

IN-HOSPITAL COMPLICATIONS OF CORONARY ARTERY BYPASS SURGERY IN DIABETIC AND NON DIABETIC PATIENTS WITH THE USE OF HEART LUNG MACHINE

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ABSTRACT

Background and Objectives: The coronary artery bypass grafting (CABG) operation has perhaps become one of extensively studied operation in the history of surgery. It has been shown to be highly effective for the relief of ischemic heart diseases, and to have prolonged life in some subsets of patients. Diabetes mellitus is an established independent risk factor for causing significant morbidity and mortality after coronary artery bypass grafting. The objective of this study was to compare the complications after CABG in diabetic and non-diabetic patients during hospital stay in the first 3 to 4 days.

Methodology: It was a prospective study with three days follow up of 200 patients undergoing CABG with the use of heart lung machine (on pump). Patients were divided in to two groups i.e. diabetics and non-diabetics. Independent sample t-test was used to compare the means of two groups in pre and post-operative conditions while chi-square test was used for bivariate analysis to confirm the significant association of complications for two groups. p -value ≤ 0.05 was considered as significant.

Results: The mean age of diabetic patients was 56.10 ± 8.63 years and mean age of non-diabetics was 54.78 ± 11.17 years. Of all the data analyzed there was an overall male predominance. The two groups of patients were similar with regard to ejection fraction pre and post operatively. There was a significant difference in postoperative urea and creatinine levels in both groups. The types of complications within the two groups differed in that the immediate renal dysfunction (36%), bleeding (14%) and intra-aortic balloon pump use (17%) were significantly greater (p -value < 0.05) in diabetic patients compared to the non-diabetics (13%, 8% and 7% respectively). Occurrence of postoperative atrial fibrillation, low cardiac output syndrome and prolong ventilator support were statistically insignificant for both groups.

Conclusion: Diabetics have worst hospital and long term outcome after coronary artery bypass grafting in terms of immediate renal dysfunction, bleeding and intra-aortic balloon pump use.

Keywords: Cardiopulmonary bypass, Heart lung machine, Coronary artery bypass grafting, Diabetes Mellitus, Mortality.

INTRODUCTION

Cardiopulmonary bypass (CPB) is a technique that temporarily takes over the function of the heart and lungs during surgery.¹ The CPB pump itself is often referred to as a heart lung machine or “the pump”.² Coronary artery bypass grafting (CABG) along with cardiopulmonary bypass is commonly used to graft the diseased vessels.³ CABG is associated with many peri-operative complications including: bleeding, infections of the chest wound, kidney failure and conduction disturbances.⁴

Diabetes mellitus (DM) is a major risk factor for cardiovascular disease, and atherosclerosis is responsible for 80% of deaths in patients with DM.⁵ Approximately 20% to 30% of patients undergoing coronary

artery bypass surgery have DM.⁶ Patients with diabetes have more advanced diffuse coronary artery stenosis and have increased incidence of end organ dysfunction, including renal insufficiency and neurologic deficits.^{7,8}

In the perioperative and postoperative courses of coronary bypass operations, diabetic patients are often at a disadvantage compared with non-diabetic patients.⁹ Accelerated arteriosclerosis associated with diabetes increase the long term mortality rates.¹⁰ Patients with DM had postoperative strokes more often and spent, on average, more days in hospital.¹¹ The incidence of acute renal failure (ARF) during CABG increases in the presence of co morbid diseases such as diabetes mellitus. Longer periods of CPB and perfusion

pressures below 60 mmHg are associated with increased incidence of postoperative renal failure.¹² The rationale of this study was to compare the early clinical outcome in terms of postoperative complications following isolated CABG in diabetic and non-diabetic patients so as to guide our planning to reduce the mortality rate.

METHODS

It was a prospective longitudinal study of 200 patients (100 diabetics and 100 non diabetics) undergoing CABG with three days follows up after surgery. Study was conducted at Punjab institute of cardiology and completed in six months. We used non probability (purposive) sampling. All patients from age 30 years onwards regardless of gender who underwent CABG with the use of heart lung machine (cardiopulmonary bypass) were included in the study. Other patients who were having valvular or congenital procedures such as ASD and VSD patients and those having CABG without bypass (off pump) were excluded.

Data Collection Methods

Patients were followed up for three days after surgery. In addition to collecting basic demographic details, frequency of postoperative complications and other related perfusion parameters were noted down on a short structured questionnaire. Patients were asked about the presence of chronic hypertension and diabetes mellitus. Information was also obtained regarding smoking history and history of heart disease in first degree relatives.

Statistical Techniques

Patients were divided into two groups i.e; diabetics and non-diabetics. Both descriptive and inferential statistical analyses were done in Statistical Package for Social Sciences (SPSS) version 16.0. Categorical data were presented as percentages while descriptive and frequency distribution was used for quantitative analyses. Independent sample t-test was used to compare the means of two groups in pre and post-operative conditions while chi-square test was used for bivariate analysis to confirm the significant association of com-

plications for two groups. p-value ≤ 0.05 was considered as significant.

RESULTS

The mean age of diabetic patients was 56.10 ± 8.63 years and mean age of non-diabetics was 54.78 ± 11.17 years. There were 170 (85%) male and 30 (15%) female patients.

Table 1 shows the comparison between the diabetics and non-diabetics in preoperative and post operative conditions. There was no statistically significant difference between preoperative serum creatinine levels in diabetics and non-diabetics as the p-value is 0.204 which is > 0.05 (insignificant). But the difference was significant postoperatively as the mean post operative serum creatinine levels in diabetic and non diabetic patients were 1.62 ± 0.80 mg/dl and 1.14 ± 0.45 mg/dl respectively with a p-value 0.000 (> 0.05).

Similarly for preoperative urea levels there was no significant difference between diabetics and non-diabetics as p-value 0.078 which is > 0.05 (insignificant). However there was a significant difference in post-operative urea levels between diabetics and non-diabetics (57.5 ± 7.3 and 43.1 ± 8.4 respectively) as p-value 0.002 i.e. < 0.05 which is significant.

Ejection fraction shows insignificant difference between both groups pre and post operatively as p-value > 0.05.

Table 2 shows the association of complications between diabetic and non diabetic patients undergoing CABG in a bivariate analysis. Complications that were significantly associated with diabetic patients were immediate renal dysfunction, bleeding and intra aortic balloon pump (IABP) use as compared to non-diabetics.

There were total 200 patients in which 49 had immediate renal dysfunction (including 36 diabetic and 13 non diabetic) p-value 0.03 (< 0.05) which is significant. Similarly out of 200 patients 22 of the patients had bleeding as a complication with p-value 0.02 (< 0.05) which is significantly associated with diabetics. With respect to Intra aortic balloon pump (IABP) use a total of 24 patients were supported on IABP out of

Table 1: Comparison between Diabetics and Non-diabetics in Pre and Post-op Conditions.

	Pre-operative		P-value	Post-operative		P-value
	Diabetics	Non Diabetic		Diabetics	Non-diabetics	
	Mean ± S.D	Mean ± S.D		Mean ± S.D	Mean ± S.D	
Ejection Fraction (%)	47 ± 5.7	47 ± 7.4	0.57	48.29 ± 6.4	47.29 ± 7.44	0.410
Creatinine (mg/dl)	1.02 ± 0.24	0.94 ± 0.54	0.204	1.62 ± 0.80	1.14 ± 0.45	0.000*
Urea (mg/dl)	34.22 ± 8.4	31.16 ± 9.2	0.078	57.5 ± 7.3	43.1 ± 8.4	0.002*

*p-value < 0.05 - significant

which 17 were diabetics with p-value 0.04 (< 0.05) thus signifying that diabetics were more prone to the use of IABP as compared to non-diabetics.

Other complications such as, low cardiac output syndrome, prolonged ventilatory support and atrial fibrillation (AF) were not significantly associated with diabetics in bi-variate analysis as their p-values were > 0.05.

Fig. 1 shows frequency of various complications in diabetics and non-diabetics. Most common complication was low cardiac output

Table 2: Association of Complications in Diabetics and Non-diabetics.

Complications	Diabetics n = 100	Non-diabetics n = 100	P-value
Atrial fibrillation (AF)	15	10	0.39
Immediate renal dysfunction (IRD)	36	13	0.03*
Bleeding	14	08	0.02*
Low cardiac output syndrome	49	44	0.60
Intra aortic balloon pump (IABP) used	17	07	0.04*
Prolong ventilator support	22	17	0.41

*p-value < 0.05 - significant

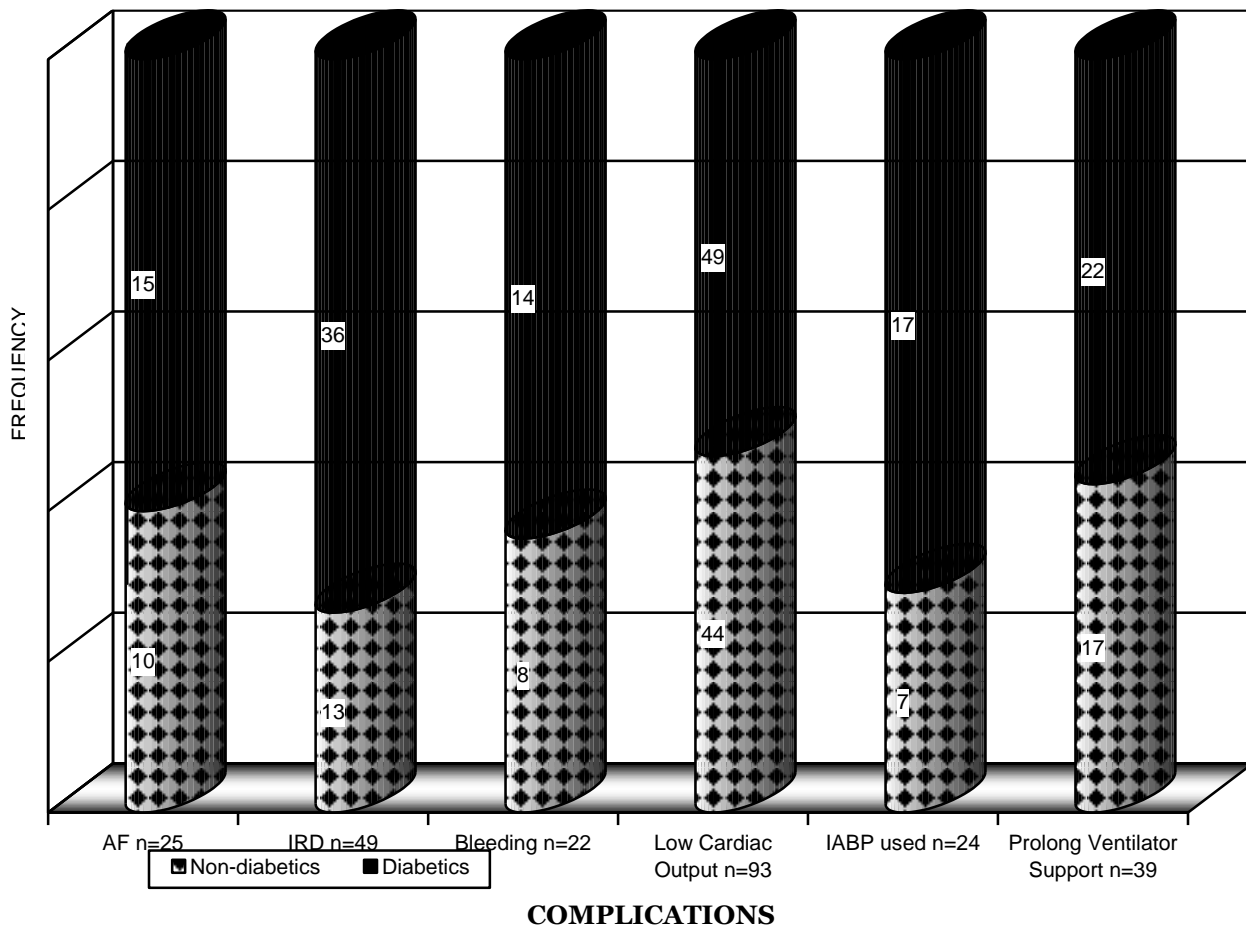


Fig. 1: Frequency of Various Complications in Diabetics and Non-diabetics.

syndrome following immediate renal dysfunction (IRD), prolong ventilator support, atrial fibrillation (AF), IABP use and bleeding.

DISCUSSION

Diabetes mellitus is a recognized risk factor for poor early and late outcome after CABG.¹³CAD is not only

more prevalent in diabetic patients compared to the rest of the population, but it tends to be more extensive, involving multiple vessels and being rapidly progressive.¹⁴

The World Health Organization has estimated that the global burden of diabetes would increase from 135 million in 1995 to 299 million by the year 2025 and an

increasing proportion of patients undergoing CABG are diabetic.¹⁵ Calafiore and colleagues¹⁶ found no significant difference between diabetic and non-diabetic patients with respect to all cause in-hospital and five – year mortality after CABG.

Of all the data analyzed it was observed that diabetic patients were older and more likely to be males, obese and hypertensive. Our results support the findings of Carson, et al,¹⁰ who suggested that patients with DM were at significantly greater risk of death or suffering a serious postoperative complication when compared with non-diabetics. In agreement with previous studies we found an unfavorable effect of diabetes on post operative outcomes. We were able to show the increase in the incidence of prolonged intubation time in diabetic patients, but the results were not significant as that of suggested in other reports.^{17,18}

We were able to show significant increase in incidence of postoperative renal dysfunction in diabetic patients in bivariate analysis, and this finding was consistent with other studies.^{19,20} Similarly Intra aortic balloon pump (IABP) insertion was significantly higher in diabetic patients and these results were consistent with the previous literature.⁹ After analyzing our results, we can assume that there is no association between diabetes and postoperative a trial fibrillation as consistent with Moshtaghi, et al.⁹ In agreement with the study conducted by Woodman, et al,²¹ bleeding complications were higher in diabetics in our study. However, its exact frequency, pathogenesis, and role in CPB related bleeding remains poorly established.

DM does have a significant impact on in-hospital morbidity with regard to renal dysfunction, bleeding and use of intra aortic balloon pump. Long term follow up in order to find late complications in diabetic patients after coronary artery bypass surgery seems necessary.

Limitations

We did not consider the two subgroups of diabetes (insulin dependent and non insulin dependent) separately. Furthermore, it is recommended that our findings should be confirmed by doing further studies with long term follow-up.

It is **concluded** that results indicate that diabetic patients have higher perioperative and postoperative complications than non-diabetic patients. Complications that were significantly associated with diabetics include immediate renal dysfunction, bleeding and intra-aortic balloon pump use. So diabetes mellitus should be considered a patient related risk factor, both on short and long term basis, following CABG.

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Authors Contribution

All authors made equal contribution to conceive and design, and/or acquisition of data, and/or analysis and interpretation of data.

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