EFFECT OF DIABETIC STATUS ON MORBIDITY AND MORTALITY FOLLOWING ACUTE MYOCARDIAL INFARCTION

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SUMMARY

The morbidity and mortality from actue myocardial infarction (AMI) is high in diabetics. This may be due to more extensive myocardial damage as diabetics have more severe coronary artery disease (CAD). This short term prospective study evaluated the clinical course of AMI in diabetic patients. Patients admitted with AMI were assessed for glycemic status, clinical events and left ventricular function on echocardiography. Fifty diabetic and sixty non-diabetic patients were enrolled. The baseline characteristics were well matched. More diabetic patients were in Killip class II and III [(56 % VS 21 %) P< 0.05] class IV [(12 % VS 6 %) p= NS] and had higher mortality [(14 % VS 5 %)p = NS]. Diabetic patients also showed more impairment of left ventricular function assessed on echocardiography LVFs 20 ± 8 % VS 25 ± 5 %) P< 0.05]. Diabetics had higher fasting glucose [(164 ± 68 VS 90 ± 13mg/dl) p< 0.001] and higher fructosamine level [(445 ± 152 VS 226 ± 50 micro mol/L) P< 0.001]. Diabetes was considered adequately controlled in 12 patients against 38 patients with fructosamine level [(250 ± 25 VS 494 ± 168 micro mol/L) p<0.001] and fasting glucose [(105 ± 12 VS 175 ± 25 mg/dl) p< 0.01]. Heart failure was more common in uncontrolled diabetics than controlled diabetics [(70 % VS 34 %) P< 0.05] but there was no difference in mortality. Diabetic status in general and uncontrolled diabetes in particular is associated with higher morbidity and left ventricular dysfunction.

INTRODUCTION

The association between coronary artery disease (CAD) and diabetes mellitus has long been acknowledged. Not only there is higher incidence of AMI[1] but the case fatality rate is about two times higher in diabetics than it is in nondiabetics.[2,3] This may be due to more extensive and distal CAD[4] with preexisting cardiac dysfunction due to diabetic cardiomyopathy[5] and autonomic imbalance.[6] Metabolic changes assoicated with AMI are more pronounced and deleterious in diabetics and include release of catecholamine,[7] cortisol[8] and free fatty acids.[9]

Little is known whether adequate control of diabetes in preinfarction period alters the outcome after AMI. Historical information such as polyuria, nocturia, home urine testing, fasting and random blood glucose level are weak predictors of actual mean concentration of blood glucose. Experience with use of glycosylated hemoglobin (GH) and serum fructosamine (FA) throughout 1980s confirmed their usefulness as an objective index of medium to longterm

TABLE - I

CHARACTERISTICS OF DIABETIC AND NON DIABETIC PATIENTS

	NON DIABETIC (n=60)	DIABETIC (n=50)	p. VALUE —
Age	54 ± 8	55 ± 8	NS
Sex			
Male	51 (85%)	41 (82%)	NS
Female	9 (15%)	9 (18%)	NS
Hypertension	14 (23%)	16 (32%)	NS
Obesity	15 (25%)	17 (34%)	NS
Smokers	16 (26%)	13 (26%)	NS
Chest Pain	58 (95%)	46 (92%)	NS
Syncope	1	2	NS
Streptokinase	44 (73%)	36 (72%)	NS
KILLIP CLASS			
I	43 (72%)	16 (32%)	<0.01
II/III	13 (21%)	28 (56%)	<0.05
IV	4 (6 %)	6 (12%)	NS
METABOLIC STATUS			
Fasting glucose (mg%)	90 ± 13	164 ± 68	<0.001
Fructosamine(micro mol/L)	226 ± 60	445 ± 152	<0.001
Fasting cholesterol (mg%)	193 ± 23	199 ± 38	NS
Mortality	3 (5%)	7 (14%)	NS

glycemic status. GH reflects average glycemic status of the past 4-8 weeks[10,11] and fructosamine of 1-2 weeks.[12,13]

The aim of this study is to see the course of AMI in diabetics and whether adequate diabetes control has an impact on morbidity and mortality following AMI.

MATERIAL AND METHODS

DEFINITIONS

DIABETES MELLITUS

Diabetes mellitus was considered present if the patient had been given this diagnosis and was receiving treatment i.e, diet, tablets or insulin. Patients with no previous history of diabetes but a fasting blood glucose level of more than 120mg/dl and raised fructosamine more than 285 micro mol/L were identified as having diabetes and were included in the study. Diabetes was considered adequatly controlled when fructosamine level was less than 285 micro mol/L

MYOCARDIAL INFARCTION

The diagnosis "definite AMI" required fulfilment of at least 2 of the following criteria

1) Chest pain or discomfort of at least 15 minutes duration

2) ECG: ST elevation more than 2mm in at least 2 of 12 leads or development of Q waves.

3) At least 2 values of serum CK, SGOT level 2 times above the normal 10-16 hours after onset of symptoms.

The patients were kept in CCU for at least 48 hours and closely monitored for arrythmias and haemodynamic status. Patients were treated with nitrates, beta blockers and thrombolytic therapy if there was no contraindication. Heart failure was managed with diuretic and, if needed, inotropes. After one month, if there was no contraindication, the patients had exercise stress testing.

INCLUSION CRITERIA

Patients of both sexes having first myocardial infarction and age less than 70 were included. Patient who received streptokinase or not were included. Both insulin dependent and non insulin dependent were enrolled.

TABLE - II

COMPARISON OF NON DIABETIC AND DIABETIC PATIENTS. ECG, ECHOCARDIOGRAPHY AND STRESS TEST

	NON DIABETICS (n =60)	DIABETICS (n=50)	
ECG			
Location of infarct			
Anterior	28 (46%)	30 (60%)	NS
Inferior	26 (44%)	18 (36%)	NS
Non Q	6 (10%)	2 (4%)	NS
Arrythmias			
Sinus tachycardia	9 (15%)	16 (32%)	NS
Bradyarrythmia	5 (8%)	4 (8%)	NS
Tachyarrythmia			
AF	2 (4%)	1 (2%)	NS
VT/VF	4 (6%)	4 (8%)	NS
ECHOCARDIOGRAPHY			
LV FS	25 ± 5%	20 ± 8%	<0.05
LV ED (increased)	10 (16%)	12 (24%)	NS
STRESS TEST			
Average time (min)	9.5±2	7.2±2.5	<0.05
Abnormal results			
Ischemia (ST depresion)	36%	50%	NS
PVCs	23%	28%	NS
VT	0	0	NS
Reason for discontining			
Target Heart rate	26%	22%	NS
Angin	26%	28%	NS
Fatigue	52%	55%	NS
Dyspnea	13%	12%	NS

TABLE - III

COMPARISON OF CONTROLLED AND UNCONTROLLED DIABETICS

	CONTROLLED (n=12)	UNCONTROLLED (n=38)	
Age	51 ± 7	53 ± 9	NS
Male	10(83%)	31 (81%)	NS
Hypertension	4 (33%)	12 (31%)	NS
Obesity	5 (41%)	12 (31%)	NS
Smoker	5 (41%)	8 (21%)	NS
Chest pain	11(91%)	35 (92%)	NS
Anterior MI	9 (75%)	21 (55%)	NS
Streptokinase	10(83%)	26 (68%)	NS
KILLIP CLASS			
I	8 (66%)	11 (28%)	<0.05
II & III	3 (25%)	23 (60%)	<0.05
IV	1 (9%)	4 (10%)	NS
METABOLIC STATUS			
Fasting Glucose (mg/dl)	105 ± 15	175 ± 25	<0.001
Fructosamine(micro mol/L)	250 ± 25	494 ± 168	<0.001
Cholesterol(mg/dl)	190 ± 21	195 ± 25	NS
ECHOCARDIOGRAPHY			
LV FS	21 ± 4%	20 ± 5%	NS
LVED (increased)	5 (41%)	7 (18%)	NS
MORTALITY	1 (8%)	6 (15%)	NS

EXLUSION CRITERIA

Patients with age more than 70 and life threatening co-morbid diseases e.g. cerebrovascular accident, advanced chronic lung disease, renal failure and malignancy were excluded.

RESULTS

From July 1994 to April 1995 a total of 110 patients were studied of which 50 were diabetic and 60 non diabetic.

Table-I shows that there was no difference between the two groups regarding age and sex. Hypertension was less common in nondiabetics than diabetics [(23% VS 32%) p NS]. Similarly obesity was found to be less common in nondiabetics [(25% VS 34%) p= NS]. There was no difference regarding smoking habits between nondiabetics and diabetics. Chest pain was equally experienced by nondiabetics and diabetics [(95% VS 92%) p=NS]. Comparable number of patients in both the groups received streptokinase [(73% VS 72%) p=NS]. Heart failure was less common in non diabetics as majority of these patients were in killip class I [(72% VS 32%) p=<0.01], less patients in killip class II and III [(21% VS 56%)) p=<.05 and IV (5% VS 14%) p=NS]. There was gross difference between nondiabetic and diabetic patients

regarding fasting blood glucose [(90± 13 VS 164 ± 68 mg/dl) p < 0.001], fructosamine [(226 ± 60 VS 445 ± 152 micro mol/L) p< 0.001]. There was no difference in the fasting cholesterol levels [(193 ± 23 VS 199 ± 38 mg/dl) p = NS]. Although there was higher mortality in diabetics but it was not statistically significant [(14% VS 5%) p= NS].

Table-II shows that there was no difference between nondiabetic and diabetics regarding site of infarction i.e. anterior [(46% VS 60%) p=NS], inferior [(44% VS 36%) p=NS], non "Q" [(10% VS 4%) p=NS]. Sinus tachycardia was slightly more common in diabetics (32% VS 16%) but it was statistically insignificant. There was no difference regarding bradyarrythmias [(8% VS 8%) p=NS] and tachyarrythmias e.g. AF [(4% VS 2%) p=NS], VT/VF [(8% VS 6%) p=NS] in diabetics and nondiabetics respectively. There was more impairment of LV function, assessed on echocardiography, in diabetics than nondiabetics [LVFS(20±8% VS 25±5%) p< 0.05]. Patients having increase in LV size were not different (24% VS 60%) p=NS in diabetics and nondiabetics respectively. Nondiabetic patients had better exercise tolerance than diabetics as is evident from exercise duration [(9.5 ± 2 VS 7.2 ± 2.5 min) p < 0.05]. However there was no difference regarding ischemic response [(36% VS 50%) p=NS, Angina [(26% VS 28%) p=NS], fatigue [(52% VS 55%) p=NS] and dyspnea [(13% VS 12%) p=NS] in nondiabetic and diabetics respectively.

Table-II shows that there was no differenvce between controlled and uncontrolled diabetics regarding age [(51 ± 7 VS 53 ± 9) p =NS], malle sex [(83% VS 81%) p=NS] hypertension [(33% Vs 31%) p=NS], obesity [(41% VS 31%) p=NS] smoking habits [(41% VS 21%) p=NS], Anterior MI [(75% Vs 55%) p=NS] and streptokinase [(83% VS 68%) p=NS]. Heart failure was less commmon in controlled than uncontrolled diabetics as majority of them were in killip class I [(66% VS 28%) p< 0.05] less in II and III [(25% VS 60%) p< 0.05] and IV [(9% VS 10%) p=NS].

There was gross difference regarding fructosamine [(250 ± 25 VS 494 ± 168 Micro mol/L) p< 0.001], fasting glucose {(105±15 Vs 175±25 mg/dl P<0.001)} in controlled and uncontrolled diabetics respectively.

There was no difference in LV function, as assessed on echocarciography [LVFS(21 ± 4% VS 20% ± 5%) p=NS] in controllled and uncontrolled diabetics respectively. Mortality rates were slightly higher in uncontrollled diabetics (15% VS 8%) but it was statisticaly not significant.

DISCUSSION

Although the discovery of insulin prevented the premature death of many diabetic patients, it has created new problems like long term microvascular, macrovascular and neurological complications. Coronary artery disease is a common complication of diabetes and accounts for 30 to 50 % of all diabetic deaths over 40 year of age.[14] Patients with diabetes mellitus have higher short and long term mortality rates after AMI then nondiabetic patients.[15,16,17] Diabetic patients have a poorer cardiovascular profile before AMI[4,5] and more severe damage there after, than non diabetes.[17] In our study congestive heart failure was more common in diabetics (70%) than nondiabetics (28%) despite the fact that the 2 groups were comparable regarding age sex, site of AMI, H/O hypertension and thrombolytic therapy. Our figures are comparable with 67.3% in diabetic patients reported by Partemain and Bradely[18] and slightly higher than 50% reported by Forrester et al[19] and 48.3% by Smith et al.[20]

It is a conventional teaching that diabetic patients with AMI present with atypical symptoms and frequently are admitted to hospital with painless infarction.

In one series 42% of diabetic patients with AMI presented with no chest pain compared with 6% of nondiabetic patient.[21] In another study, 35% of patients with AMI were admitted to general wards, 27% without any pain and 8% with mild chest pain judged to be angina pectoris not AMI.[15] However, we did not see this phenomenon in our population of patients i.e., more than 90% of both diabetic and nondiabetic patients complained of chest pain or pressure at the time of admission. Similar to our observation, Smith et al[20] also reported chest pain in 96% of their diabetic patients. The reason for the considerable difference in chest pain as presenting symptom in earlier studies and our series is not clearly known.

As is believed that hperglycemia is a forerunner of diabetic vascular complications, intense diabetes management is suggested to prevent or delay complications. Serum fructosamine is a unique retrospective index of average blood glucose level of the past 1-2 weeks and can be used as a tool to monitor glycemic control. In this study diabetes was considered adequately controlled on the basis of fructosamine levels. Proper diabetes control in the preinfarction period was found to have favourable impact on the outcome of diabetic patients with myocardial infarction as suggested by lower incidence of heart failure (34% VS 70%) $P < 0.05$ and mortality (8% VS 15%) NS. Roth et al however, have showed no effect of diabetes control on clinical course of myocardial infarction.[22]

The diabetic patients who performed stress test showed less effort tolerance than non diabetic patients. The most common reason fordiscontinuing the test was fatigue followed by angina. There was no difference with respect to ischemic response in the 2 groups. Our figure of 50% ischemic response in diabetic patients is higher than 32% reported by Smith et al (24) and 40% by Sami et al (23). The higher ischemic response may be due to the fact that other studies used 60% heart rate limited protocol while our study was target heart rate limited.

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