

The Frequency of Previously Undiagnosed Diabetes Mellitus in Patients with Acute Coronary Syndrome Using HBALC

SARA AHMED¹, MUHAMMAD ZUBAIR², ABDUL SALAM³, QAMAR ZAMAN⁴, ASLAM LATIF⁵, AMAR DEEP⁶

¹FCPS (Adult Cardiology), Clinical Fellow, Department of Emergency, National Institute of Cardiovascular Diseases Karachi, Pakistan

²FCPS (Adult Cardiology), Post Fellow, Advanced Cardiac Imaging Department, National Institute of Cardiovascular Diseases Karachi, Pakistan

³FCPS (Adult Cardiology), Clinical Fellow, Adult Cardiology, National Institute of Cardiovascular Diseases Karachi, Pakistan

⁴FCPS (Adult Cardiology), Post Fellow, Interventional Cardiology Department, National Institute of Cardiovascular Diseases Karachi, Pakistan

⁵FCPS (Adult Cardiology), Post Fellow, Department of Interventional Cardiology Department, National Institute of Cardiovascular Diseases Karachi, Pakistan

⁶FCPS (Cardiology), Electrophysiology Department, National Institute of Cardiovascular Diseases Karachi, Pakistan

Corresponding author: Sara Ahmed, Email: shahhina052@gmail.com, Cell: 03350345963

ABSTRACT

Objective: To assess the proportion of previously undiagnosed diabetes mellitus in patients with acute coronary syndrome (ACS) using HbA1c.

Methods: A cross-sectional study was conducted at the Department of Cardiology, National Institute of Cardiovascular Diseases Karachi, Pakistan between 15th July, 2020 and 15th January, 2021. One hundred and thirty-nine patients admitted with acute chest pain and diagnosed with ACS were recruited in the study. After a thorough history, clinical examination, ECG, serum troponin-I level, hemoglobin level and HbA1c were done on these patients. Patient's age, gender, HbA1c level and BMI was noted. Outcome (diabetes, pre-diabetes, non-diabetic) for each patient was noted.

Results: Majority of study participants were males (n=98; 70.50%) and the rest were females (n=41; 29.50%). The mean age of study participants was 56.09±4.91 years. The mean±SD HbA1c level in the study population was 5.10%±0.81%. STEMI (n=99; 71.22%) was most common and followed by NSTEMI (n=40; 28.78%). Diabetes Mellitus was diagnosed in 15 (10.79%) study participants. No statistically significant association was found between diabetes mellitus and age, sex, and kind of ACS.

Conclusion: Previously undiagnosed diabetes mellitus is quite common in patients with acute coronary syndrome and the physicians should actively look for diabetes mellitus in such patients.

Keywords: Diabetes Mellitus, Acute coronary syndrome, STEMI, NSTEMI, HbA1c, Complications, Morbidity.

INTRODUCTION

An estimated 12–14% of people worldwide are believed to have diabetes mellitus. Additionally, one in four hospitalised patients is thought to have diabetes.¹ A Study on Qatar population with acute coronary syndrome shows that 45% of hospitalized patients previously not known to have diabetes mellitus fell within prediabetes (14.1%), diabetes (21%) or stress hyperglycemia (9.8%).² In acute myocardial infarction (AMI), which is considered a part of the acute coronary syndrome, the frequency of newly diagnosed diabetes was found to be 10%.³

A study from Ayub Medical College, Abbottabad, Pakistan, showed prevalence of diabetes to be 31.6% in the individuals admitted with acute coronary syndrome (ACS). In this study 25.6% patients were previously known diabetics.⁴ So we can assume that 6% of these patients were found to have diabetes which was previously unknown. This is quite low, compared to the numbers that we see in the studies mentioned above. Moreover, the method used to diagnose diabetes in this study was fasting blood glucose, and HbA1c was only done in known diabetics to look for adequate control. This may have actually resulted in over estimation of diabetes as many of the patients with acute coronary syndrome have the acute stress hyperglycemia and are not actually diabetics.² Furthermore HbA1c has been correlated with the progression to coronary vascular disease development even in cases without DM, especially in the cases of obesity, dyslipidemia and old age.⁵ Thus, we have a discrepancy between the local and international data. Furthermore, the above mentioned study was actually not designed to assess the frequency of newly diagnosed diabetes. In comparison to individuals with established diabetes and those with normoglycemia, those with raised sugar levels have a greater death risk and spend more time in the hospital. In compared to non-DM patients with normal blood sugar levels, patients with hyperglycemia have been reported to be at increased risk for negative outcomes, a poorer prognosis, and a mortality following myocardial infarction of up to 3.9 times.⁶⁻¹⁰

Early diagnosis and appropriate management of diabetes is therefore essential in the management of acute coronary syndrome.¹¹ Thus implementing that for any patient presenting with acute coronary syndrome it is very important to know whether that patient is diabetic. So, there is a need to assess the burden of newly detected diabetes in patients presenting with acute coronary

syndrome in our population by using HbA1c as the method for diagnosis of diabetes. In our study we aimed to determine the frequency of diabetes mellitus which was previously undiagnosed in patients with acute coronary syndrome by using HbA1c. This study would allow us to evaluate the proportion of undiagnosed cases of diabetes in our setup who would allow us to determine the number of undiagnosed cases of DMT2 in our setup who have presented with acute coronary syndrome.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Department of Cardiology, National Institute of Cardiovascular Diseases Karachi, Pakistan between 15th July 2020 and 15th January, 2021. A non-randomized, consecutive sampling technique was used to include the participants in the research.

A sample size of 139 was determined using the WHO software by keeping the confidence Level of 95%, anticipated proportion of diabetes mellitus in acute myocardial infarction to be 10%,³ and absolute precision of 5%.

Patients presenting to Cardiology Ward with acute coronary syndrome (STEMI / N-STEMI / USA), aged between 30 and 80 years, of either gender (male and female) were included in the study. Known diabetic individuals, chronic kidney disease (as it interferes with troponin level), patients with anemia i.e. Hb of < 10 mg/dl, and patients with known hemoglobinopathies in history (as these will interfere with the HbA1c result) were exempted from the study.

After obtaining approval of the Ethical committee of the hospital, patients admitted to Cardiology Unit with acute chest pain were considered for this study. After a thorough history, clinical examination, ECG, serum troponin-I level, hemoglobin level and HbA1c were done on these patients. Those patients who meet the inclusion and exclusion criteria were included in the study after informed consent from the patient (or the next of kin if the patient was unconscious). Patient's age, gender, HbA1c level and BMI was noted. Outcome (diabetes, pre-diabetes, non-diabetic) for each patient was noted, and data was collected on a proforma by the trainee herself.

Acute coronary syndrome will be described as a patient who presents with acute central chest pain (< 24 hour in onset) with the following changes according to the definitions:

STEMI: On a standard 12 lead ECG, STEMI will be diagnosed if ST-segment elevation at the J point of > 1 mm occurs in at least 2 concordant leads or finding of a novel left bundle branch block (LBBB) on the electrocardiogram (ECG).

NSTEMI: Chest pain, ECG changes to meet STEMI criteria, but elevated troponin I level elevated to >0.06 ng/mL Unstable Angina (USA): Typical chest pain, but ECG and troponin I level not meeting STEMI or NSTEMI criteria. Body mass index (BMI): weight in kg divided by height in m². Diabetes was our primary outcome and is defined as HbA1C of 6.5% or more²⁰⁵ pre-diabetes were described as HbA1C of 5.7 to 6.4%, patients without diabetes were defined as HbA1C less than 5.7%.

Data was entered into and analyzed on a statistical package for social sciences (SPSS) version 21. Mean and standard deviation were determined for age and HbA1C level. Proportions were determined for dichotomous or other non-binary variables like gender, type of acute coronary syndrome and outcome (diabetes, pre-diabetes and non-diabetic). Stratification was done for outcome according to age, gender and type of acute coronary syndrome. Chi square was applied for data analysis and p value 0.05 or less was taken as significant.

RESULTS

There 139 study participants with a predominance towards the males (n=98; 70.50%) and the rest of study participants were females (n=41; 29.50%). The mean age of patients was 56.09 ± 4.91 years. The mean HbA1c level in the study population was 5.10±0.81. The lowest HbA1c was 4.4% and the highest level was 7.8%.

Most common type of acute coronary syndrome in the study was ST- segment elevation myocardial infarction (n=99; 71.22%) followed by non-ST segment elevation myocardial infarction (n=40; 28.78%).

Table 1: Characteristics associated with study population

Parameter	Mean ± SD/ N(%)
Age	56.1 ± 4.9
HbA1c level	5.1 ± 0.8
Gender	
Male	98 (70.5%)
Female	41 (29.5%)
Acute coronary syndrome	
ST-segment elevation myocardial infarction	99 (71.2%)
Non-ST-segment elevation myocardial infarction	40 (28.8%)
Diabetes mellitus (Outcome)	
Yes	15 (10.8%)
No	124 (89.2%)

15 (10.79%) study participants were diagnosed as having diabetes. When the outcome variable i.e., diabetes mellitus was stratified according to age, gender and type of acute coronary syndrome, albeit the findings were not significant, statistically (p > 0.05)

Table 2: Association of diabetes with patient characteristics

	Outcome		P value
	Non-Diabetic	Diabetic	
Age of patients			0.39
< 56 yrs	64 (51.6%)	6 (40%)	
≥ 56 yrs	60 (48.4%)	9 (60%)	
Gender			0.12
Male	90 (72.6%)	8 (53.3%)	
Female	34 (27.4%)	7 (46.7%)	
Acute coronary syndrome			0.11
ST-segment elevation myocardial infarction	91 (73.4%)	8 (53.3%)	
Non-ST-segment elevation myocardial infarction	33 (26.6%)	7 (46.7%)	

DISCUSSION

In the modern era, diabetes mellitus (DM) is a major global source of illness and mortality. Diabetes is associated with high risks of hospitalisation, visual problems, kidney damage, and limb

disability.¹² DM has a major economic effect and significantly contributes to the growing cost of healthcare internationally.¹³ Diabetes is one of the most common non-communicable diseases in the world. The prevalence of DM varies greatly among the populations and ethnic groups studied.¹⁴ Several emerging nations are now reporting prevalence rates that are consistently high.¹⁵

Pakistan has a very high prevalence of diabetes mellitus. The recently concluded National Diabetes Survey reported that one in four Pakistani is having diabetes mellitus.¹⁶

The frequency of newly-diagnosed diabetes mellitus in this study was 10.79%. The frequency is in line with various reports published in the literature.

The incidence of undiagnosed diabetes mellitus was 12.2% in a research that looked at the prevalence of undiagnosed diabetes or prediabetes and correlations with ischemic endpoints among individuals with non-ST- segment elevation acute coronary syndrome (ACS). The same study reported known diabetes in 32.5% and pre-diabetes in 10.8%.¹⁷

Another study that employed HbA1c to test individuals with ACS who had no history of diabetes for levels of glucose intolerance found that the incidence of recently discovered diabetes was 10.8%.¹⁸ In this research, the diabetic department recruited individuals who had been hospitalised to cardiology department with an initial diagnosis of ACS but no previous diabetes diagnosis. An initial HbA1c blood test was performed on participants on days 2 or 3 after admission to check for diabetes. Participants were requested for a repeat HbA1c test if the results were abnormal (> 6.0%), and for an oral glucose tolerance test (OGTT) at 3 months if the results were intermediate (6.0–6.4%). ACS patients were divided into groups based on their diagnosis and subsequent treatment.¹⁸ On the other hand, we did not repeat the HbA1c test to confirm the diagnosis in the patients.

Interestingly, a recently published study has reported that the diagnostic yield in patients with acute coronary syndrome can be increased by repeatedly testing for diabetes mellitus.¹⁹ The study found that individuals with acute coronary syndrome had a 17.5% prevalence of type 2 diabetes and came to the conclusion that patients with ACS and previously undetected diabetes were more likely to have impaired glucose tolerance 3 months after hospitalisation than while they were there. Integrating the findings from the hospital stay with the results from three months later significantly increased the diagnostic yield.¹⁹

Another recently published study from India reported a 14.7% prevalence of newly diagnosed diabetes mellitus in patients with acute coronary syndrome.²⁰ The mean age of the participants was 61.20 11.69 years, which was higher than the average age in our research, which was 56.09 4.91 years. A 4:1 ratio of men to females indicated that males were more prevalent. 102 people (14.7%) had diabetes that had not yet been properly diagnosed.²⁰

A recently published study from Bangladesh reported that diabetes was diagnosed in 23.8% of study participants. 135 (54.44%) of the 248 research participants had abnormal glucose levels. Men made up 87.10%. (216). IGT (prediabetic) was 31.94% (69%) and diabetic was 24.54% among males (53). The study population's median age (SD) was 51.71 11.84 years. In 45.6% (113) of the patients, normal glucose tolerance (NGT) was discovered; in 30.6% (76) and 23.8% (59) of the instances, IGT (prediabetic) and diabetes were found. In acute coronary syndrome, non-diabetic Bangladeshi individuals had a significant rate of hyperglycemia (ACS).²¹

This was a small hospital based study with a small sample size. Therefore, the results of this study cannot be generalized onto the general population. Repeated HbA1c testing was not done to confirm the results and therefore a study with larger sample size with an aim to confirm the initial results of diabetes screening should be conducted to determine the true extent of the problem.

CONCLUSION

The prevalence of previously undiagnosed diabetes mellitus in patients presenting with acute coronary syndrome is alarmingly high. Considering diabetes as an important risk factor for coronary artery disease, these results point to the need of widespread effective screening programs to detect diabetes mellitus in the general population in order to decrease the macrovascular complication of diabetes mellitus.

Conflict of Interest: None declared

Source of Funding: None declared

Acknowledgement: Nil

REFERENCES

- Gangopadhyay KK, Bantwal G, Talwalkar PG, Muruganathan A, Das AK, Diabetes CG. Consensus evidence-based guidelines for in-patient management of hyperglycaemia in non-critical care setting as per Indian clinical practice. *J Assoc Physicians India*. 2014;62(7 Suppl):6-15.
- Abdullatef WK, Al-Aqeedi RF, Dabdoob W, Hajar HA, Bener A, Gehani AA. Prevalence of unrecognized diabetes mellitus in patients admitted with acute coronary syndrome. *Angiology*. 2013;64(1):26-30.
- Arnold SV, Stolker JM, Lipska KJ, Jones PG, Spertus JA, McGuire DK, et al. Recognition of Incident Diabetes Mellitus During an Acute Myocardial Infarction. *Circ Cardiovasc Qual Outcomes*. 2015 1 ;8(3):260—7.
- Ahmed N, Kazmi S, Nawaz H, Javed M, Anwar SA, Alam MA. Frequency of Diabetes Mellitus in patients with Acute Coronary Syndrome. *J Ayub Med Coll Abbottabad*. 2014;26(1):57—60.
- Memon AG, Soomro MK, Kolachi MA. Correlation of Glycated Hemoglobin (HbA1c) with Different Cardiovascular Risk Factors in Non-diabetic Patients. *J Cardiovasc Dis Diagn* [Internet], 2016 10 [cited 2017 May 6]; Available from: <https://www.esciencecentral.org/journals/correlation-of-glycated-hemoglobin-hb1c-with-different-cardiovascular-risk-factors-in-nondiabetic-patients-2329-9517-1000243.php?aid=73258>
- Mukherjee JJ, Chatterjee PS, Saikia M, Muruganathan A, Das AK, Diabetes CG. Consensus recommendations for the management of hyperglycaemia in critically ill patients in the Indian setting. *J Assoc Physicians India*. 2014;62(7 Suppl): 16- 25.
- Gardner LS, Nguyen-Pham S, Greenslade JH, Parsonage W, D'emden M, Than M, et al. Admission glycaemia and its association with acute coronary syndrome in Emergency Department patients with chest pain. *Emerg Med J*. 2014;emermed – 2014.
- Afridi M, Iqbal MH, Nawab Z, Ullah HE, Kakakhel SK. Influence of type 2 diabetes mellitus on the Killip class in acute myocardial infarction patients visiting Hayatabad Medical Complex, Peshawar, Khyber Pakhtunkhwa. *J Med Stud* [Internet], 2016 [cited 2017];2(1). Available from: <http://www.jms.rmi.edu.pk/index.php/jms/article/view/61>
- Rehman S, Khan AS, Hafizullah M, Amjad A. Role of glycosylated hemoglobin (hba1c) in diabetics presenting with Acute Myocardial Infarction (AMI) on B-type Natriuretic Peptide (BNP) and its correlation with left ventricular functions. *Pak Heart J* [Internet], 2017 2;49(4).
- Ali M, Butt UM, Akram Z, Qureshi MA. Impact of Diabetes on early complications in acute coronary syndrome patients. *Pak Heart J* [Internet], 2016 [cited 2017];49(3). Available from: <http://pkheartjournal.com/index.php/pkheart/article/view/117>
- Rosiek A, Leksowski K. The risk factors and prevention of cardiovascular disease: the importance of electrocardiogram in the diagnosis and treatment of acute coronary syndrome. *Therapeutics and clinical risk management*. 2016;12:1223.
- Diabetes 1996: Vital Statistics. Authors: Cowic CC, Eberhardt MS Eds. Published: American Diabetes Association 1996, Alexandria, VA.
- Rubin RJ, Altman WM, Mendelson DN. Health care expenditure for people with diabetes mellitus, 1992. *J. Clin. Endocrinol. Metab.*, 1994;78:809A809F
- King H, Rewers M. Global estimates for prevalence of glucose intolerance. *Diabetes Care*, 1993; 16:121-25.
- Ramaiya KL, Kodali VVR, Alberti KGMM. Epidemiology of diabetes in Asians of the Indian Subcontinent. *Diabetes Metab. Rev.*, 1990;6:125-46.
- Diabetes prevalence in Pakistan reaches an alarming 26%, reveals latest survey. *The News International* [Internet]. Islamabad. 2017; Available from: <https://www.thenews.com.pk/print/224434-Diabetes-prevalence-in-Pakistan-reaches-an-alarming-26-reveals-latest-survey>
- Giraldez RR, Clare RM, Lopes RD, Dalby AJ, Prabhakaran D, Brogan GX, et al. Prevalence and clinical outcomes of undiagnosed diabetes mellitus and prediabetes among patients with high-risk non-ST-segment elevation acute coronary syndrome. *Am Heart J*. 2013;165(6):918– 925.e2.
- Lugg ST, May CJH, Nightingale P, Tuffley RPE, Al- Hourani J, De P. HbA1c screening for new onset diabetes following acute coronary syndrome: is it a worthwhile test in clinical practice? *J Diabet Metabol Disord* [Internet]. 2017 [cited 2017 Sep 30]; 16(1). Available from: <http://jdm.donline.biomedcentral.com/articles/10.1186/s40200-017-0296-4>
- Bjarnason TA, Oskarsdottir ES, Hafthorsson SO, Kristinsdottir LB, Skuladottir FB, Kaernsted B, et al. Diagnosis of diabetes mellitus and prediabetes is improved by repeated measurements in patients with acute coronary syndrome. *Atherosclerosis*. 2015;241(1):e218.
- Ashraf M, Sharma S, Rashid A, Ismail M, Tanvir M, Sharma P, et al. Prevalence of Undiagnosed Diabetes Mellitus in Acute Coronary Syndrome Patients: A Hospital-based Study. *Int J Scient Study*. 2016;4(2):179–84.
- Rahman MZ, Nahar N, Hoque MA, Rahman MM, Islam MD, Khatun M, et al. Glycemic Status During Acute Coronary Syndrome of Non-Diabetic Patients. *Khawaja Yunus Ali Med Coll J*. 2017;7(1):697.