COMPARATIVE OUTCOME OF ACUTE CORONARY SYNDROME IN DIABETICS AND NON-DIABETICS

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Abstract

Background : It is well known that Coronary Artery Disease (CAD) is strongly associated with Diabetes Mellitus (DM). When CAD develops in diabetic patients the incidence of Acute Coronary Syndrome (ACS) becomes double. Diabetics also suffer more heart failure, pulmonary edema & renal failure while in hospital. The proportion of ACS in diabetic patients is increasing. This trend will likely continue because the population has become more sedentary and overweight. A few studies available comparing the various outcomes of ACS patients with & without DM in our country yet we know that burden of both ACS and DM in our population is increasing. **Materials and methods:** This analytical study was conducted from July, 2013 to June, 2104 in the Department of Cardiology of Chittagong Medical College Hospital. Subjects were by purposive sampling and grouped into two groups as diabetic (Group A) & non diabetic (Group B) each group had 100 patients. Data processing and analysis was done with the help of computer using statistical software SPSS version-17 for windows. Statistical analyses were done by appropriate tests of significances (i.e. t-test, chi-square test). **Results:** The diabetic group had a significantly higher mean age (52.84 ±8.40 years) compared to the non-diabetic group (47.96 ± 9.52) (p=0.000) and majorities of the patients were male. Raised level of Serum Troponin I and mean LVEF was highly significant between the groups. The patients

of both groups developed cardiogenic shock and heart failure in a different proportion (10 % and 4%: p= 0.042) which was statistically significant. Arrhythmia was an outcome in both groups without significant difference and recurrent angina was only found in diabetic group (n=06). **Conclusion:** Our study revealed higher number of complications, mortality and worse clinical features in diabetic ACS patients determining the additional adversities and complicated management with a lower prognostic outcome.

Key words

Acute coronary syndrome; Diabetic; Cardiac. outcome.

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Introduction

Acute Coronary Syndrome (ACS) refers to constellation of symptoms that are compatible with acute myocardial ischemia which include ST Segment Elevation Myocardial Infarction (STEMI) Non ST Segment Elevation Myocardial Infarction (NSTEMI) & Unstable Angina[1]. All three conditions share a common pathophysiology, characterized by acute coronary insufficiency due to disruption of a vulnerable plaque with superadded thrombus formation. It was estimated in the United States of America that 1.7 million patients with acute coronary syndrome were admitted to hospital each year. Of them only one quarter present with STEMI with other three quarters that is approximately 1.4 million have UA/NSTEMI[2].

It is well known that Coronary Artery Disease (CAD) is strongly associated with Diabetes Mellitus (DM). It increases the risk of CAD by two fold to six fold, which accounts for 80% of deaths among patients with diabetes mellitus[3]. It is also well known that risk factors for CAD cluster in diabetic patients. In addition to traditional risk factors, a number of diabetic specific risk factors are present in diabetic patients which make the risk higher for developing CAD in diabetic patients. Furthermore when CAD develops in diabetic patients the incidence of ACS become double and diabetic patients without previous myocardial infarction have similar risk of developing

myocardial infarction as non diabetic patients with previous myocardial infarction[3,4]. The pattern of CAD in diabetic patients is different from those without diabetes. Different studies have also found that diabetic patients with ACS have more severe Coronary Artery Disease (CAD) more ulcerated plaques and intracoronary thrombi[5,6]. Presence of DM is associated with two fold higher risk of death when compared with non diabetic patients placing diabetic patients at high risk category[7]. They also suffer more heart failure, pulmonary edema & renal failure while in hospital[8]. A study from Bangladesh found 11.9% of patients with ischemic heart disease had DM[9]. The proportion of ACS in diabetic patients is increasing. This trend will likely continue because the population has become more sedentary and overweight & also because of developing countries are going toward western pattern of dietary activity[3].

In addition to being a risk factor for the development of coronary artery disease, diabetes influences the outcome following ACS. Different studies have also suggested that patients with DM are not only an increased risk for acute coronary syndromes but also have worse outcomes after these events[7]. A variety of basic pathophysiological mechanism has been proposed to explain the adverse influence of diabetes on ACS. These differences are in atherosclerotic disease development, distribution & progression, endothelial dysfunction, derangement in proteo-fibrinolytic system, Platelet function & exaggeration of inflammatory process[3].

Outcomes of these patients can be improved by proper assessment and appropriate management. For the purpose of evaluation & management of patients with ACS risk stratification now plays a central role. Accurate determination of risk has become a major focus in the initial evaluation of ACS. The initial medical history, Physical examination, ECG assessment of renal function & cardiac biomarkers measurement can be integrated for estimation of risk of death or non fatal MI. Risk assessment is useful not only for selecting site of care but also important to make appropriate decision about which pharmacological or interventional treatment should be used. High risk patients may derive more benefit from the hospital use of effective treatments and the risk benefit ratio of certain treatments may also be more in favor of

benefit for these patients. As patients with DM are at a higher risk for adverse events, a more comprehensive primary & secondary prevention as well as close monitoring and follow up is recommended. European society of cardiology also recommended an invasive & potent antithrombotic therapeutic strategy for such patients[10].

There are yet a few studies available comparing the various outcomes of ACS patients with & without DM in our country. We Know that burden of both ACS and DM in our population is high and still increasing. In our study we attempted to determine the outcomes of diabetic & non diabetic patients with ACS and compared between the groups along with demographic, clinical and investigation findings related to ACS and DM.

Materials and methods

This observational study was conducted over a period extending from July, 2013 to June, 2104 in the Department of Cardiology of Chittagong Medical College Hospital (CMCH). Subjects were selected from patients who were admitted with Acute Coronary Syndrome in the coronary care unit of Department of Cardiology, Chittagong Medical College Hospital by purposive sampling. The purpose of the study was explained in detail to each subject, written informed consent was obtained and detail history was taken. The patients were grouped into two groups as diabetic (Group A) & non diabetic (Group B) each group had 100 patients. The patients were considered as diabetic if he or she had previous history of diabetes mellitus and being treated with oral hypoglycemic agent or insulin or diabetic diet, or having a random blood glucose level more than 200mg/dl.

A pre-tested, pre-designed case record form was used to collect data of the study participants. Baseline clinical features, vital signs and history of risk factors were recorded. Blood sample for serum creatinine, Troponin I was collected and tests were performed in CMCH. Clinical diagnosis and outcomes were determined later based on clinical and investigation findings and put in the record form.

Collected data was compiled, checked, edited & analyzed. Data processing and analysis was done with the help of computer using statistical software SPSS version-17 for windows. Statistical analyses were done using appropriate tests of significance e.g. continuous will be compared through student's t-test and categorical variables by

chi-square test. p value of less than 0.05 was considered statistically significant with confidence interval set at 95%.

Inclusion criteria

i) Patients with acute coronary syndrome having Crescendo angina (More severe, prolonged or frequent) superimposed on a pre-existing pattern of stable, exertion related angina pectoris or Angina pectoris of new onset (Within one month) or Angina pectoris at rest

ii) Post-infarction unstable angina (Within 02 weeks of a documented myocardial infarction)

iii) Patients with a raised random plasma glucose level>200mg/dl

iv) Voluntarily providing written informed consent to participate in the study.

Exclusion criteria

i) Patients with stable angina

ii) Patient with renal failure, hepatic failure

iii) Patients with valvular or congenital heart diseases.

Results

Table I : Distribution of clinical examination findings between the study groups (n = 200)

Clinical Examinations	Group A (n = 100) Mean ± SD	Group B (n = 100) Mean ± SD	p-value
Heart Rate (Per minute)	88.30 ± 15.70	86.34 ± 15.37	0.373
Systolic BP (mmHg)	136.75 ± 19.25	127.50 ± 31.56	0.013
Diastolic BP (mmHg)	85.30 ± 11.52	78.80 ± 17.19	0.002
BMI (Kg/m²)	25.76 ± 2.51	26.15 ± 2.48	0.264

p value reached by t-test

**Table II:** Distribution of investigation findings between the study groups (n = 200)

Investigations	Group A (n=100)	Group B (n=100)	p value
ST Changes in ECG (Depression/Elevation)	92	93	[a] 0.788
Serum Troponin I (Raised)	52	25	[a] 0.002
	Mean ± SD	Mean ± SD	
LVEF (%)	50.82 ± 9.99	55.86 ± 8.15	[b] 0.000
RBS (mg/dl)	222.82 ± 72.16	127.92 ± 28.88	[b] 0.000

[a] p value reached by chi-square test. [b] p value reached by t-test.
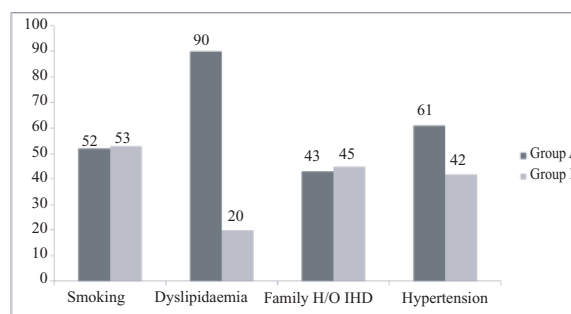
Table III: Distribution of outcomes between the study groups (n = 200)

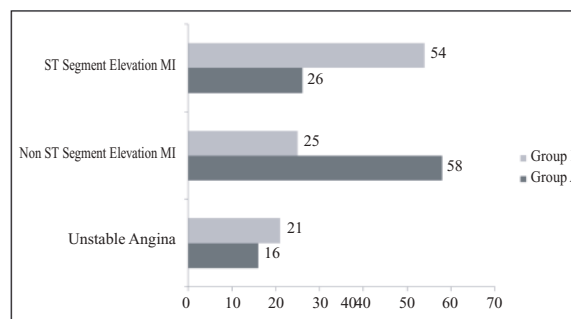| Outcomes	Group A (n = 100)		Group B (n = 100)		p-value
	n	%	n	%	
Cardiogenic Shock	10	10.0	4	4.0	0.042
Heart Failure	16	16.0	9	9.0	0.027
Arrhythmias	20	20.0	12	12.0	0.123
Recurrent Angina	6	6.0	0	0.0	0.013
Death	4	4.0	0	0.0	0.048

p values reached by chi-square test
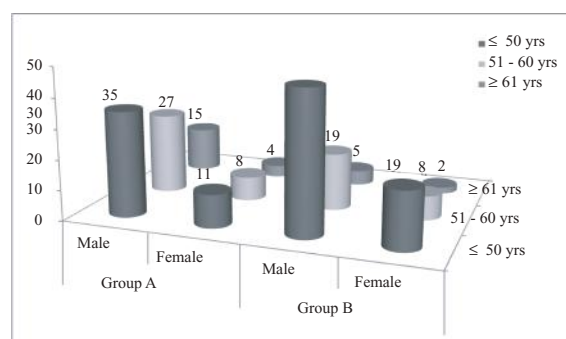
Fig 1 : Distribution of age and sex between the study groups (n = 200)

Fig 2 : Distribution of risk factors for CHD between the study groups (n = 200)

Fig 3 : Distribution of clinical diagnosis between the study groups (n = 200)

Figure 1 shows that forty six percent (46%) of the patients in the diabetic group were < 50 years, followed by 51-60 years (35%) and 61years (19%) of age compared with sixty six percent (66%) in < 50 years group among non-diabetic patients followed by 51-60 years (27%) and a lower percentage that is 7% had an age ≥ 61 years. The diabetic group had a significantly higher mean age (52.84 ±8.40 years) compared to the non-diabetic group (47.96 ± 9.52) (p=0.000). Majorities of the diabetics (77%) and non-diabetics (72%) were male, while 23% of diabetic group and 28% of non-diabetic group were female.

Clinical examination reveals that the mean heart rate was almost identical (88.30 ±19.25 vs 86.34 ± 15.37) between groups. But the mean systolic blood pressure was significantly higher in the diabetic group compared to that in non-diabetic group (136.75 ± 19. vs 127.50 ± 31.56; p = 0.013) (Table I). The presence of risk factor like dyslipidemia and hypertension was found significantly higher in the diabetic group than those in the non-diabetic group (90% & 61% vs 20% & 42%) (Fig 2). Smoking habit was however little high in the non-diabetic group than diabetic group (52% vs 53%) which was not statistically significant. Family H/O Ischemic Heart Disease was identically distributed between the groups (Fig 2) which was also not significant.

Table II illustrates the ST changes in ECG was (Diabetic-92% and Non-diabetic-93%) that was not statistically significant. Raised level of Serum Troponin I (Diabetic-52% and Non-diabetic-25, p value [a] =0.002) was highly significant between the groups. The mean LVEF in group A was Mean ±SD- 50.82 ± 9.99 and in Group B Mean± SD- 55.86 ± 8.15 with a statistically significant difference. The mean random blood sugar in the diabetic and non-diabetic group was also found to be significantly different.

Diagnosis of the diseases reveals that in the diabetic group number of patients with Non ST segment Elevation MI was 58 and 25 in non-diabetic group. On the contrary, 26 patients had ST segment elevation MI in the diabetic group and 54in the non-diabetic group. Unstable angina was 16 in the diabetic group & 21 in the non-diabetic group. However a highly significant difference was observed between the groups (Fig 3).

Table III depicts the complications experienced by the patients. The patients of both groups developed cardiogenic shock (10 % vs 4%: p= 0.042) but in a different proportion within the group which was statistically significant. Arrhythmia was an outcome in both groups without significant difference (Group A-20 and Group B-12) and recurrent angina was only found in diabetic group (n=06). Heart failure was another significantly different outcome for the patients in two groups (Diabetic-16 and Non-diabetic-09). None of the non-diabetic patients died while 04 diabetic patients died due to the complications.

Discussion
This study was carried out to assess outcomes in ACS patients having DM and without DM. Clinical diagnosis, investigation findings and risk factors of the patients was also compared between the groups. The diabetic group had a significantly higher mean age (Mean ± SD- 52.84 ± 8.40) compared to the non-diabetic group (Mean ± SD- 47.96 ± 9.52) and majority of the patients in both groups were male (Diabetic-77%, Non-diabetic-72%) but in diabetic group percentage of female were higher than those without diabetes mellitus (Diabetic-23%, Non-diabetic- 28%). Similar age and sex related findings was found in other studies where higher number of diabetic patients with ACS were female and older than non-diabetic[3, 11]. Clinical examination demonstrated that the mean heart rate was almost identical between groups (Diabetic: Mean ± SD- 88.30 ± 15.70, Non-diabetic: Mean ± SD- 86.34 ± 15.37). The mean systolic blood pressure was significantly higher in diabetics than the non-diabetics (Diabetic: Mean ± SD- 136.75 ± 19, Non-diabetic: 127.50 ± 31.56; p = 0.013) as found in another study. But mean systolic blood pressure in both groups were slightly higher than this study[11]. In case of risk factors smoking and family history of ischemic heart diseases were not significantly different between the groups. As compatible with earlier findings hypertension and dyslipidemia were significantly more in the diabetic patients than non diabetic patients (Diabetic: Hypertension- 90, Dyslipidemia- 61 and non-Diabetic: Hypertension- 20, Dyslipidemia- 42), though there were minor differences among the exact percentage of patients with hypertension and dyslipidemia. These findings proved the well known fact that diabetes mellitus, hypertension and dyslipidemia often co-exist and are important component of metabolic syndrome[11,12].

This study revealed that among the diabetic patients 16% had unstable angina, 58% had Non ST segment elevated myocardial infarction (Non-STEMI) and 26% had ST-segment elevated myocardial infarction (STEMI). 21% of non-diabetics had unstable angina, 25% had non ST segment elevation MI & 54% had ST segment elevation MI. A previous multi-centre study also found that 26%, 29% & 45% were diabetic patients and 23%, 27%, 50% of non diabetic patients had unstable angina, non-ST elevation MI and ST-elevation, respectively[13].

Diabetes with MI had poor prognosis despite improvement in coronary care[14]. Other studies also demonstrated that ACS patients with diabetes mellitus had poor prognosis both in short & long term including death [11,13,15]. In this study diabetic ACS patients suffered more in-hospital complications similarly found in more than one previous studies demonstrating that ACS patients with Diabetes Mellitus encountered higher number of complications like CHF, arrhythmia[15,16]. This can partly be explained by "Diabetic cardiomyopathy" is a specific entity which influences the systolic & diastolic function and might have contributed diabetic patients to suffer heart failure more. Likewise autonomic neuropathy which causes disturbances in myocardial blood flow, myocardial function & reduced heart rate variability, might be a cause of arrhythmia and CHF[17]. Other unknown reasons might also be responsible for these complications. Recurrent angina occurred only in diabetic patients (n=06) and urgent revascularization was also needed in one of the diabetic patients. Why recurrent angina occurred only in diabetic patients was unknown. But several factors including abnormalities of platelet function and fibrinoproteolytic system, autonomic and endothelial dysfunction, increased fatty acid turnover might have predisposed these patients to recurrent ischemic events[18].

In this study number of in-hospital mortality was 04 and all were diabetic patients. Studies found that in-hospital mortality among diabetic patients in comparison to non-diabetics was higher than non diabetic patients (diabetic mortality- 11.7% and non-diabetic mortality- 6.4%) but their finding was little higher than this study. So, the overall higher mortality in diabetic patients was consistent with the finding of our study, though we didn't have any death among non-diabetic

patients. This difference might be due to small sample size of this study[15]. Studies also showed diabetes mellitus to be a strong independent predictor of adverse outcomes for patients admitted across the entire spectrum of ACS[16].

Comparative findings of investigations, clinical diagnosis, cardiovascular parameters and outcomes including death may help in developing an insight to critical understanding of distribution of cases of ACS based on presence or absence of diabetes in the patients which further has a great importance in the clinical management of such patients.

Limitations

This study was conducted with a small sample size over a short period of time. Only 200 patients were included in this study over a year. Even with sincere and supportive efforts we had difficulty in effective communication with the patients in some cases, since the level of education of the patients was not adequate to understand the technical terms well. Rich patients used to come less frequently into the govt. hospitals. Hence the exact scenario among the geriatric population was least established.

Contribution of authors

Conclusion

Our study revealed higher number of complications, mortality and worse clinical features in diabetic ACS patients determining the additional adversities and complicated management with a lower prognosis rate. Since, we have an increasing number of diabetics in community along with the higher incidences of different cardiovascular diseases due to overwhelming risk factors and favorable lifestyles for all kind of non communicable diseases we need to take the findings of this study with a great concern. Further studies, especially multi-centre studies with larger sample size may help in revealing the grievousness of the effect of diabetes in coronary syndrome patients and contribute in developing effective patient care management plans.

Disclosure

All the authors declare no competing interest.

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