

Hospital Outcome of Hypertensive Non-ST Elevation Myocardial Infarction Patients in Diabetic and Non-Diabetic Groups

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Abstract:

Objective: Acute myocardial infarction is one of the leading causes of all acute emergencies and is becoming an important public health problem in the developing countries. Non-ST elevation myocardial infarction (NSTEMI) is more heterogeneous in their presentation and may be poorly characterized in clinical practice, leading to greater variation in diagnosis and treatment. Patients with diabetes and hypertension who develop a NSTEMI are at increased risk for poor hospital outcome. This study is aimed to assess the differences between hypertensive diabetic and hypertensive non-diabetic patients with NSTEMI and to evaluate the prognostic impact of selected clinical and laboratory parameters on the occurrence of hospital complications.

Methods: This was a cross-sectional analytical study. All the adult hypertensive patients of newly diagnosed NSTEMI with or without diabetes mellitus admitted in Ibrahim Cardiac Hospital & Research Institute, Dhaka who fulfilled the inclusion and exclusion criteria were enrolled. The study population comprised of 100 hypertensive patients with their first NSTEMI, and were divided into two groups according to the presence of type 2 diabetes mellitus. Group I (n = 40) patients were diabetic and Group II (n = 60) were non-diabetic. Hospital outcome of the study population was recorded. The incidence of in hospital adverse clinical events in the two groups was compared by using the odds ratio of the two binomial proportion analyses.

Results: Among 100 hypertensive NSTEMI patients, 40% were diabetic (Group I) and 60% were non-diabetic (Group II). Mean age was 58.1±10.2 years in case of diabetic group (Group I) and 56.3±10.5 years in non-diabetic group (Group II) ranging from 30-70 years. Male patients (66%) were predominant in the study. Most common clinical presentation was chest pain which was 77.5% in Group I and 83.3 % in Group II followed by sweating (12.5% and 16.7%), dyspnea (10.0% and 11.7%), syncope (5.0% and 6.7%) and atypical chest pain (2.5% and 3.3%) respectively. Smoking was the commonest risk factor which was 62.5% in Group I and 75% in Group II followed by dyslipidemia (32.5% and 36.7%), family history of IHD (30% and 23.3%) and obesity (22.5% and 13.3%) respectively. Diabetic hypertensive patients had significantly higher heart rate, hypertensive peaks and more episodes of asymptomatic ST segment depression. Most common in hospital complications were heart failure (30% and 16.7%), arrhythmias (22.5% and 6.7%), renal failure (10% and 5.0%), cerebral ischemia (7.5% and 1.7%), death (7.5% and 3.3%) and cardiogenic shock (5.0% and 3.3%) in Group I and Group II respectively.

Conclusion: In hospital adverse clinical events were more frequent in diabetic hypertensive individuals compared to non-diabetics.

Keywords: Hypertension, Diabetes, NSTEMI, Outcomes

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Introduction:

Coronary artery disease (CAD) is one of the common causes of death and disability in developed countries, responsible for about one in every five deaths¹. It is rapidly becoming a pandemic within the developing world as well where it involves a relatively younger population². Being one of the leading causes of all acute emergencies, acute myocardial infarction has become an important public health problem in the developing countries³. Non-ST-segment elevation myocardial infarction (NSTEMI) is more heterogeneous in their presentation and may be poorly characterized in clinical practice, leading to greater variation in diagnosis and treatment⁴. Diabetes mellitus (DM) and hypertension frequently coexist in the same patient. This association has a negative impact on prognosis by strongly predisposing the individual patient to the development of an accelerated atherosclerotic cardiovascular disease. Consequently, diabetic hypertensive subjects have a higher incidence of coronary artery disease than patients with diabetes or hypertension alone⁵. Patients with diabetes who develop a NSTEMI are at increased risk for each hospital outcome including heart failure, renal failure, cardiogenic shock and death⁶.

It is observed that the incidence rates (per 100,000) of STEMI declined appreciably (121 to 77), whereas the incidence rates of NSTEMI increased slightly (126 to 132)⁷. The annual incidence of NSTEMI varies significantly between countries, with a mean global annual incidence of about 3 per 1000 population⁸. Diabetes mellitus is becoming a pandemic worldwide. The worldwide number of people with DM is expected to double in thirty years, increasing from 171 million in 2000 to 366 million in 2030. The highest percentages of increases in disease prevalence are likely to be in developing nations. The prevalence of DM in the rural population of Bangladesh is 7.2%⁹. The incidence of DM in patients hospitalized with MI ranges between 10-20% and approximately 40% have impaired glucose levels¹⁰. Diabetic patients have a higher prevalence of coronary artery disease with an increased number of fatal coronary events due to a higher incidence of plaque rupture and superimposed thrombosis in diffusely diseased coronary arteries¹¹. The increased risk of atherosclerosis in patients with DM is caused by endothelial dysfunction and abnormal platelet reactivity as well as coagulation fibrinolysis balance disorders¹². Diabetic patients develop complications more frequently after MI and have doubled the in-hospital and long-term mortality compared to non-diabetic patients. Cardiogenic shock, heart failure, renal failure, arrhythmia, re-infarction, cerebral infarction are serious complications in diabetics¹¹.

In Bangladesh, few studies have been undertaken in the past regarding the association DM with adverse cardiovascular events but no study has done describing the presenting characteristics, management and outcomes of hypertensive diabetic and hypertensive nondiabetic patients with NSTEMI. The aim of this study was to describe hospital outcome of hypertensive diabetic and hypertensive nondiabetic groups with all clinical presentations of NSTEMI.

Methods:

This cross-sectional analytical study was conducted at the Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka between August, 2017 to January, 2018. A total of 100 newly diagnosed NSTEMI patients within 24 hours of symptom onset and having hypertension with or without Diabetes Mellitus aged ≥ 30 years and < 70 years admitted in the Department of Cardiology, ICHRI within the study period fulfilling the inclusion and exclusion criteria were included in this study by convenient purposive sampling. Study subjects having presence of ST segment elevation on the presenting 12-lead electrocardiogram, clinical or laboratory evidence of any previous coronary event of any kind, or suffering from secondary hypertension, renal insufficiency, clinically significant liver disease, chronic obstructive lung disease, chronic alcoholism and severe anaemia, hypertensive emergency or crisis and unwilling to take part in the study were excluded from the study. The study patients (n=100) were divided into 2 groups:

Group I (Diabetic group): NSTEMI patients having Hypertension and with diabetes (n=40) and Group II (Non-diabetic group): NSTEMI patients having Hypertension and had no history of diabetes (n=60). Detailed clinical history and examination were carried out and recorded in preformed case record form. Blood was collected for glucose level and serum biochemical marker for myocardial necrosis. Other necessary laboratory investigations and imaging study were done and recorded. Finally, in hospital outcome were observed and compared between two groups. Comparison was done by using odds ratio.

Results:

A total of one hundred patients with NSTEMI and having hypertension admitted in the Department of Cardiology, ICHRI fulfilling the inclusion and exclusion criteria were included in this study during the period from August 2017 to January 2018. The patients were classified into two groups on the basis of presence or absence of DM. The patients with NSTEMI having hypertension and diabetes

were assigned as Group I and those with NSTEMI having hypertension and no diabetes were assigned as Group II.

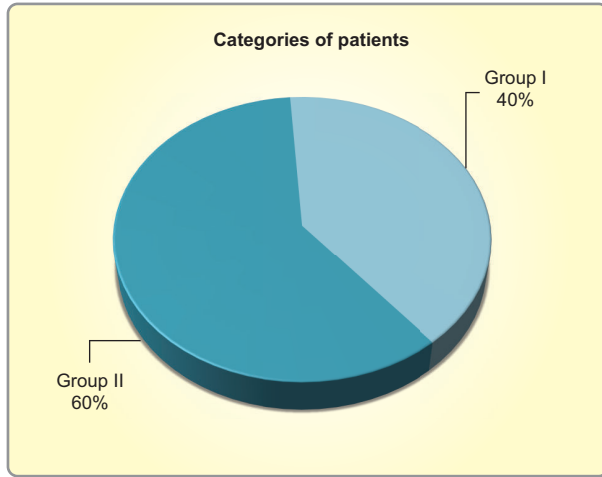


Fig.-1: Pie chart shows distribution of patients according to presence of diabetes (n=100)

Group I: Hypertensive Diabetic NSTEMI patients, Group II: Hypertensive Non-Diabetic NSTEMI patients.

In our study, it was observed that majority (42.5%) patients belonged to age group 61-70 years in diabetic NSTEMI group (Group I) and (36.6%) in non-diabetic NSTEMI (Group II). The mean age was 58.1±10.2 years in Group I and 56.2±10.5 years in Group II. There was no significant difference in age distribution between the two groups.

Table-I
Distribution of the study population by age (n=100)

Age (in years)	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
30 – 40	2	5	4	6.7	
41 – 50	8	20	15	25	
51 – 60	13	32.5	19	31.7	
61 – 70	17	42.5	22	36.6	
Mean± SD	58.1±10.2		56.2±10.5		0.904 ^{ns}

ns = not significant, P value reached from Student's *t* test
Group I - Hypertensive Diabetic NSTEMI patients
Group II - Hypertensive Non-diabetic NSTEMI patients.

Majority (60%) patients were male in Group I and 70% in Group II. There was no significant difference in gender distribution between the two groups.

Table-II
Sex distribution of patients (n=100)

Sex	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
Male	24	60	42	70	0.9 ^{ns}
Female	16	40	18	30	

ns=not significant, P value reached from chi square test
Group I - Hypertensive Diabetic NSTEMI patients
Group II - Hypertensive Non-diabetic NSTEMI patients.

Among study subjects, most common clinical presentation was chest pain in both Group I (77.5%) and Group II (83.3%), Other common symptoms were sweating (12.5% and 16.7% in Group I and Group II respectively), dyspnea (10.0% and 11.7% in Group I and Group II respectively), syncope (5.0% and 6.7% in Group I and Group II respectively) and atypical chest pain was least common in both groups (2.5% and 3.3% in Group I and Group II respectively). There was no statistically significant difference in symptoms between the two groups.

Table III
Clinical presentation of patients

Clinical Presentation	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
Chest pain	31	77.5	50	83.3	
Sweating	5	12.5	10	16.7	
Dyspnea	4	10.0	7	11.7	0.57 ^{ns}
Syncope	2	5.0	4	6.7	
Atypical chest pain	1	2.5	2	3.3	

ns=not significant, P value reached from chi square test
Group I - Hypertensive Diabetic NSTEMI patients
Group II - Hypertensive Non-diabetic NSTEMI patients.

Smoking was the commonest risk factor which was 62.5% in hypertensive diabetic NSTEMI patients and 75% in hypertensive non-diabetic NSTEMI patients. Other risk factors were dyslipidemia (37.5% and 30%), family history of IHD (30% and 23.3%) and obesity (22.5% and 13.3%) in group I and group II respectively. No statistically significant difference was noted between groups in relation to risk factors of MI (p>0.05).

Table-IV
Distribution of the study patients by risk factors (n=100)

Risk factors	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
	Smoking	25	62.5	45	
Dyslipidemia	15	37.5	22	30	0.43 ^{ns}
Family history of IHD	12	30.0	14	23.3	0.45 ^{ns}
Obesity	9	22.5	8	13.3	0.23 ^{ns}

ns = not significant, P value is measured by Chi-square test

Group I – Hypertensive Diabetic NSTEMI patients

Group II – Hypertensive Non-diabetic NSTEMI patients.

NSTEMI diabetic patients (60%) developed more complications than non-diabetic NSTEMI patients (33%) which were statistically significantly (p<0.05).

Table-V
In-hospital outcome of study participants (n = 100)

Hospital outcome	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
	Death	3	7.5	2	
Complications	24	60	20	33	0.001 ^s
Recovery	13	32.5	38	63.3	0.003 ^s

ns= non-significant, s= significant, P value calculated by Chi-square test

Group I - Hypertensive Diabetic NSTEMI patients

Group II – Hypertensive Non-diabetic NSTEMI patients.

Most common complication was heart failure (30% in Group I and 16.7% in Group II). Other complications were renal failure (10% and 5.0%), cerebral ischemia (7.5% and 1.7%), death (7.5% and 3.3%) and cardiogenic shock (5.0% and 3.3%) respectively in diabetic and non-diabetic hypertensive patients with NSTEMI. Proportion of arrhythmia and cerebral ischemia was statistically significantly higher among diabetic patients than that of non-diabetic patients (p<0.05). Other complications were also higher in diabetic group but difference with non-diabetic patients was not statistically significant.

Table VI
Distribution of patients according to complications (n = 100)

Complications	Group I (n=40)		Group II (n=60)		P value
	n	%	n	%	
	Death	3	7.5	2	
Heart failure	12	30.0	10	16.7	0.065 ^{ns}
Arrhythmia	9	22.5	4	6.7	0.004 ^s
Renal failure	4	10.0	3	5.0	0.078 ^{ns}
Cardiogenic shock	2	5.0	2	3.3	0.145 ^{ns}
Cerebral ischemia	3	7.5	1	1.7	0.012 ^s

s= significant, ns=not significant, P value calculated by Chi-square test

Group I – Hypertensive Diabetic NSTEMI patients

Group II – Hypertensive Non-diabetic NSTEMI patients.

Univariate logistic regression analysis shows that diabetic NSTEMI patients had significantly higher odds of developing arrhythmia (OR 4.06, 95%CI 1.16 – 14.28; p<0.05) than non-diabetic NSTEMI patients. Diabetic patients also had higher odds of developing other complications, but those were not statistically significant (p>0.05).

Table-VII
Univariate logistic regression analysis showing odds ratio of developing different complications in hypertensive diabetic NSTEMI patients (n = 100)

Complications	Odds Ratio (OR)	95% CI (Confidence interval)	P value
Death	2.35	0.37 – 14.75	0.361 ^{ns}
Heart failure	2.14	0.82 – 5.59	0.119 ^{ns}
Arrhythmia	4.06	1.16 – 14.28	0.029 ^s
Renal failure	2.11	0.45 – 9.99	0.346 ^{ns}
Cardiogenic shock	1.53	0.21 – 11.30	0.679 ^{ns}
Cerebral ischemia	4.78	0.48 – 47.73	0.182 ^{ns}

s= significant, ns=not significant, p value determined by logistic regression analysis

Group I – Hypertensive Diabetic NSTEMI patients

Group II – Hypertensive Non-diabetic NSTEMI patients.

Discussions:

Cardiovascular disease is the leading cause of morbidity and mortality in people with diabetes mellitus. Patient with DM have a 2 to 4 fold increase in risk of developing cardiovascular disease than those without DM¹³. Morbidity, mortality and re-infarction rate are higher following NSTEMI in diabetic than non-diabetic subjects,

with one-year mortality in this population as high as 50%¹⁴.

This study was carried out with an aim to compare the in-hospital outcome of hypertensive diabetic and hypertensive non-diabetic patients with NSTEMI. Total 100 patients were included in the study. Forty diabetic hypertensive NSTEMI patients were included in Group I and 60 non-diabetic hypertensive NSTEMI patients were included in Group II.

The mean age was found to be 58.1±10.2 years in Group I and 56.2±10.5 years in Group II. No statistically significant ($p>0.05$) difference was observed between two groups. This is consistent with the study conducted by Colivicchi et al. (2008) where that mean age of diabetic patients was 54±2 years and of non-diabetic patients was 56±5 years⁵. The present observation is also similar to a study done in Bangladesh by Salim et al. (2015) which revealed that mean age was 58.7 ± 10.7 years in diabetic patients and 57.3 ± 13.2 years in non-diabetic patients with no statistically significant difference¹⁵.

In the present study, majority of patients were in 7th decade of life in Group I and in Group II (42.5% and 36.6% respectively). In concordance with this study, Franklin et al. (2004) observed that higher incidence of MI was in 65-74 age group in both diabetic and non-diabetic patients⁶.

NSTEMI was predominant in male patients in both diabetic and non-diabetic groups (respectively, 60% and 70%). Franklin et al. (2004) showed almost similar results, where male was 60.9% in diabetic group and 69.2% in non-diabetic group. There was no statistically significant difference between the two groups in term of sex distribution⁶. Kyto et al. (2015) have shown that men have a 2.4-fold overall risk for NSTEMI compared with women, which explains the higher prevalence of male in these studies¹⁶.

The most common clinical presentation was chest pain in both diabetic and non-diabetic groups, which were 77.5% in Group I and 83.3 % in Group II. Dyspnoea was found in 10% and 11.7% cases respectively. Similarly, Cader et al. (2017) noted that 74.2% patients with NSTEMI were admitted with chest pain in their study and 42.3% patients had dyspnoea¹⁷. Other common symptoms at presentation were sweating, syncope and atypical chest pain in both groups. There was statistically insignificant difference in clinical presentation between two groups. Similar observations were also described by Dabek et al. (2016) that where NSTEMI patients usually presented with chest pain (78.8%), dyspnoea (10.6%), syncope

(3.5%) and atypical chest pain (2.2%)¹².

In the present study, smoking was the commonest risk factor which was 62.5% in diabetic hypertensive and 75% in non-diabetic hypertensive patients with NSTEMI. Other risk factors were dyslipidaemia (32.5% and 36.7%), family history of IHD (30% and 23.3%) and obesity (22.5% and 13.3%) in Group I and Group II respectively. The difference between the groups was not statistically significant regarding risk factors. Similar proportion were found in a previous study by Salim et al. (2015) which enlisted that tobacco user was 65.4% and 76.9%, dyslipidaemia was present in 32.7% and 40.4%, family history of IHD present in 30.8% and 23.1% and obesity was found in 19.2% and 5.8% in diabetic and non-diabetic patients respectively¹⁵. Most common risk factor of NSTEMI reported by Dabek et al. (2016) was smoking (44%)¹². Franklin et al. (2004) also stated that smoking was the most common risk factor of NSTEMI in both diabetic and non-diabetic patients, which was found 49.5% and 60.6% patients respectively in their study⁶.

In this study, diabetic patients developed significantly more complications than non-diabetic patients ($p<0.05$). Most common complication was heart failure in both group of patients (30% and 16.7% respectively for Group I and Group II patients). Other complications were renal failure (10% and 5.0%), arrhythmia (22.5% and 6.7%), cerebral ischemia (7.5% and 1.7%), and cardiogenic shock (5.0% and 3.3%) in Group I and Group II respectively. Among them, arrhythmia and cerebral ischemia occurred at a significantly higher proportion in diabetic patients than non-diabetic patients ($p<0.05$). In hospital mortality for Group I and Group II patients were 7.5% and 3.3% patients respectively. Colivicchi et al. (2008) found significantly higher proportion of in-hospital events as well as heart failure in diabetic patients than those of non-diabetic patients⁵. Franklin et al. (2004) revealed that most common hospital outcomes were heart failure (28.9% and 16.5%), renal failure (8.4% and 4.5%), death (6.3% and 5.1%) and cardiogenic shock (4.8% and 4.1%) respectively in diabetic hypertensive and non-diabetic hypertensive patients with NSTEMI⁶. Cader et al. (2017) also reported that about 4.9% of NSTEMI patients had cardiogenic shock, 12.5% had heart failure, 6.6% had acute kidney injury and 8.3% had death¹⁷.

Logistic regression analysis showed that the odds ratio of diabetic patients developing heart failure was 2.14, renal failure was 2.11, arrhythmia was 4.06, cerebral ischemia was 4.78, cardiogenic shock was 1.53 and death was 2.35. Iqbal et al. (2011) reported that the OR of

NSTEMI patients with DM developing heart failure was 2.5, ($p < 0.05$) and cardiogenic shock was 1.9, ($p < 0.05$)³.

In a systematic review by Johansson and colleagues (2017), MI survivors remain at higher risk of dying at first year than the general population, particularly when additional risk factors such as diabetes, hypertension, or older age are present¹⁸. Therefore, it is pertinent to emphasize on control of diabetes and hypertension in the secondary prophylaxis of patients with myocardial infarction.

Conclusion:

NSTEMI in diabetic hypertensive patients is significantly associated with more in-hospital complications and worse outcome in comparison to non-diabetic hypertensive patients particularly cardiac arrhythmia and cerebral ischaemia. There were no statistically significant differences in terms of presentation and risk factors for coronary artery disease among diabetic versus non-diabetic patients with hypertension presenting with NSTEMI.

Limitations of the study:

Although the result of this study supports the hypothesis, there are some facts to be considered which might have affected the result of the current study. It was a single center study. The number of study population was relatively small. Sampling method was non-randomized, so there was risk of selection bias. Long term follow up was not possible.

Recommendations:

In this study it was observed that most diabetic hypertensive patients with NSTEMI come at the late stage, making treatment options difficult and so more complications have already developed. However, if limitations of this study are considered, this is a one hospital based prospective study that may not represent the total scenario of our community or country. So, further study can be done with community based large sample size at national level.

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