Original article

STUDY ON ST-SEGMENT ELEVATION ACUTE MYOCARDIAL INFARCTION (STEMI) IN DIABETIC AND NON-DIABETIC PATIENTS

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ABSTRACT

Objective: To compare some epidemiological and other parameters between diabetic and non-diabetic subjects admitted with STEMI.

Methodology: Two hundred and forty patients were included in the study, 76 (32%) were diabetic, and 164 (68%) were non-diabetic.

Results: Among diabetic patients 11/76 were newly diagnosed. The male to female ratio in diabetic was 1.5:1 (P=0.02), while in non-diabetic it was 5.8:1 (P=0.001). At age 55-64 years, STEMI was observed in higher (P=0.001) percentage of diabetic than non-diabetic patients. 82% of the patients reached the hospital within six hours of chest pain. 52.5% of patients were smokers, 40% had long-standing dyslipidaemia, 32.5% were obese, 32% were diabetic and 29% had hypertension. Significant (P = 0.000003) percentage of non-diabetic patients were smokers, while of diabetic patients (P = 0.03) were obese. Dyslipidaemia was the stronger risk factor among diabetics, while it ranked number three in non-diabetic patients. The lateral infarction was more common (P =0.01) in diabetics. Anterior and inferior infarction was more common than inferior + right ventricular and lateral infarction in both diabetic and non-diabetic patients. Trop-T level was low in 46% and high in 54% of diabetic patients, while it was negative in 10%, detectable in 3%, low in 39% and high in 48% of non-diabetic patients. The mean level of various enzymes did not show statistical difference between diabetic and non-diabetics including CK (2008±785; 1045±356), CK-MB (211±75; 157±23) and Trop-T (1.85±0.28; 1.77±0.21). Irrespective of diabetic status, the mean stay of patients in the hospital was 5.99±1.04 days.

Conclusion: Smoking, dyslipidaemia and obesity are strong risk factor for STEMI. Infarction of anterior site is more frequent. Among diabetics, chances of STEMI are almost equal in male and female, while among non-diabetics it is six male to one female.

KEY WORDS: ST-segment elevation, AMI, Diabetic, Non-diabetic, Risk factors.

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INTRODUCTION

Acute myocardial infarction (AMI) is an important cause of acute emergencies and is on the rise in the developing world.[1] Certain risk factors predispose to AMI which are categorized as modifiable (smoking, hypertension, high blood cholesterol, obesity, physical inactivity and diabetes) and non-modifiable (age, sex and family history of heart disease).

Diabetes is a worldwide problem and is on the rise with advancing age, obesity and decreased physical activity. The adult diabetes is predicted to increase from 2.8% in 2000 to 4.4% in 2030.[2] It is further stated that by the year 2030, most of the cases will be from India, China and United States.[3] The risk of myocardial infarction is 2-4 times higher in diabetics,[4,5] thus causing higher morbidity and mortality among diabetics.[6] The later is four times higher in diabetic men and eight times in diabetic women.[7] In France, 10-20 percent of AMI patients are diabetic.[8,9] The clinical symptoms of AMI differ between diabetic and non-diabetic, as less intense pain or asymptomatic infarction is more common in diabetic patients.[10,11]

The current study was undertaken to assess the status of STEMI in diabetics and non-diabetics coupled with epidemiology and risk factors.

METHODOLOGY

The study was carried out on patients admitted in Cardiac Center, Divisional Headquarter Hospital, Faisalabad. It was a comparative analytical study carried out in 240 consecutive diabetic and non-diabetic patients having ST-segment elevation acute myocardial infarction (STEMI).

Patients of 15-75 years of age of either sex having a history of chest pain of more than 30 minutes but less than 24 hours with ST-segment elevation were included in the study. Patients with known diabetes status and newly identified cases on the basis of World Health Organization criteria[12] at the time of hospital admission were included in diabetic group. Complete history of each patient was recorded at the time of hospital admission. A 12-lead ECG of each patient was done at the time of hospital admission or when patient complained of chest pain and before or 90 minutes after streptokinase injection which was then analyzed for ST-segment elevation.

The patients were divided into four groups on the basis of ST-segment elevation in different leads as under.

V1 – V6 = Anterior AMI
II, III, aVF = Inferior AMI
II, III, aVF+ V4R = Inferior + Right ventricular AMI
I, aVL, V5, V6 = Lateral AMI

Blood samples of 5ml were collected from the patients under study. These samples were analyzed for serum CK and CK-MB and Trop-T by using commercially available kits (Human, Randox, respectively). Blood glucose was determined in serum samples obtained from patients suspected for diabetes using commercial kits (Centronic). HbA1c was determined on whole blood samples by using commercially available kits (Bicon). Oral permission of each patient was sought to include them in the study.

The data obtained was analyzed by using chi-square test to find out the difference between diabetics and non-diabetics in different parameters studied.[13]

RESULTS

Of the 240 patients included in the study, 32% were diabetic, while 68% were non-diabetic. Among the diabetic patients, 85.5% were established cases, while 14.5% were newly diagnosed. The male to female ratio was 1.5:1 (P=0.02) in diabetics, while it was 5.8:1 (P=0.001) in non-diabetics, with an overall male to female ratio of 3.4: 1 (P=0.001) (Table-I).

There was no significant difference of STEMI incidence in various age groups of diabetics and non-diabetics except at age 55-64 years in which it was higher in diabetics (44.7% vs. 24.4%, p=0.001). 79.3% of non-diabetics and 88% of diabetics (p>0.5) reached hospital within six hours of start of chest pain.

Table-II shows the presence of risk factors. Overall 52.5% patients were smokers, 32.5% were obese and 28.7% were hypertensive. There were higher number of smokers in non-diabetics (p=0.000003) and more number of obese in diabetics (p=0.03).

Table-III shows that the lateral infarction was higher (p=0.01) in diabetics while difference

Table-I: Comparison of gender between diabetic (76) and non-diabetic (164) patients admitted with STEMI.

Gender	*Non-diabetic%(n)*	*Diabetic%(n)*	*Combined / Overall%(n)*
Male	85.4*(140)	59.2*(45)	77.1(185)
Female	14.6**(24)	40.8**(31)	22.9(55)
	P = 0.001÷^{2} = 49.00	P = 0.023÷^{2} = 5.16	P = 0.001÷^{2} = 29.16

The values in a row with
* P = 0.001 (÷2 = 12.79)
** P = 0.00001 (÷2 = 20.03)

in site of infarction at other sites was non-significant. The anterior and inferior infarction occurred in higher percentage of both diabetic and non-diabetic patients compared with inferior + right ventricular and lateral infarction.

The Trop-T level in diabetics was low in 46% and high in 54% of patients, while it was negative in 10%, detectable in 3%, low in 39% and high in 48% of non-diabetic patients. The mean of Hb1Ac and fasting blood sugar level was 10.01±3.17 and 202.40±80.54 in non-diabetics and diabetics, respectively. The mean stay of patients in the hospital was 6.06±2.42 days irrespective of diabetic status.

DISCUSSION

Acute myocardial infarction (AMI) is one of the major health problems all over the world and the coronary artery thrombosis is the leading cause of it.[14] During the past decades, several epidemiological studies have provided a portrait of the potential of coronary heart disease.[15] In the developing countries, urbanization is taking place at a rapid pace that is responsible for change in the lifestyle which adversely affects the metabolism thereby causing a large increase in the number of diabetic patients.[16] Diabetes is associated with a marked increase in the risk of coronary heart disease.[17] There are numerous other associated risk factors to AMI, which include smoking, hypertension, overweight, physical inactivity and advancing age, etc. This study was thus conducted on patients admitted with ST-segment elevation acute myocardial infarction. The study focused on the comparison of various risk factors in diabetic and non-diabetic patients with some other associated factors. We found that 68% of patients admitted with STEMI were non-diabetic which is almost similar to a study where 27% patients were diabetic.[18] However, a study from Karachi reported 43.4% of the patients admitted with AMI were diabetic.[19] We also found that 14.5% of patients were unaware of their status of diabetes thus they

Table-II: Various risk factors in overall and in diabetic and non-diabetic patients admitted with STEMI.

Parameters	*Non-diabetic (n = 164)*		*Diabetic (n = 76)*		*Total patients(n = 240)*	
	No.	%	No.	%	No.	%
Hypertension	43	26.2	26	34.2	69	28.7
Smoking	103	62.8 *	23	30.3 *	126	52.5
Obesity (BMI > 30)	46	28.0 **	32	42.1 **	78	32.5
Dyslipidemia	62	37.8	34	44.74	96	40
Prior History of IHD	32	19.5	15	19.7	47	19.6
Family history of IHD	13	7.9	2	2.6	15	6.2

The values in a row with
* vary significantly at P = 0.000003 (÷2= *22.00)*
** vary significantly at P = 0.03 (÷2= 4.71)

Table-III: Comparison of site of infarction between diabetic and non-diabetic patients admitted with STEMI.

Site of Infarction	*No. of Patients(n = 240)*		*Total Patients%(n)*
	Non-diabetic%(n)	*Diabetic%(n)*	
Anterior AMI(V1-V6)	55.5(91)	50.0(38)	53.8(129)
Inferior AMI(II, III, aVF)	31.1(51)	28.9(22)	30.4(73)
Inferior + right ventriclular AMI(II, III, aVF+V4R)	8.5(14)	6.6(5)	7.9(19)
Lateral AMI(I, aVL, V5, V6)	4.9 *(8)	14.5 *(11)	7.9(19)

The values in a row with * P = 0.01 (÷2= *6.27)*

were called as newly diagnosed. In Mexico, newly diagnosed diabetics varied from 7.8 to 15.4% in men, while 5.8% to 12.4% in women.[20]

The result of male to female ratio among diabetics was 1.5: 1 compared with 5.8: 1 in non-diabetics. A higher prevalence of ischemic heart disease in male than female has been reported in a study from England[21] and from Karachi.[19] Thus the present results are in agreement that male population is more prone to STEMI which may be linked to genetic / hormonal differences. Our results showed occurrence of AMI in higher percentage of patients of 45-74 years old, irrespective of sex with a mean age of 53.69±11.69 years. Ayub *et al*. reported a mean age of 55.69±13.45 year,[22] while Liuzzo *et al*. reported it to be 61±11 years.[23] We found 52% of non-diabetic and 30% diabetic patients were of less than 55 years of age. However, 23% non-diabetic and 12% diabetic patients were of less than 44 years of age which suggests that AMI is now occurring in relatively young people in Pakistan. In another study, AMI occurred in 26.5% cases in age less than 55 years; in 23.1% cases in age 55-64 years; in 27.7% cases in age 65-74 years; in 18.9% cases in age 75-84 years and in 3.8% cases in age more than 85 years.[24] Thus the results of present study were in congruence with previous reports.[22,24]

We found that 82% of patients reached the hospital within six hours of chest pain irrespective of the diabetic status. The present study revealed presence of chest pain in 100% of diabetic and non-diabetic patients with minor difference in the intensity of chest pain with no difference in location. However, absence of chest pain in 8% diabetic and 4% non-diabetic has been reported.[25] Another study reported absence of chest pain in 16.9% of diabetics and 15.0% of non-diabetics.[26] However, our results were in agreement with study from Canada, in which chest pain was observed in each case admitted with AMI.[27]

The results of present study with reference to risk factors were similar to those published earlier that diabetic patients were more hypertensive than non-diabetics.[28] These results were almost similar to earlier studies in Pakistan where hypertension was significant factor in diabetics compared with non-diabetics.[29] Similarly, Atmaca *et al*. reported that diabetic patients had more hypertension and CAD history than non-diabetics.[30]

We found non-significant difference in the site of infarction between diabetic and non-diabetic patients except the lateral infarction which occurred in significantly higher numbeer of diabetic than non-diabetic patients. However, the number of patients in lateral infarction group is small. Our results were in agreement with those of Tipoo *et al*. who reported that most of the infarcts were anterior (56.6%) in location.[19] Culic *et al*. reported 47.7% anterior, 46.3% inferior and 6% lateral infarction.[31] The results of the present study and of Culic *et al*. suggest that occurrence of lateral infarction is rare in both diabetic and non-diabetic patients compared with infarction at other

sites.[31] It has been reported that diabetes exerts a potent multifactorial atherosclerotic effect, especially with increase in age.[32] Left anterior descending artery that supplies the anterior cardiac wall seems to be more susceptible to development of atherosclerosis in comparison to right coronary and left circumflex arteries.[33] Left anterior descending artery is exposed to more powerful biomechanic and haemodynamic stress resulting from the contraction of the heart, which may be related to greater endothelial and artery wall damage favouring development of atherosclerotic process. Therefore, it seems likely that more extensive atherosclerotic lesions underlay anterior infarction, which was also observed in higher percentage of patients during present study and seems to be one of the reasons for its adverse outcome. Infarcts in the lateral wall are caused by occlusion of non-dominant circumflex arteries.[34]

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