Journal of Saidu Medical College 2012; 2 (2)

HOSPITAL OUTCOMES OF ACUTE MYOCARDIAL INFARCTION IN PATIENTS WITH AND WITHOUT DIABETES MELLITUS

Ibrahim Shah, Sherbahadar, Mohammad Hafizullah, Syed Tahir Shah, Abdul Hadi
Department of Cardiology, Postgraduate Medical Institute, Lady Reading Hospital Peshawar

ABSTRACT

Objective: To compare hospital outcomes of acute myocardial infarction (AMI) in patients with and without diabetes mellitus.

Methodology: This observational cohort study was carried out in the department of Cardiology, Postgraduate Medical Institute Govt. Lady Reading Hospital Peshawar. A total of 444 patients with AMI were studied from December 2009 to December 2011. Among these half of patients were diabetic while rests were non-diabetic. After enrolment in the study, patients were monitored for in- hospital complications of AMI.

Results: Most of the baseline characteristics were similar between the two groups of patients. However patients in diabetic group had more hypertension, dyslipidemia, high glucose level, less smoking, high heart rate and raised blood pressure on presentation as compared to patients in non-diabetic group. Complication rates were significantly higher in the diabetic group as compared to non-diabetic group. Complication rates between diabetic and non-diabetic groups were atrial fibrillation (AF) 14.4% V 8.1%; P=0.036 respectively while ventricular tachycardia (VT) 10.8% V 13.1% ;P=0.464, ventricular fibrillation (VF) 3.2% V 4.1 %; P=0.611, advanced AV blocks 12.2%V 6.3% ;P=0.033, acute heart failure (AHF) 24.8% V 17.1% ;P=0.047, cardiogenic shock(CS) 18% V 7.2%;P=0.001, recurrent MI (Re-MI) 14.4% V 7.7%; P=0.000, acute renal failure 9%V5%; P=0.001 and death rate 13.5 % V 8.1 %; P=0.000 respectively.

Conclusion: Diabetes mellitus is associated with an increase risk of in-hospital complications after AMI.

Key words: Diabetes mellitus, hospital Outcomes, Acute Myocardial Infarction

INTRODUCTION

Myocardial infarction (MI) is the leading cause of death worldwide. Its annual incidence in the United States is estimated to be 600 000 new and 320 000 recurrent attacks. In 2004, Acute Myocardial infarction (AMI) resulted in 695 000 hospital stays and $31 billion in hospital charges[1]. Similarly the South Asian countries of India, Pakistan, Bangladesh, Sri Lanka and Nepal contribute the highest proportion of the burden of cardiovascular diseases including MI compared with any other region globally[2, 3, 4]. In Pakistan it is estimated that one in five middle-aged adults may have underlying coronary artery disease (CAD)[5].

Myocardial infarction is complicated by a number of electrical and mechanical complications. These complications are especially common in diabetic patients[6]. It is an independent risk factor for the development of complications after AMI and are among the most common diseases in the modern and developing world It is estimated that the total number of people with diabetes will rise from 171 million in 2000 to 366 million by 2030. With the increase in obesity, insulin resistance and the metabolic syndrome, the worldwide prevalence of diabetes is expected to double by the year 2030. Similarly Pakistan is also facing heavy burden of diabetes with estimated prevalence of 12%.It has affected approximately 6.9 million people in this country and predicted to affect 11.5 million people by 2025. World Health Organization (WHO) has ranked Pakistan 6th on diabetes prevalence list[7].

Some international studies conducted in Europe and United States have demonstrated that diabetes is an independent risk factor for in-hospital complications after AMI[6,8,9]. These patients have a significantly higher risk of heart failure and cardiogenic shock after MI and therefore worse outcome[8]. However there are very few studies which look at the outcome of AMI in our local

population. So the aim of this paper is to assess the effect of diabetes mellitus on in-hospital complications in patients with AMI.

MATERIAL AND METHODS

This observational cohort study was conducted in the department of Cardiology, Postgraduate Medical Institute Govt. Lady Reading Hospital Peshawar from December 2009 to December 2010 for a total period of one year. The sample size was 444 using 10.5% proportion of cardiogenic shock in diabetic and 6.6% proportion in non- diabetic with 80% power and 5% significance level using WHO sample size estimating software [10]. It was equally divided between two groups i.e. 222 in each group. Purposive non probability sampling technique was used. Study population was consisting of patients having AMI with and without diabetes mellitus. It included both genders of patients with age ranged from thirty to seventy-five years. Patients having preexisting congestive heart failure, valvular heart diseases, congenital heart diseases, cardiomyopathies of any cause and pulmonary artery hypertension either primary or secondary, ventricular tachycardia, atrial fibrillation, advance AV blocks, old left bundle branch block, permanent pacemakers (PPM) and implantable cardiac defibrillators (ICD) were excluded as these conditions make the diagnosis of in hospital complications of MI complex. Patients with chronic renal failure (CRF), previous MI and coronary artery bypass graft surgery (CABG) were also excluded as in these patients the complications rate of MI are very high and causing bias in the study results.

After taking approval from the hospital ethical committee, patients fulfilling the above mentioned inclusion criteria were recruited from Coronary Care Unit. After taking an informed written consent, patient's history and clinical examination was undertaken. CK-MB level, daily fasting blood sugar (FBS) and hemoglobin (Hb) was obtained from hospital laboratory. Mean blood glucose level was derived from five fasting blood sugar levals. Treatment variables (throbolysis or primary PCI) were recorded.

Patients were hospitalized for five days until further needed. They were monitored for complications. Cardiac monitors (NIHON KOHDEN BSM-2301 K) and ECG (BTL 085-ECG) were used for the monitoring of electrical complications and recurrent MI. Mechanical complications were detected with the help of clinical examination and echocardiography using acuson CV 70 SIEMENS. If patients develop new chest pain, ECG and CK-MB were done to diagnose recurrent myocardial infarction. All this data was recorded on a proforma.

Confounding variables mentioned in the exclusion criteria were controlled. Bias in the study was controlled by following strict inclusion criteria for patient's selection, measurable operational definitions for the diagnosis of complications and using the same ECG and echocardiography equipments for all patients.

OPERATIONAL DEFINITIONS[6]

Myocardial infarction (MI) was diagnosed in the presence of two of the following criteria: pain suggestive of myocardial ischemia lasting for at least 30 min; unequivocal new electrocardiographic alterations; or increase of creatinine kinase (CK-MB isoenzyme) to more than two times the upper limit. Patients with both ST elevation (STEMI) and non-ST elevation MI (NSTEMI) were included. ST segment elevation myocardial infarction (STEMI) was diagnosed when ST elevation of =2 mm in =2 contiguous precordial leads, or 1 mm in =2 contiguous limb leads or when new left bundle branch block was found on the qualifying ECG.

Diabetes mellitus (DM) was defined as chronic use of antihyperglycaemic drugs or previously documented diagnosis from medical record or established during hospital stay by repeated fasting blood glucose estimation to be =126 mg/dl.

Hospital outcomes were measured in terms of electrical or mechanical complications, recurrent myocardial infarction, acute renal failure and in

hospital death.

Electrical Complications included ventricular tachycardia (VT), ventricular fibrillation (VF), atrial fibrillation (AF) and advanced AV block.

Mechanical Complications included acute heart failure and cardiogenic shock (CS).

Ventricular Tachycardia was defined by the occurrence of a series of three or more consecutive premature ventricular complexes on ECG whose duration exceeds 120 ms with the STT vector pointing opposite the major QRS deflection.

Ventricular Fibrillation was defined by the presence of irregular undulations of varying contour and amplitude, without possible distinction of QRS complexes, ST segment or T waves in the presence of unrecordable carotid pulse and blood pressure.

Atrial Fibrillation: Irregular interval between QRS Complexes with absent P wave in two or more leads on surface ECG.

Advance AV Blocks included second and third degree AV blocks.

Second Degree Heart Block

Type 1: Progressive increase in PR interval culminating in a P wave not followed by QRS complex on surface ECG.

Type 2: Fixed PR interval with every second or third p wave not followed by QRS complex on surface ECG.

Third Degree Heart Block: Complete dissociation between P wave and QRS complex on surface ECG.

Acute Heart Failure (AHF) was defined as breathlessness (by asking from patient to be present at rest or 10 meters walking), bilateral chest crepitations, S3 gallop on auscultation and heart rate of >120 bpm and or an increase in jugular venous pressure of more than 3cm from sternal angle when patient is at 45 angle to bed with help of two rulers.

Cardiogenic Shock (CS) was defined as systolic blood pressure of <90 mm Hg for more than one hour that is not responsive to intravenous normal saline administration and associated with signs of hypo perfusion i.e. cyanosis, cold extremities, changes in mental status (disoriented in time, place and person), persistent oliguria (urine output less than 400ml/24 h measured with Foley's catheter or condom catheter attached to urine bag).

Recurrent Myocardial infarction (Re MI) was diagnosed when patient developed new chest pain of more than 30 minutes duration with new ST segment elevation of >1 mm in two contiguous leads and/or elevation of CK-MB more than two times of the baseline value.

Acute Renal Failure was diagnosed when patient had a creatinine level of more than 2mg/dl on more than two occasions and rising along with oliguria (Urine output less 400ml/24 hours.

In-Hospital mortality: In -hospital death due to cardiovascular causes (cardiac or cerebrovascular).

STATISTICAL ANALYSIS

It was performed using statistical package for social sciences (SPSS) version 16. Numerical variables were presented as mean±SD. Categorical variables were presented as frequencies and percentages. Comparison between two groups was performed by using student-t test for numerical variables and Chi-Square test for categorical variables. P Value = 0.05 was considered significant. Results were presented as tables.

RESULTS

BASELINE CHARACTERISTICS

Among 444 patients with acute MI, 222 patients were diabetic and while rests were non-diabetic.

Patient characteristics and parameters on admission to the coronary care units are shown in Table [2]. Most of the baseline characteristics were similar between the two groups of patients. However patients in diabetic group had more hypertension, more dyslipidemia, less smoking, increased glucose level, high heart rate and raised blood pressure on presentation as compared to patients in non-diabetic group.(Table I)

Table[2]: Baseline characteristics of patients with and without diabetes mellitus presenting with AMI.

Baseline Characteristics of Patients	Diabetic Group n=222	Non-Diabetic Group n=222	P-value
Male (%)	122(55.0%)	135(60.8%)	0.12
Female (%)	100 (45.0%)	87 (39.2%)	0.12
Mean Age(Years) SD	57.2 **9.95**	**56.4 10.1**	0.42
Hypertension	147(34.7%)	77(66.2%)	0.001
Dyslipidemia	110(49.5)	86(38.5)	0.001
Positive Hx for CAD	64(28.8)	69(31.1)	0.42
Smoking	39(17.6)	57(25.7)	0.001
Duration of DM(years)	**7.59 4.78807**		
Duration of HT (Years)	**5.05 3.40**	**3.91 3.16**	0.015
STEMI (%)	161(72.5)	153(68.9)	0.42
NSTEMI (%)	61(27.5)	69(31.1)	0.42
Anterior MI on ECG (%)	85(50.6)	83(49.4)	0.12
Heart Rate(Beats/min)	**88.5 22.3**	**82.9 18.4**	0.004
Systolic Blood Pressure(mmHg)	**148.9 28.2**	**135.0 22.1**	0.001
Diastolic Blood Pressure(mmHg)	**83.0 18.3**	**75.7 15.5**	0.001
Mean blood glucose (mg/dl)	**160.2 52.3**	**134.2 31.4**	0.001
Hemoglobin level(g/dl)	**11.8 2.1**	**11.87 2.1**	0.86
Symptoms to Thrombolytic time(hours)	**2.95 2.06**	**2.79 1.63**	0.49
Thrombolytic Therapy (%)	117(52.7)	121(54.5)	0.49
Primary PCI (%)	3(1.4)	5(2.3)	0.36

HOSPITAL OUTCOMES

Complication rates were significantly higher in the diabetic group as compared to non-diabetic group as shown in table [22].

Table [22]: Hospital Outcomes in diabetic and non-diabetic patients.

Complications of MI	Diabetic Group	Non-Diabetic Group	P-value
Atrial Fibrillation (%)	32 (14.4)	18 (8.1)	0.03
Ventricular Tachycardia (%)	24 (10.8)	29 (13.1)	0.46
Ventricular Fibrillation (%)	7 (3.2)	9 (4.1)	0.61
Advanced AV Blocks (%)	27 (12.2)	14 (6.3)	0.03
Acute Heart Failure (%)	55 (24.8)	38 (17.1)	0.05
Cardiogenic Shock (%)	40 (18.0)	16 (7.2)	0.001
Recurrent MI (%)	32 (14.4)	17(7.7)	0.001
Acute renal failure	11(5)	20(9)	0.001
In-hospital death (%)	30 (13.5)	18(8.1)	0.001

DISCUSSION

The results of this observational study suggests that diabetic patients with an AMI have a greater prevalence of cardiovascular risk factors and have a higher rate of adverse hospital outcomes than patients without diabetes. With few exceptions, these patterns were observed in both patients with ST segment elevation M.I.(STEMI and non ST segment elevation MI(NSTEMI).

Diabetic patients with acute myocardial infarction have more risk factors and comorbities as compared to nondiabetic patients[8,9,10,11,12]. Many studies have demonstrated that diabetic patients with an AMI are more older, have high prevalence of dyslipidemia and hypertension and less likely to be smokers than patients without diabetes[8, 9,10,11,12,13,14,15,16]. The findings of our study are consistent with these prior studies. Our patients with diabetes had high prevalence of hypertension, dyslipidemia and less smoking. However, the increased morbidity and mortality of AMI associated with diabetes cannot be explained by a worse risk profile alone[17]. Factors such as diabetic cardiomyopathy, small vessel disease, increased platelet activity, decreased fibrinolysis and autonomic neuropathy leading to ventricular arrhythmia may account for the poor prognostic outlook of diabetic patients[18,19]. In our study diabetic patients presented with high heart rate and raised blood pressure as compared to non-diabetic patients. It is in accordance with published literature. Jonas M et al. recently studied diabetic patients with AMI and found the same

observations[6].

Diabetic patients presenting with acute myocardial infarction have adverse hospital outcome as compared to nondiabetic patients. Nearly twice as many diabetic as nondiabetic patients with an AMI experienced heart failure during their index hospitalization. This increased risk has been previously observed and has not been attributable to conditions typically associated with heart failure such as decreased ejection fraction, hypertension, obesity and prior myocardial infarction. Differences in the risk of heart failure are also not adequately explained by older age, sex, duration of coronary disease and uncontrolled hyperglycemia[9,15,19]. Some investigators have invoked the role of diabetic cardiomyopathy as a potential causative factor in the development of heart failure in patients with diabetes and an AMI. Similar mechanisms likely increase the risk of cardiogenic shock in patients with diabetes and an AMI[19].

In this study diabetic patients experience higher rates of atrial fibrillation (AF) and advanced AV blocks as compared to non-diabetic patients. This is in accordance with published literature. Kjaergaard SC. et al reported higher incidence of AF and advanced AV blocks in diabetic patients as compared to nondiabetic patients[20]. Some investigators have invoked the role of diabetic autonomic neuropathy and recurrent ischemia as a potential causative factor in the development of these electrical complications in patients with diabetes and an AMI[10].

In the present study, hospital case-fatality rates for diabetic patients with an AMI were almost twice as high as those for nondiabetic patients. These findings have been previously reported[21,22,23]. These higher death and complications rates may be explained for a few reasons. Firstly poor control of diabetes, hypertension and other risk factors for coronary artery disease in our patients, secondly late presentation to hospital for treatment due to unawareness about MI and poor logistic support, thirdly infrequent use of primary PCI in AMI patients as primary PCI is superior to pharmacological reperfusion and fourthly the tendency of Asian people for higher mortality due to MI[23,24].

The strengths of this study include its prospective design, the use of standardized criteria for defining AMI and hospital outcomes and the exclusion of patients confounding results.

Several limitations must also be kept in mind in interpreting the results of our study; Firstly the diagnosis of diabetes was based on the review of medical records alone and no information was available about diabetes control in the past. Secondly we have presented data on in-hospital complications only and no follow up details are given. Diabetes mellitus is a chronic condition and long follow up period is needed to look its adverse outcomes.

In conclusion diabetic patients with an AMI present with a greater prevalence of cardiovascular risk factors and have a higher rate of adverse hospital outcomes than patients without diabetes. Aggressive and immediate medical management of diabetic patients with proven cardiac therapies and revascularization strategies may reduce complications rate during both the acute hospitalization and a long-term follow-up.

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Correspondence.
Dr. Ibrahim Shah
Department of Cardiology
Postgraduate Medical Institute
Lady Reading Hospital Peshawar
Email:cardiol2011@yahoo.com
Cell No: 03339113365