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COMPARISION OF IN-HOSPITAL COMPLICATIONS BETWEEN DIABETIC HYPERTENSIVE AND DIABETIC NORMOTENSIVE PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

Ibrahim Shah[1], Mohammad Hafizullah[2], Syed Tahir Shah[3], Hikmatullah Jan[4], Samiullah Khan[5]

[1-5] Department of Cardiology, Lady Reading Hospital & Khyber Medical University, Peshawar - Pakistan

Address for Correspondence:
Dr. Ibrahim Shah,
Department of Cardiology,
Lady Reading Hospital, Peshawar - Pakistan

E-mail: cardiol2011@yahoo.com

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Contribution
All the authors contributed significantly to the research that resulted in the submitted manuscript.

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ABSTRACT

Objective: To compare the frequency of in-hospital complications between diabetic hypertensive and diabetic normotensive patients presenting with acute myocardial infarction (MI).

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

Results: Most of the baseline characteristics were similar between the two groups of patients. However patients in diabetic hypertensive group had a long history of diabetes, high heart rate and blood pressure on presentation. Complication rates were not different statistically between the two groups. Complication rates between diabetic hypertensive and diabetic normotensive groups were; atrial fibrillation (AF) 15.3% vs. 12.12% p=0.204 respectively while ventricular tachycardia (VT) 14% vs. 12.6% p=0.390, ventricular fibrillation (VF) 4.5% vs. 3.8 % p=0.405, type 1 second degree heart block 8.6% vs. 6.8 % p=0.296, type 2 second degree heart block 2.3% vs. 1.4% p=0.362, complete heart block(CHB) 11.7% vs. 9.9% p=0.323, acute congestive heart failure (CHF) 13.1% vs. 9.5% p=0.269, left ventricular failure (LVF) 19.9% Vs 16.7% p=0.147, cardiogenic shock(CS) 14% vs. 10.4% p=0.080, recurrent MI (Re-MI) 14% vs. 10.8% p=0.194 and death rate 14 % vs. 12.2 % p=0.336 respectively.

Conclusion: Hypertension in diabetic patients is not associated with an increase risk of in-hospital complications after acute MI.

Key Words: Diabetes, Hypertension, In-hospital complications, Acute Myocardial Infarction

INTRODUCTION

Myocardial infarction (MI) is the leading cause of death worldwide. It affected one hundred thousand individuals all over world in the year 2000.[1, 2, 3] Its course is complicated by number of electrical and mechanical complications. These complications are influenced by coexisting diabetes mellitus and hypertension which are the most prevalent diseases in the modern world.[4] It is estimated that the total number of people with diabetes will rise from 171 million in 2000 to 366 million by 2030. In Pakistan it has affected 6.9 million people and predicted to affect 11.5 million by 2025.[5] Similarly hypertension is also a major public health problem worldwide with global prevalence of about 15-37%. Its prevalence in Pakistan is estimated to be 23% and 18% in urban and rural areas respectively.[6,7,8] It affects approximately 70% of patients with diabetes and is approximately twice as common in persons with diabetes as in those without.[9] These two disorders lead to structural and functional cardiac impairment which ultimately translate into cardiovascular morbidity and mortality.[10]

Previous studies have clearly demonstrated that diabetes is an independent risk factor for in-hospital complications after acute MI.[11] Similarly hypertension (HT) is also associated with worse outcome after acute MI.[12-13] However, its effect has been mainly studied in non diabetic patients after acute MI. There are very few studies with regard to the effect of hypertension (HT) on the in-hospital complications after acute MI in diabetic patients. So the aim of this study is to assess the effect of hypertension (HT) on in-hospital complications after acute MI in diabetic patients.

METHODOLOGY

This observational cohort study was conducted in the department of Cardiology, Lady Reading Hospital, Peshawar from December 2009 to September 2010 for a total period of eight months. The sample size was 444 using 10.6% proportion of cardiogenic shock in diabetic hypertensive and 6.8% proportion in diabetic normotensive with 80% power and 5% significance level using WHO sample size estimating software.[4] 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 diabetes mellitus with and without hypertension and acute MI. Myocardial infarction (MI) was diagnosed in the presence of two of the following criteria: pain suggestive of MI 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 new ST segment elevation $\geqslant$ 1 mm was seen on two consecutive 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 previous documentation of fasting blood glucose levels $\geqslant$126 mg/dl (7.0 mmol/l).

Hypertension was defined as chronic use of antihypertensive drugs or a previously documented blood pressure $\geqslant$130/80 mmHg from medical record.

This study 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 and cardiology ward. 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 in-hospital complications such as electrical (AF,VT,VF and advanced AV blocks) , mechanical (LVF CHF and CS) complications, recurrent myocardial infarction and in–hospital death.

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.

Statistical analysis was performed using statistical package for social sciences (SPSS) version 16. Numerical variables were presented as mean$\pm$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 $\leqslant$ 0.05 was considered significant. Results were presented as tables.

RESULTS

Among 444 diabetic patients with acute MI, 222 patients were hypertensive and 222 were normotensive. Patient characteristics and parameters on admission to the coronary care units are shown in Table 1. Most of the baseline characteristics were statistically similar between the two groups. However diabetic hypertensive patients had a long history of diabetes, having high heart rate and blood pressure on presentation as compared to diabetic normotensive patients.

Complication rates between the two groups were insignificant statistically as shown in Table 2. Complication rates between diabetic hypertensive and diabetic normotensive groups were; atrial fibrillation (AF) 15.3% vs. 12.12% p=0.204 respectively while ventricular tachycardia (VT) 14% vs. 12.6% p=0.390, ventricular fibrillation (VF) 4.5% vs. 3.8 % p=0.405, type 1 second degree heart block 8.6% vs. 6.8 % p=0.296, type 2 second degree heart block 2.3% vs. 1.4% p=0.362, complete heart block(CHB) 11.7% vs. 9.9% p=0.323, acute congestive heart failure (CHF) 13.1% Vs 9.5% p=0.269, left ventricular failure (LVF) 19.9% vs. 16.7% p=0.147, cardiogenic shock(CS) 14% vs. 10.4% p=0.080, recurrent MI (Re-MI) 14% vs.10.8% p=0.194 and death rate 14 % vs. 12.2 % p=0.336 respectively.

There were no gender differences in the complication rates between the two groups.

Table 1: Baseline Characteristics of Patients

Baseline Characteristics of Patients	Diabetic Hypertensive Group n=222	Diabetic Normotensive Group n=222	P-value
Female (%)	99 (44.6)	88(39.6)	0.168
Male (%)	123(55.4)	134(60.45)	0.168
Mean Age	57.21±10.13	56.40±10.14	0.400
Duration of DM(years)	8.36 ±4.92	5.01 ±3.02	0.000
Duration of HT (Years)	4.57 ±3.34		
STEMI (%)	149(67.1)	146(65.8)	0.420
NSTEMI (%)	73(32.9)	76(34.2)	0.420
Anterior MI on ECG(%)	64(28.8)	58(25.2)	0.640
Heart Rate(Beats/min)	87.05±19.53	81.64±18.29	0.003
Systolic Blood Pressure (mmHg)	149.05±27.33	130.82±18.69	0.000
Diastolic Blood Pressure (mmHg)	84.05±19.44	72.48±18.56	0.000
Mean blood glucose(mg/dl)	139.42±38.65	140.27±37.01	0.807
Hemoglobin level(g/dl)	11.85±2.27	11.84±1.97	0.947
Symptoms to Thrombolytic time(hours)	3.14±2.12	2.72±1.29	0.069
Thrombolytic Therapy(%)	127(57.2)	110(49.5)	0.097
Primary PCI (%)	4(1.8)	4(1.8)	0.638

HT = Hypertension, DM= Diabetes Mellitus, STEMI = ST-elevation Myocardial Infarction, NSTEMI = Non–ST-elevation Myocardial Infarction

Table 2: In-hospital Complications in Diabetic Hypertensive and Diabetic Normotensive Patients

Complications of MI	Diabetic Hypertensive Group	Diabetic Normotensive Group	P-value
Atrial Fibrillation (%)	34 (15.3)	27 (12.2)	0.204
Ventricular Tachycar dia (%)	31 (14.0)	28 (12.6)	0.390
Ventricular Fibrillation (%)	10 (4.5)	8 (3.6)	0.405
Type 1 Second degree AV block (%)	19 (8.6)	15 (6.8)	0.296
Type 2 Second degree AV block (%)	5 (2.3)	3 (1.4)	0.362
Complete heart block (%)	26 (11.7)	22 (9.9)	0.323
Acute Left Ventricular Failure (%)	43 (19.9)	37 (16.7)	0.269
Congestive Heart Failure (%)	29 (13.1)	21 (9.5)	0.147
Cardiogenic Shock (%)	31 (14.0)	23 (10.4)	0.080
Recurrent MI (%)	31 (14.0)	24 (10.8)	0.194
In-hospital death (%)	31 (14.0)	27 (12.2)	0.336

DISCUSSION

This study failed to prove an added risk of hypertension on in- hospital complications after acute MI in diabetic patients. It did not show any interaction in term of in-hospital complications after acute MI between hypertension and diabetes mellitus. It is in accordance with the published international data. Jonas et al recently studied 4317 diabetic patients with acute MI with or without coexistent hypertension. They found no added risk of hypertension in term of in- hospital complications after acute MI. However one year outcome in term of mortality and congestive heart failure was higher in diabetic hypertensive patients as compared to diabetic normotensive patients.[4]That was a retrospective study and patient's data were retrieved from registries of coronary care units operating in Israel. Contrary to that, our study was a prospective study and patients were prospectively observed for in-hospital complications. Secondly it showed higher in-hospital complications rate in both groups as compared to patients in that study. For example the frequency of cardiogenic shock was 10.6% and 6.8% in diabetic hypertensive and diabetic normotensive patients respectively in that study. In our study it is 14% and 10.4% in diabetic hypertensive and diabetic normotensive patients respectively. The higher complication rate in this study as compared to that may be explained for a few reasons. Firstly poor control of diabetes and hypertension 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 MI patients as primary PCI is superior to pharmacological reperfusion and fourthly the tendency of Asian people for higher mortality due to MI.[14,15]

Most of other studies compared in-hospital outcomes between diabetic hypertensive and nondiabetic hypertensive patients and concluded that In-hospital adverse clinical events particularly heart failure were more frequent in diabetic hypertensive as compared to non-diabetics hypertensive patients.(40.3% versus 18.1%, P = 0.01).[16]

Most of the research work in the past was done on the long term effects of hypertension after acute MI. It revealed that antecedent hypertension increases the risk of heart failure (HF) and other adverse cardiac events after acute MI in the long term even when successfully reperfused by primary PCI or thrombolytic therapy. However these studies did not look for in- hospital complications[17,18].

In previous studies, the prevalence of hypertension was low (12.6%) in diabetic patients presenting with acute MI as hypertension was defined by JNC-6.[18] Since the definition of hypertension in diabetic patients (125/75) has been changed according to JNC-7, the prevalence of hypertension has increased in diabetic patients considerably.[19]

Considerable experimental and clinical evidence indicates that elevated blood pressure is critically important in the pathogenesis of diabetic heart disease. Coronary artery disease is much more common in patients with both diabetes mellitus and hypertension than in patients with diabetes mellitus or hypertension alone, and the

development of atherosclerosis was found to be accelerated, with more plaque fissuring and a lower coronary perfusion reserve index, when diabetes mellitus and hypertension coexist. Patients with combined diabetes mellitus and hypertension also tend to have impaired systolic and diastolic ventricular function with more left ventricular hypertrophy and congestive heart failure than counterparts with diabetes mellitus or hypertension alone.[20-23]

Contrary to the expectations, risk of in hospital complications after acute MI in diabetic patients with or without a history of hypertension was similar. Elevated blood pressure accelerates diabetic heart disease. It is possible that long term follow-up is required to see the effect of hypertension on complications after MI. Alternatively, a history of hypertension may not increase mortality if blood pressure is well controlled. In the present study, hypertensive patients have relatively controlled blood pressure. The average blood pressure on admission was 149/84 mmHg in the diabetic hypertensive patients and 130/72 mmHg in the diabetic normotensive patients suggesting a good control of blood pressure. It is also possible that in some hypertensive patient's blood pressure dropped after MI and therefore hypertension was even better controlled. If this is the case, strict blood pressure control can eliminate the added risk of hypertension to diabetes mellitus and thereby improve prognosis of diabetic patients with ischemic heart disease.[16,24,18] Tenenbaum et al recently showed that hypertension is an independent predictor of increased mortality in diet-treated but not in pharmacologically treated diabetic patients with chronic ischemic heart disease, suggesting the possible benefit of early blood pressure control in this population.[25]

The protection conferred on the diabetic patients treated intensively for hypertension was also evident in the Hypertension Optimal Treatment (HOT) study.[26] In this study, diabetic hypertensive patients benefited the most from intensive blood pressure lowering, with a 51% reduction in major cardiovascular events in the target group of diastolic blood pressure 80 mmHg compared with the 90 mmHg group.

Blood pressure should be controlled up to recommended targets as proposed by the guidelines and not beyond that. This issue is recently addressed in ACCORD Trail presented at the American College of Cardiology's 59th annual scientific session on April 29, 2010 in Atlanta. Researchers randomly assigned 4,733 participants with elevated blood pressure to a target systolic blood pressure of either less than 120 mmHg (the intensive group) or to less than 140 mmHg (the standard group). After an average follow-up of about five years, researchers found no significant differences between the intensive group and the standard group in rates of a combined endpoint including nonfatal heart attack, nonfatal stroke, or cardiovascular death.[27] Different studies noted a gender difference in the impact of diabetes on the outcome after MI, with females having a worse prognosis.[28] In the present analysis of patients with MI, the risk of in-hospital complications was similar among male and female patients in diabetic hypertensive as well as in diabetic normotensive group.

Limitations of study were: Information on blood pressure and diabetes control of these patients in the past was lacking in both group of patients and therefore its impact on prognosis between the two groups cannot be assessed directly. The present study included data on in-hospital complications only and no follow up data were taken. Hypertension is a chronic condition and long follow up period is needed to look its adverse outcomes. Based on the above limitations the effect of coexistent diabetes and hypertension on long term complications of MI cannot be excluded.

CONCLUSION

Hypertension in diabetic patients is not associated with an increase risk of in-hospital complications after acute MI.

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