Medical Education & Research (GIPMER), New Delhi.

Study period: Duration of study was 1.5 year between October 2018 and March 2020.

Study population: All diabetic postoperative CABG patients admitted in CTVS ICU and CTVS wards of G.B.

Pant Institute of Postgraduate Medical Education & Research (GIPMER), New Delhi.

Sample size: Sample size of study was 218 patients.

Statistical analysis was done by Epi info (TM) 7.2.2.2, which is a trademark of the centers for disease control and prevention (CDC). Descriptive analysis was used to calculate the means with associated standard deviations (SD). Test of proportion was utilized to see the standard normal deviate (Z) for comparison among the difference proportions. T-test compared the means of the two groups. P<0.05 was considered statistically significant.

RESULTS

Preoperative factors and demographic data are shown in Table 1. In this study, the patients in group 2 are younger (p<0.0001), having significantly higher fasting blood sugar and serum LDL (p<0.0001) with higher incidence of unstable angina and acute myocardial infarction.

Table 1: Preoperative factors and demographics.

Parameters	Group 1 (n=96) (%)	Group 2 (n=122) (%)	Test statistic	P value
Age (years)	65±7	45±8	t_{216}=17.99	<0.0001 S
Sex: female gender	31 (32.3)	51 (41.8)	Z=1.46	0.14 NS
Body mass index (kg/m²)	29±3.8	29±4.5	t_{216}=0.01	0.99 NS
Smoking	65 (67.7)	71 (58.2)	Z=1.47	0.13 NS
COPD	23 (24.0)	19 (15.6)	Z=1.41	0.16 NS
Hypertension	52 (54.2)	75 (61.5)	Z=1.46	0.25 NS
Serum LDL (hyperlipidemia)	115±17	130±22	t_{216}=5.67	<0.0001 S
Unstable angina (USA)	33 (34.4)	75 (61.5)	Z=3.96	<0.0001 S
Acute myocardial infarction	27 (28.1)	59 (48.4)	Z=2.91	0.0036 S
Ejection fraction	55±7	55±9	t_{216}=0.01	0.99 NS
CVA	5 (5.2)	12 (9.8)	Z=1.34	0.18 NS
Serum creatinine (mg/dl)	0.85±0.35	0.92±0.38	t_{216}=1.41	0.16 NS
Fasting blood sugar (mg/dl)	142±40	220±55	t_{216}=12.11	<0.0001 S
HbA1c (g%)	6.5±0.5	9.5±1.5	t_{216}=20.67	<0.0001 S
Duration of diabetes (years)	8.5±5.5	9.5±7.6	t_{216}=1.12	0.26 NS

S-Statistically significant, NS- Statistically not significant

Table 2: Variables for measuring the short-term outcomes-morbidity and mortality indicators.

Variables	Group 1 (n=96)		Group 2 (n=122)		Test statistic	P
	N	%	N	%		
Revision due to bleeding	7	7.3	6	4.9	Z=0.59	0.54 NS
Duration of mechanical ventilation (hours)	24±16		22±18		t_{216}=0.86	0.38 NS
CVA	3	3.1	14	11.5	Z=2.41	0.015 S
AF	12	12.5	30	24.6	Z=2.16	0.031 S
Renal failure requiring dialysis	5	5.2	21	17.2	Z=2.71	0.0067 S
Sternal wound infection	15	15.6	48	39.3	Z=3.64	<0.0001 S
Leg wound infection	13	13.5	47	38.5	Z=4.01	<0.0001 S
Mediastinitis	5	5.2	8	6.6	Z=0.59	0.54 NS
Pneumonia	3	3.1	4	3.3	Z=0.01	0.99 NS
UTI	11	11.5	29	23.8	Z=2.21	0.027 S
Sepsis	8	8.3	28	23.0	Z=2.96	0.003 S
Length of ICU stay (days)	5±2		8±4		t_{216}=6.71	<0.0001 S
In-hospital mortality	2	2.1	9	7.4	Z=1.71	0.08 NS

S-Statistically significant, NS- Statistically not significant.

Table 2 depicts the short-term outcome variables in two group. There is no significant difference in rate of reoperation due to bleeding and duration of mechanical ventilation between two groups in this study. Group 2 patients had higher incidence of CVA (p=0.015). The study reveals significantly higher incidence of AF in group 2 patients (p=0.031). Occurrence of renal failure requiring dialysis was significantly higher among group 2 patients (p=0.0067). Sternal and leg wound infection (p<0.0001), UTI (p=0.027) and sepsis (p=0.003) were significantly higher in group 2 patients. But the incidence of mediastinitis and pneumonia was not significantly different between two groups. This study showed no significant difference in mortality, but the length of ICU stay was more in group 2 patients (p<0.0001).

DISCUSSION

In this study the patients with poorly controlled diabetes had more adverse short-term outcomes after surgery in view of cerebrovascular accidents, new onset AF, need for dialysis, surgical site infection (SSI), UTI, sepsis, length of hospital stays.

Arslan et al reported that poor preoperative glycemic control (HbA1C≥7%) was associated with more morbidity after CABG in terms of reoperation due to bleeding, SSI, CVA, need for dialysis, prolonged mechanical ventilation, prolonged hospital stays and postoperative new-onset AF.[3] There is no significant difference in rate of reoperation due to bleeding between two groups in this study.

Schnack et al reported that there is a strong correlation of pneumopathy with HbA1c levels.[4] In this study, there is no significant difference in duration of mechanical ventilation between two groups.

Hjalmarsson et al studied 501 patients and reported that poor glycemic control is associated with increased risk of CVA and subsequent unfavorable outcomes.[5] In this study, group 2 patients had higher incidence of CVA (p=0.015).

Kinoshita et al studied the relation between HbA1c levels and the postoperative atrial fibrillation.[6] In their study the patients who had significantly lower HbA1c developed AF postoperatively (HbA1c 5.8 vs 6.1, p=0.01). Dublin et al reported higher occurrence of AF in diabetic patients and the risk is directly proportional to HbA1c levels.[7] the study reveals significantly higher incidence of AF in group 2 patients (p=0.031).

In this study, occurrence of renal failure requiring dialysis was significantly higher among group 2 patients (p=0.0067). Halkos et al studied that elevated HbA1c was associated with higher rate of post-operative renal failure.[2]

Alserius et al had done a prospective study expressing the correlation between HbA1c concentrations, infection rate and mortality in 605 patients.[8] Sternal wound infection rate was significantly higher in patients with HbA1c≥6%. In this study, sternal and leg wound infection (p<0.0001), UTI (p=0.027) and sepsis (p=0.003) were significantly higher in group 2 patients. But the incidence of mediastinitis and pneumonia was not significantly different between two groups.

This study shows no significant difference in mortality, but the length of ICU stay was more in group 2 patients (p<0.0001). Brandt et al studied that there is no significant relation between diabetes and mortality.[9]

Limitations

It was a retrospective study with a limited number of patients focusing only on the short-term outcomes.

CONCLUSION

HbA1c is now routinely advised as a preoperative work-up of diabetic patients with coronary artery disease (CAD) for CABG, because HbA1c is the best indicator till date to know the status of long-term glycemic control as well as a predictor of morbidity and mortality after CABG. Even elective CABG should be postponed to avoid the morbid complications of diabetes if poorly controlled on the basis of HbA1c level.

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