

Original Research Article

Prevalence of diabetes in patients with myocardial infarction: a study in a tertiary care centre

Lalatendu Mohanty¹, Debananda Sahoo^{1*}, Dayanidhi Meher², Panchanan Sahoo³

¹Department of Medicine, ²Department of Endocrinology, ³Department of Cardiology, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India

Received: 08 September 2016

Accepted: 12 September 2016

*Correspondence:

Dr. Debananda Sahoo,

E-mail: drdebanandasahoo@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Diabetics experience a greater mortality during the acute phase of myocardial infarction (MI) and a higher morbidity in the postinfarction period. This study was conducted to assess the prevalence of diabetes as a risk factor for acute myocardial infarction.

Methods: Detailed demographic details such as age, gender, weight, BMI, blood pressure, smoking and alcohol details, previous clinical and medical history were noted for all the patients. Blood was collected from the patients for random blood glucose levels and HbA1c levels. On the 2nd and the 5th days of admission, fasting blood glucose levels were measured.

Results: 63.5% patients were males and only 36.5% of them were females with the average age being around 66 years. Most of the patients who were admitted to the hospital with MI were obese or overweight with elevated cholesterol and triglyceride levels. Out of the 104 patients, 59 (56.7%) had no diabetics, 29 (27.9%) were known diabetics. 11 (10.6%) of them were identified as diabetic during the hospitalization.

Conclusions: The chronic and acute hyperglycaemia associated to acute coronary syndromes, mainly in acute myocardial infarction is an independent and determinant factor in the outcome for patients with and without diabetes mellitus.

Keywords: Acute myocardial infarction, Diabetes mellitus, Prevalence, Risk factors

INTRODUCTION

Diabetes affects more than 6% of the people in US alone and is present in more than 30% of the patients hospitalized with acute coronary syndromes. It has been recognized for some time that diabetics experience a greater mortality during the acute phase of myocardial infarction (MI) and a higher morbidity in the postinfarction period.^{1,2} This increased risk is almost two to four fold for coronary heart disease (CHD) in patients with diabetes.^{1,3} They also have a two-fold risk for short-term mortality rate after myocardial infarction (AMI), even after the adjustment of CHD4.

AMI is the leading cause of death in both men and women. Age, sex and diabetes are the known risk factors for survival. It has been reported that women have a higher 30-day mortality after AMI than men.^{5,6} Few other studies have reported that higher early post-MI mortality rates may be limited to younger women, who represent a distinct group characterized by unique risk factors and pathophysiology.⁷

However, in the recent years, there has been a transition of the burden of cardiovascular disease in Asia, where it is expected to reach alarming proportions due to the increasing rates of smoking, alcoholism, obesity and diabetes.^{8,9}

Nearly 20% of the patients with AMI and without previously known diabetes develop elevated glucose levels during their hospitalization.^{10,11} This further increases the mortality rates among the patients with AMI.¹³ The reason for this association is estimated to be the underlying unrecognized diabetic status.^{14,15} The appearance of the higher sugar levels may be due to the stress of the AMI.

The prevalence in the number of previously known diabetes and newly detected diabetes in patients with acute myocardial infarction is limited. Therefore the study was conducted to identify the prevalence of diabetes, both previously known and newly detected in the patients with AMI in the area.

METHODS

This study was conducted by the department of medicine at Kalinga Institute of Medical Sciences during the period of two years and four months. 104 patients with myocardial infarction, who were admitted into our hospital, were included into the study. Informed consent was taken from all the patients before the inclusion into the study. All patients had fulfilled the diagnostic criteria for acute myocardial infarction.

Detailed demographic details such as age, gender, weight, BMI, blood pressure, smoking and alcohol details, previous clinical and medical history were noted for all the patients. Patients with epilepsy, subdural hematoma and sub-arachnoid hemorrhage or any other neurological disability that would affect the HbA1c levels were excluded from the study.

Blood was collected from the patients for random blood glucose levels and HbA1c levels. Cholesterol levels and triglyceride levels were also estimated. On the 2nd and the 5th days of admission, fasting blood glucose levels were measured.

Patients were considered diabetic if they were known diabetic or their glucose levels were, RBS >200 mg/dL, fasting glucose >126 mg/dL and post prandial glucose >200 mg/dL. If even on the 5th day if the glucose levels were <126 mg/dl, they were considered to be non-diabetic.

Newly diagnosed diabetics were defined as such if they have elevated glucose level during their entire hospital stay. They were further confirmed after 2-3 months of re-measuring the glucose levels, when the patient came for follow-up.

Patients who were not previously known diabetics and whose fasting blood glucose were <126 mg/dl were considered to be non-diabetic. All the patients with normal blood glucose levels during the stay, but could not be further investigated due to early death or due to any other difficulties were also classified as non-diabetic.

Therefore, the final assessment of the patients based on blood glucose levels was done as:

- *Euglycemic*: patients with normal RBS, FBS and PPBS and HbA1c
- *Known diabetic*: Those who have a previous history of diabetes.
- *Newly detected diabetes*: Those with RBS \geq 200 mg/dL, fasting glucose \geq 126 mg/dL, post prandial glucose \geq 200 mg/dL and HbA1c >6.5% but without a history of diabetes.
- *Stress hyperglycemia*: RBS \geq 200 mg/dL with HbA1c <6.5%.

RESULTS

The total mortality of the patients was 9 (8.7%). Most of the patients were males and only 36.5% of them were females.

The average age of the patients was around 66 years. Many of the patients who were diabetic and had MI were smokers, whether regular or occasional, though the alcoholics were not many (Table 1).

Table 1: Demographic details.

Details	Men	Women	Total
No of patients	66 (63.5%)	38 (36.5%)	104
Age	64.6 \pm 3.6	69.3 \pm 5.1	66.2 \pm 3.1
BMI			
<25	41 (62.1%)	24 (63.2%)	65 (62.5%)
\geq 25	25 (37.9%)	14 (36.8%)	39 (37.5%)
Smoking status			
Never	29 (43.9%)	37 (97.4%)	66 (63.5%)
Occassional	18 (27.3%)	1 (2.6%)	19 (18.3%)
Always	19 (28.8%)	0	19 (18.3%)
Alcoholic status			
Never	41 (62.1%)	31 (81.6%)	72 (69.2%)
Occasional	16 (24.3%)	3 (7.9%)	19 (18.3%)
Regular	9 (13.6%)	4 (10.5%)	13 (12.5%)
Blood pressure			
Systolic	136 \pm 5	139 \pm 5	-
Diastolic	92 \pm 2	94 \pm 4	-

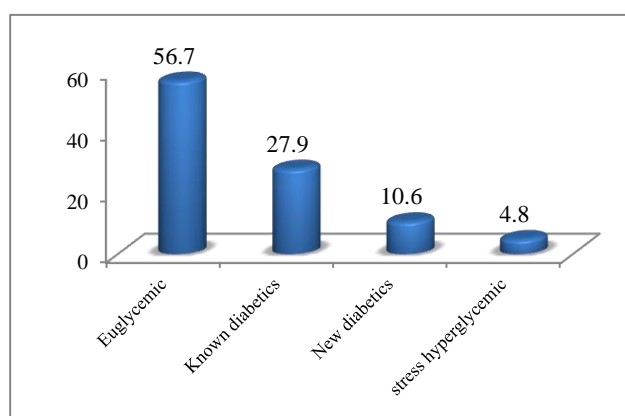
Most of the patients who were admitted to the hospital with MI were obese or overweight with elevated cholesterol and triglyceride levels. The TGL levels were nearly 200 mg/dl while the total cholesterol was 212.4 mg/dl (Table 2).

There was a significant elevated glycated hemoglobin levels among the diabetic patients.

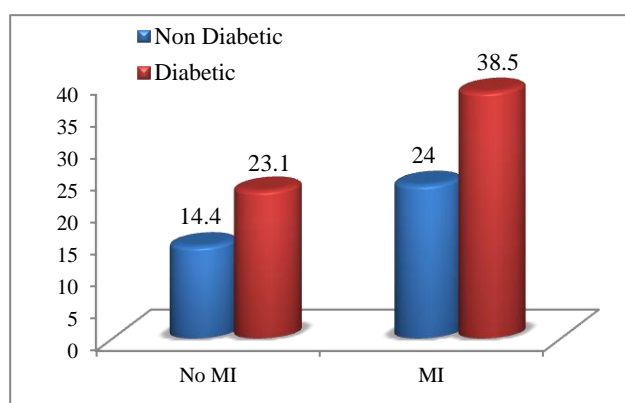
Out of the 104 patients, 59 (56.7%) had no diabetics, 29 (27.9%) were known diabetics. 11 (10.6%) of them were identified as diabetic during the hospitalization while 6 had elevated blood sugar levels due to stress (Figure 1).

Table 2: Biochemical details.

Details	Patients with diabetes	Patients without diabetes
Total cholesterol (mg/dL)	212.4±5.2	141.9±7.6
HDL- cholesterol (mg/dL)	44.5±2.2	41.5±4.6
LDL-cholesterol (mg/dL)	136.1±4.1	123.4±3.9
Triglycerides (mg/dL)	198.5±5.3	119±6.7
Fasting plasma glucose (mg/dL)	126.1±6.1	95.7±2.1
Hb (g%)	13.6±0.9	11.9±0.4
Glycated hemoglobin	8.03±1.4	4.9±0.1

**Figure 1: Categorization according to glycaemic status.**

Diabetic patients who have had an MI previously are more at risk to a recurrent MI rather than those without. It has been observed in our study that the risks for diabetic patients without a prior MI are equally prone to an MI as that as the non-diabetics who have had a previous attack (Figure 2).

**Figure 2: Association between diabetes and previous MI among the patients.**

DISCUSSION

Farmington study reports increased incidence of heart disease in patients with diabetes and its poor prognosis

than their non-diabetic counterparts. Mortality rate was also more in men than in women among the diabetic patients than the non-diabetic patients.³

The diabetic patients who sustain myocardial infarction are more likely to get complications than those patients who have no diabetes such as recurrent infarction, cardiogenic shock, atrioventricular and intraventricular conduction abnormalities, chronic congestive heart failure and myocardial rupture.¹⁵⁻¹⁷

In our study, the prevalence of diabetes among the patients with myocardial infarction was 40 (38.5%). This was comparatively high in relation to a few other studies but a few studies corroborated our study.^{15,18} In a study by Tenerz et al, reported that every fourth patient hospitalized with acute myocardial infarction had diabetes mellitus.¹⁹

The main cause of death in industrialized countries such as USA is coronary artery disease, especially if it is associated with diabetes. There is a considerable decrease in life expectancy in such people.²⁰ 9 (8.7%) patients in our study, died due to MI and all of them were diabetic.

Elevation of blood glucose levels on admission during the early phase of MI in patients who have no history of diabetes is said to be a predictor of in hospital and long term outcome in patients with AMI. This elevation is said to be mainly stress related.²¹ In our study we have had 6 (4.8%) such cases.

The association between diabetes and non-fatal AMI may be a direct effect of diabetes. The metabolic effect of diabetes on cardiovascular morbidity and mortality is complex.²²⁻²⁵ Diabetes is associated with activation of the renin-angiotensin-aldosterone system.^{22,23} Collagen cross-linking is a major mechanism by which vascular and cardiac compliance is diminished in diabetes and may also contribute to diabetic cardiomyopathy.^{24,25} Other potential underlying mechanisms may include accelerated atherosclerosis associated with diabetes. Hyperglycaemia, insulin resistance, and advanced glycation end-products have been implicated in vascular inflammation and endothelial dysfunction in patients with diabetes.²⁶ Further important contributing factors may include increased platelet activation, presence of a chronic hypercoagulable state, and impaired fibrinolysis.²⁷⁻²⁹ Serum levels of insulin-like growth factor-binding protein-1 are elevated in patients with diabetes, which in turn has been shown to be associated with increased risk for cardiovascular mortality and morbidity in these patients.³⁰ The prevalence of known diabetics in our study were 27.9% while in studies by Singh et al it was 24%, Gracy et al it was 8.5% and Kiers et al the incidence was 17%.³¹⁻³³

The newly diagnosed diabetic in our study was 10.6% while in a study by Woo et al, it was 18% and Singh et al it was 8.75%.^{31,34}

A Finnish population based study has shown that patients with diabetes without a previous history of MI have as a great risk for infarction as individuals without diabetes with a previous myocardial infarction. The 7-year incidence rates of MI (fatal and nonfatal) in subjects without diabetes were 18.8% in those with a previous MI and 3.5% in those without a history of infarction, the corresponding rates in individuals with diabetes were 45.0% and 20.2%, respectively.^{35,36}

In our study, 25 patients who were non-diabetic had a history of previous MI while 24 patients with diabetes had a MI for the first time, indicating that the risks for these two conditions were the same. 40 patients accounting for 38.5% in our study had a previous history of MI and were diabetic, showing that with these conditions the risk factor was high.

CONCLUSION

The chronic and acute hyperglycemia associated with acute coronary syndromes, mainly in acute myocardial infarction is an independent and determinant factor in the outcome for patients with and without diabetes mellitus. The control of blood sugar levels in patients especially in patients who have had a history of MI will lead to better outcomes and better quality of life.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

- Jacoby R, Nesto R. Acute myocardial infarction in the diabetic patient: pathophysiology, clinical course and prognosis. J Am Coll Cardiol. 1992;20:736-44.
- Aronson D, Rayfield E, Cheseboro J. Mechanisms determining course and outcome of diabetic patients who have had acute myocardial infarction. Ann Intern Med. 1997;126:296-306.
- Kannel WB, McGee DL. Diabetes and glucose tolerance as risk factors for cardiovascular disease: the Framingham Study. Diabetes Care. 1979;2:20-6.
- Woodfield SL, Lundergan CF, Reiner JS, Greenhouse SW, Thompson MA, Rohrbeck SC, et al. Angiographic findings and outcome in diabetic patients treated with thrombolytic therapy for acute myocardial infarction: the GUSTO-I experience. J Am Coll Cardiol. 1996;128:1661-9.
- Hochman JS, Tamis JE, Thompson TD, Weaver WD, White HD, Van de, et al. Sex, clinical presentation, and outcome in patients with acute coronary syndromes. global use of strategies to open occluded coronary arteries in acute coronary syndromes iib investigators. N Engl J Med. 1999;341:226-32.
- Berger JS, Elliott L, Gallup D, Roe M, Granger CB, Armstrong PW, et al. Sex differences in mortality following acute coronary syndromes. J Am Med Asso. 2009;302:874-82.
- Vaccarino V, Parsons L, Every NR, Barron HV, Krumholz HM. Sex-based differences in early mortality after myocardial infarction national registry of myocardial infarction 2 participants. N Engl J Med. 1999;341:217-25.
- Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. Circulation. 1998;97:596-601.
- Nguyen HN, Fujiyoshi A, Abbott RD, Miura K. Epidemiology of cardiovascular risk factors in Asian countries. Circ J. 2013;77:2851-9.
- Kosiborod M, Inzucchi SE, Krumholz HM. Glucometrics in patients hospitalized with acute myocardial infarction: defining the optimal outcomes-based measure of risk. Circulation. 2008;117:1018-27.
- Kosiborod M, Rathore SS, Inzucchi SE. Admission glucose and mortality in elderly patients hospitalized with acute myocardial infarction: implications for patients with and without recognized diabetes. Circulation. 2005;111:3078-86.
- Capes SE, Hunt D, Malmberg K, Gerstein HC. Stress hyperglycaemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. Lancet. 2000;355:773-78.
- Bartnik M, Ryden L, Ferrari R. Euro heart survey investigators. the prevalence of abnormal glucose regulation in patients with coronary artery disease across Europe. The euro heart survey on diabetes and the heart. Eur Heart J. 2004;25:1880-90.
- Norhammar A, Tenerz A, Nilsson G. Glucose metabolism in patients with acute myocardial infarction and no previous diagnosis of diabetes mellitus: a prospective study. Lancet. 2002;359:2140-4.
- Rytter L, Troelsen S, Nielsen BH. Prevalence and mortality of acute myocardial infarction in patients with diabetes. Diabetes Care. 1985;8:230-4.
- Stone P, Muller J, Hartwell T. The effect of diabetes mellitus on prognosis and serial left ventricular function after acute myocardial infarction: contribution of both coronary disease and left ventricular dysfunction to the adverse prognosis. J Am Coll Cardiol. 1989;14:49-57.
- Czyzk A, Krolewski A, Szablowska S, Alot A, Korezynski J. Clinical course of myocardial infarction among diabetic patients. Diabetes Care. 1989;38:350-7.
- Lundberg V, Stegmayr B, Asplund K, Eliasson M, Huhtsaari F. Diabetes as a risk factor for myocardial infarction: population and gender perspectives. J Int Med. 1997;241:485-92.
- Tenerz A, Lonnberg I, Berne C, Nilsson G, Leppert J. Myocardial infarction and prevalence of diabetes mellitus. European Heart Journal. 2001;22:1102-10.
- Thom T, Haase N, Rosamond W. The American Heart Association Statistics Committee and Stroke

- Statistics Subcommittee. Heart disease and stroke statistics. 2006 update: a report from the AHA Statistics Committee and Stroke Statistics Subcommittee. *Circulation.* 2006;113:85-151.
21. Oswald GA, Corcoran S, Yudkin JS. Prevalence and risk of hyperglycemia and undiagnosed diabetes in patients with acute myocardial infarction. *Lancet.* 1984;1:1264-7.
22. Lim HS, Macfadyen RJ, Lip GY. Diabetes mellitus, the renin-angiotensin-aldosterone system, and the heart. *Arch Intern Med.* 2004;164:1737-48.
23. Miller JA. Impact of hyperglycemia on the renin angiotensin system in early human type 1 diabetes mellitus. *J Am Soc Nephrol.* 1999;10:1778-85.
24. Spiro MJ, Kumar BR, Crowley TJ. Myocardial glycoproteins in diabetes: type VI collagen is a major PAS-reactive extracellular matrix protein. *J Mol Cell Cardiol.* 1992;24:397-410.
25. Aronson D. Cross-linking of glycated collagen in the pathogenesis of arterial and myocardial stiffening of aging and diabetes. *J Hypertens.* 2003;21:3-12.
26. Basta G, Schmidt AM, Caterina R. Advanced glycation end products and vascular inflammation: implications for accelerated atherosclerosis in diabetes. *Cardiovasc Res.* 2004;63:582-92.
27. Lopez Y, Paloma MJ, Rifon J, Cuesta B, Paramo JA. Measurement of prethrombotic markers in the assessment of acquired hypercoagulable states. *Thromb Res.* 1999;93:71-8.
28. Carr ME. Diabetes mellitus: a hypercoagulable state. *J Diabetes Complications.* 2001;15:44-54.
29. Collier A, Rumley A, Rumley AG, Paterson JR, Leach JP, Lowe GD, Small M. Free radical activity and hemostatic factors in NIDDM patients with and without micro albuminuria. *Diabetes.* 1992;41:909-13.
30. Wallander M, Norhammar A, Malmberg K, Ohrvik J, Ryden L, Brismar K. IGF binding protein 1 predicts cardiovascular morbidity and mortality in patients with acute myocardial infarction and type 2 diabetes. *Diabetes Care.* 2007;30:2343-8.
31. Singh KG, Singh SD, Bijoychandra K, Kamei P, Chingkhei, Bijay M. A study on the clinical profile of stroke in relation to glycaemic status of patients. *J Indian Academy Clin Med.* 2014;15(3):177-81.
32. Gracy CS, French JM. Castlidge NEF, Venables GM, Jumes DFW. Increasing age, diabetes mellitus and recovery from stroke. *Postgraduate Medical Journal.* 1989;65:720-4.
33. Kiers L, Davis SM, Larkins R. Stroke topography and outcome in relation to hyperglycaemia and diabetes. *Journal Neurology, Neurosurgery, Psychiatry.* 1992;55(4):263-70.
34. Woo J, Lam CW, Kay R, Wong AH, Teoh R, Nicholls MG. The influence of hyperglycemia and diabetes mellitus on immediate and 3-month morbidity and mortality after acute stroke. *Arch Neurol.* 1990;47:1174-7.
35. Dandona P, Chaudhuri A, Ghanim H, Mohanty P. Effect of hyperglycemia and insulin in acute coronary syndromes. *Am J Cardiol.* 2007;99(11):12-8.
36. Haffner SM, Lehto S, Ronnemaa T, Pyorala K, Laakso M. Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. *N Engl J Med.* 1998;339:229-34.

Cite this article as: Mohanty L, Sahoo D, Meher D, Sahoo P. Prevalence of diabetes in patients with myocardial infarction: a study in a tertiary care centre. *Int J Adv Med* 2016;3:842-6.