INFLUENCE OF DIABETES MELLITUS ON OPERATIVE OUTCOME OF CORONARY ARTERY BYPASS GRAFT SURGERY

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ABSTRACT

BACKGROUND

Diabetes Mellitus (DM) was present in around 47% of population in India undergoing coronary artery bypass surgery for coronary artery disease. Our aim of the study was to determine possible pre-operative and post-operative risk factors and mortality associated with diabetes during coronary artery bypass grafting (CABG).

MATERIAL AND METHODS

We analyzed retrospective data of 224 patients at our institute operated between January 2014 to March 2014. The preoperative, intra operative and postoperative risk factors as well as the complications and 30-day mortality rates were compared between the diabetics and non-diabetics. Among the 224 patients; 132 (58.93%) were in non-diabetic group and 92(41.07%) were diabetics.

RESULTS

The 30-day mortality was 11% in patients with DM and 3% in those without DM; we observed that BMI, hypertension and weight were highly significant in diabetic group compared to non-diabetic group. Prothrombin time, inotropes duration, ICU stay, hospital stay and mechanical ventilation hours were also significantly high in diabetic group compared to non-diabetic group.

CONCLUSION

DM is an important risk predictor for short term mortality and morbidity among those undergoing CABG.

KEYWORDS

Coronary Artery Bypass Grafting, Diabetes Mellitus, Intensive Care Unit.

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INTRODUCTION: Diabetes Mellitus (DM) generates an independent risk factor for developing coronary artery disease (CAD) and frequently require coronary artery bypass grafting (CABG). It is a well-recognized possible etiological factor for coronary artery disease and cardiovascular death. The reported prevalence of diabetes among patients undergoing coronary artery bypass surgery has been estimated in different studies to be ranging up to 47% in Indian population.[1] The incidence of diabetes is increasing markedly and the World Health Organization estimates that by 2025, about 5.4% of the world population (300 million people) will be diabetic.[2] Hospitals and Clinicians who treat the diabetic patients with CAD should be aware of the effects this condition has on the outcomes of CABG surgery and the diabetic patients have more advanced; diffuse coronary artery stenosis and more end-organ dysfunction, including renal failure. The aim of this study was to determine the influence of diabetes in patients undergoing coronary artery bypass grafting surgery and also aims to find the possible post-operative and pre-operative risk factors and mortality associated with diabetes.

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METHODS: This is a prospective observational study conducted in U.N. Mehta Institute of Cardiology and Research Centre from January 2014 to March 2014. The study was approved by institute ethics committee. Two hundred twenty-four consecutive patients who underwent coronary artery bypass grafting surgical procedure for the first time were enrolled. The age of the patients in the study group ranged from 25 years to 80 years which includes both sexes. Exclusion was done to the patients who were below the age of 25 years and if the patients had multiple comorbidities as (Liver failure, renal failure, respiratory failure and advanced malignancy) and combined surgical procedure e.g. CABG with valvular intervention, carotid endarterectomy, and peripheral arterial bypass grafting that would affect their survival.

The patients were divided into two groups: non diabetic group and diabetic group and Patients were defined as diabetic based upon the having a documented history of diabetes and who needed anti-diabetic agents either on admission or preoperative diagnosis were classified as having the fasting plasma glucose of >126mg per 100ml for at least two measurements and Hypertension was defined as blood pressure of ≥140/90mmHg recorded at least two times or were on antihypertensive therapy.

All the relevant pre-operative details such as age, sex, weight, height, pre-operative diagnosis etc. were recorded. Blood investigations & Echocardiography were done as part of preoperative workup and all the relevant post-operative details such as blood investigations reports, Echo-cardiography reports details were collected of all the patients. Duration of inotrope in hours, intensive care unit (ICU) stay in days and hospital stay in days was recorded.

Statistical Analysis: Statistical analysis was carried out using SPSS version 20.0 software (SPSS Inc., USA). The chi-square test and independent sample t test were used to compare categorical and continuous variables respectively. Data were presented as Mean±SD or proportion as appropriate. The "p" value less than 0.05 was considered to be significant.

RESULT: The final study population included two hundred twenty-two patients who underwent coronary artery bypass surgery; ninety-two (41%) patients have diabetes and one hundred thirty-two (59%) non-diabetic patients.

Variables	Non Diabetic (n-132)		Diabetic (n-92)		Sig. (2-tailed)
Age (Years)	54.95±9.08		57.71±7.83		0.019
Sex	M-108	F-24	M-76	F-16	0.979
BMI (kg/m^2)	23.31±3.62		24.42±3.85		0.031
Height (cms)	161.58±8.08		160.75±16.51		0.621
Weight (kg)	60.92±10.71		65.91±16.7		0.007
Hypertension (%)	8.33%(n-11)		19.56%(n-18)		0.023
PT (sec)	12.17±1.66		12.16±1.35		0.985
Creatinine (mg/dl)	0.89±0.23		1.03±0.46		0.002
Sodium (meq/L)	137.08±3.64		135.01±4.06		0.000
Potassium (meq/L)	3.99±0.39		4.17±0.46		0.002
Total Protein (g/dl)	6.84±0.67		6.7±0.62		0.111
Albumin (g/dl)	3.79±0.34		3.72±0.41		0.146
LVEF (%)	44.21±11.65		39.58±12.18		0.006
Hb (g/dl)	12.58±1.54		12.43±1.81		0.511
Total WBC (x10^3/µL)	9254.49±2442.86		9391.75±3083.04		0.711
Lymphocytes (x10^3/µL)	33.62±9.27		29.64±9.62		0.002
Neutrophils (x10^3/µL)	57.58±10.41		62.27±10.94		0.001

Table 1: Preoperative patient's variables

BMI: Body Mass Index, PT: Prothrombin Time, LVEF: Left Ventricle Ejection Fraction, Hb: Haemoglobin, WBC: White Blood Cell.

Demographic and preoperative patient variables are shown in Table 1 respectively and the majority of patients were males (Male 82.14% and female 17.85%). The demographic and preoperative variables age (p<0.019), weight (p<0.007), BMI (p<0.031), Hypertension (p<0.023), were found to be significantly higher in diabetic group as compared to non-diabetic group and level of Neutrophils (p<0.001), Potassium (p<0.002), creatinine (p<0.002) were also found to be significantly higher in diabetic group and LVEF (p<0.006), level of sodium (p<0.0001), Lymphocytes (p<0.002) were found to be significantly lower in diabetic group as compared to non-diabetic group. The two study groups had no pre-operative significant variation in Total Protein, PT, Hb, albumin, and T.WBC.

Variables	Non Diabetic (n-132)	Diabetic (n-92)	Sig. (2-tailed)
Time duration of surgery (Hrs)	4.2±1.4	4.64±1.63	0.034
CPB time (min)	25.39±54.35	28.47±59.75	0.69
AOX time (min)	15.71±35.07	16.37±34.33	0.889

Lowest Nasopharyngeal Temperature(°C)	33.06±1.02	32.56±1.72	0.426
Total blood transfusion (n)	1.63±3.58	2.35±4.85	0.203

Table 2: Intra-operative patients' variables

CPB: Cardio Pulmonary Bypass, AOX: Aortic Cross Clamp.

Table 2 compared the data for intra-operative patient variables and the duration of surgery time (p<0.034) was found to be significantly increased in diabetic group and Lowest Nasopharyngeal Temperature, AOX Time, CPB Time, and Total blood transfusion were not significant in diabetic group as compare to non-diabetic group.

Variables	Non Diabetic (n-132)	Diabetic (n-92)	Sig.
PT (sec)	14.79±3.7	18.43±17.21	0.019
Urea (mg/dl)	34±16.72	39.44±17.72	0.02
Total Protein (g/dl)	5.79±0.84	5.46±0.82	0.005
Albumin (g/dl)	3.18±0.45	2.96±0.47	0.001
Creatinine (mg/dl)	1.06±0.22	1.18±0.40	0.004
RBS (mg/dl)	178.4±50.85	277.02±79.67	0
Hb (g/dl)	11.39±1.75	10.67±1.7	0.002
T.WBC ($x10^3$/µL)	16181.11±5101.68	14263.82±4089.38	0.003
T.RBC ($x10^6$/µL)	4.44±0.78	4.1±0.71	0.001
LVEF (%)	43.31±10.79	39.79±11.51	0.024
RVSP(mmhg)	30.19±23.89	28.49±6.11	0.528
Inotropes Duration (Hr.)	45.51±50.84	66.48±76.84	0.016
Ventilations HRS	13.27±25.36	21.93±28.34	0.017
ICU Stay (Days)	4.28±1.9	5.83±6.21	0.008
Hospital Stay (Days)	7.97±2.54	10.08±6.4	0.001
(Central venous pressure) CVP After 12Hr	11.37±6.47	13.82±8.24	0.04
Renal complication (%)	9.84%(n-13)	23.91%(n-22)	0.007
Post-op intra-aortic balloon	5.30%(n-7)	15.21%(n-14)	0.042
30 days Mortality (%)	3.03%(n-4)	10.86%(n-10)	0.035

Table 3: Postoperative patient's variable

RBS: Red Blood Sugar.

Post-operative patient variables are shown in Table-3 respectively and PT (p<0.048), Inotropes Duration (p<0.024), ICU Stay (p<0.023), Hospital stay (p<0.003), mechanical Ventilations HRS (p<0.017), CVP (p<0.040), post-op intra-aortic balloon (p<0.042) were found to be significantly higher in diabetic group as compare to non-diabetic group and also the level of Urea (p<0.022), RBS (p<0.0001), Creatinine (p<0.004) were increased in diabetic group and Total protein (p<0.005), Albumin (p<0.001), Hb (p<0.002), T.WBC (p<0.003), T.RBC (p<0.001),LVEF (p<0.024) were found to be significantly lower in diabetic group as compare to non-diabetic group. Greater 30 days' mortality rate was observed in patients with diabetic as compared to with non-diabetic patient, which was statistically significant (p=0.035), though we found that the CPB time between the groups were statistically non-significant. (p=0.4691).

DISCUSSION: Several studies have estimated 12-38% Prevalence of diabetes among patients undergoing coronary artery bypass surgery (CABG).[3,4,5] and one of study Kasliwal, RR conclude the 47.5% of the patients undergoing CABG have Diabetes in Indian population.[1] Similar to our study, the majority of such studies were carried out in western countries and limited information was available for the Indian population. In addition, the prevalence of diabetes in Asian CABG patients was consistently higher than that in Caucasians.[6]

There are conflicting data about the effect of diabetes on 30 days' mortality and morbidity following CABG. According to our study and to several other reports,[7,8] one-month mortality were found to be significantly higher in diabetic patients as compared to non-diabetic patients but some previous studies did not identify a significantly elevated risk of death in patients with diabetic.[9,10,11] There are a number of possible clarifications for the relation between diabetes and increased mortality and morbidity after CABG. The most noticeable clarification is that patients with diabetes have more comorbidity or more advanced cardiac disease at the time of surgery. While we controlled for many known risk factors previously demonstrated to be associated with mortality such as demographic characteristics, preoperative risk factors including most common comorbidities, preoperative cardiac status, preoperative haemodynamics data, preoperative creatinine level, electrolyte disturbance, metabolic abnormalities and operative information, it is still possible that there is residual confounding.

According to our study, the diabetic patients were more obese and had hypertension and lower left ventricular ejection fraction (LVEF) compared to non-diabetic patient similar to Moshtahi and Carson study.[7,12] In the current study, the post-operative renal complication and duration of surgery time was higher in diabetic patients which is similar to the data reported in Vahideh Koochemeshki study.[13] Our study findings that the mechanical ventilation time in the diabetics was more than the non-diabetics similar to report by some researchers.[14,15] And also finding that the diabetic patients had a higher length of hospital stay similar to Carson and kubal[7,12] and other main findings of our study were the higher significant association of preoperative parameter such as creatinine, potassium, neutrophils and lower LVEF, sodium level with the diabetes and In our study we have also found out postoperative prothrombin time(PT), urea, Central venous pressure(CVP), uses of Intra-aortic balloon pump were higher in diabetic patient and total protein, albumin, haemoglobin(Hb), total WBC, total RBC were significantly lower in patients with diabetes.

CONCLUSION: The present study was determined the Diabetes Mellitus (DM) is a predictor of short term mortality

and morbidity after Coronary Artery Bypass Grafting (CABG) and also diabetes had significant impact on increased use of post-operative Intra-aortic balloon pump and on renal complications.

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