Original Research Article

A comparative study of the severity and short-term complications of acute coronary syndrome (ACS) in diabetics and non-diabetics admitted to the intensive coronary care unit (ICCU) in a tertiary care hospital of western Maharashtra

Vinit Ramesh Chaudhary[1], Indranil Kulkarni[2*]

[1]Assistant Professor, [2]Junior Resident, Department of Medicine, KIMS, Karad, Maharashtra, INDIA.
Email: coolkarniindranil@gmail.com

Abstract

Background: High admission blood glucose levels after acute coronary events are common and are associated with an increased risk of deaths. Elevated admission glucose levels in non-diabetic patients with AMI are independently associated with larger infarct sizes and a higher long term mortality rates when compared with patients with normal glucose levels. Diabetes is considered as a high risk factor for 'vascular diseases'. A significant proportion of patients with acute coronary syndrome have hyperglycemia, a significant risk factor for adverse outcomes in both diabetic and non-diabetic patients. The present study was undertaken to find out the correlation between HbA1c levels and the severity and complications in diabetic and non-diabetic patients. **Methodology:** 100 patients who came with Acute Coronary Syndrome who fulfilled inclusion / exclusion criteria, will be enrolled for the study. All patients underwent routine investigations. Group A had diabetic patients with ACS and group B had nondiabetic patients. **Results:** There were 72% males and 28% females in group A, while 70% males and 30% females in group B. The mean age for Acute Coronary Syndrome in diabetic patients was 58.33 years and non-diabetics it was 58.58 years. There was significant difference between the HbA1C, Random BSL and CPKMB values of the two groups ($p < 0.01$). There was a highly significant association between Troponin-I in Diabetes and non-diabetes cases. ($p = 0.0065$). There was a highly significant difference between proportion of complications Arrhythmias, Cardiac Arrest, and Shock when diabetes group compared with Non-diabetes group (i.e. ($p<0.01$) and no significant between proportion of complications Heart failure, Accelerated Hypertension, and Diabetic Ketoacidosis ($p>0.05$). **Conclusion:** Glycosylated haemoglobin (HbA1c) is a significant and early predisposing factor for developing acute sever coronary events. Heart Failures, Cardiogenic Shock and Arrhythmias are common complications seen in ACS with HbA1C >7 % in diabetics and non-diabetics. Admission Hyperglycemia is a poor prognostic marker than Glycosylated Haemoglobin in ACS.

Key Word: acute coronary syndrome.

[*]**Address for Correspondence:**
Dr. Indranil Kulkarni, Junior Resident, Department of Medicine, KIMS, Karad, Maharashtra, INDIA.
Email: coolkarniindranil@gmail.com

Received Date: 02/08/2019 Revised Date: 21/09/2019 Accepted Date: 16/10/2019
DOI: https://doi.org/10.26611/10211223

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 03 November 2019

High admission blood glucose levels after acute coronary events are common and are associated with an increased risk of death in subjects with and without diabetes. [1] Glycosylated hemoglobin specifically measures the number of glucose molecules attached to hemoglobin. In the normal 120-days life span of the red blood cell glucose molecules join hemoglobin, forming glycosylated hemoglobin.[2, 3] Elevated admission glucose levels in non-diabetic patients with AMI are independently associated with larger infarct sizes and a higher long term mortality

How to cite this article: Vinit Ramesh Chaudhary, Indranil Kulkarni. A comparative study of the severity and short-term complications of acute coronary syndrome (ACS) in diabetics and non-diabetics admitted to the intensive coronary care unit (ICCU) in a tertiary care hospital of western Maharashtra. *MedPulse International Journal of Medicine.* November 2019; 12(2): 40-44.
https://www.medpulse.in/Medicine/

rates when compared with patients with normal glucose levels. Glycometabolic state at hospital admission is an important risk marker for long term mortality in patients with acute coronary syndrome. Diabetes is considered as a high risk factor for 'vascular diseases' with both microvascular and macrovascular complications. Macrovascular complications start taking place long before the patient has overt diabetes. Hyperglycemia is an independent risk factor for cardiovascular disease. Hyperglycemia accelerates the process of atherosclerosis by the formation of glycated proteins and advanced glycation end products, which act by increasing the endothelial dysfunction. HbA1c could be considered a good marker of glycated proteins and its assay has been used as a measure of glycemic control in several landmark trials. [1] The Framingham study has shown that the cardiovascular mortality is twice in diabetic men and four times in diabetic women when compared to their non-diabetic counterparts. HbA1c levels of more than 7% are associated with a significant increase in the risk of cardiac events and deaths. [4] Interestingly, this correlation between higher HbA1c levels and increased cardiovascular morbidity occurs even before the diagnosis of clinical diabetes. The association between dysglycemia and risk of CHD may start at levels that are only modestly elevated, well below the glucose threshold for diabetes. Currently, the degree to which mild elevations of HbA1c not in the diabetic range are associated with risk of coronary heart disease (CHD) is unclear. Prospective nested case–control studies in 2 cohorts of US health professionals, found that HbA1c was predictive of CHD risk in participants without diagnosed diabetes and with HbA1c concentrations <6.5%. [4] Measurement of HbA1c is accepted as a useful index of mean blood glucose in the treatment of patients with diabetes. Decisions regarding treatment are often based on HbA1c. HbA1c is a more comprehensive measure of total glycemic exposure than FPG due to the representation of blood glucose in the postprandial state in addition to the fasting state.[5] HbA1c concentration is associated with diabetic microvascular complications, macrovascular complications, risk of death, and cardiovascular disease.[6,7] Acute coronary syndrome (ACS) refers to any group of symptoms attributed to obstruction of the coronary arteries. The most common symptom prompting diagnosis of ACS is chest pain, often radiating of the left arm or angle of the jaw, pressure-like in character, and associated with nausea and sweating. Acute coronary syndrome usually occurs as a result of one of three problems: ST elevation myocardial infarction (30%), non ST elevation myocardial infarction (25%), or unstable angina (38%). [8] Creatinine Kinase (CK) is located in the cytoplasm of cell. 15% of the CK in the myocardium is in the form of CK-MB isoform and the remainder is CK-MM isoform. Maximal plasma levels of CK-MB are reached between 14 and 36 hours after infarction and return to normal levels after 48 to 72 hours. The plasma levels reach reliable diagnostic sensitivity (>90%) within 12 – 16 hours after onset of symptoms. [9] Troponin T and I are part of the sarcomere complex. Following infarction, their plasma levels reach reliable sensitivity (>90%) by 12 to 16 hours and maximal activity is reached by 24 to 36 hours and return to normal levels within 10 to 12 days. [10, 11] A significant proportion of patients with acute coronary syndrome have hyperglycemia, a significant risk factor for adverse outcomes in both diabetic and non-diabetic patients. Acute phase hyperglycemia and diabetes are both associated with adverse outcomes in ACS, with higher reported incidences of congestive heart failure, cardiogenic shock and death. Hyperglycemia, therefore, is seen as an epiphenomenon that is associated with poor outcomes in ACS. The mechanisms underlying the adverse association between hyperglycemia and acute ACS are not fully understood, but multiple hypotheses have been proposed. [12, 13] The present study was undertaken to find out the correlation between HbA1c levels and the severity and complications in diabetic and non-diabetic patients admitted with acute coronary syndrome to the Intensive Coronary Care Unit of a tertiary care hospital of western Maharashtra.

METHODOLOGY

Study design: Cross sectional comparative study.

Study Site: Department of Medicine, in a tertiary level hospital and teaching institute of western Maharashtra.

Study Duration: One year May 2018 – April 2019.

Sample Size and patient selection:

100 patients who came with Acute Coronary Syndrome who fulfilled inclusion / exclusion criteria, were enrolled for the study.

They will be devided in two groups:

(A) Diabetics

(B) Non-Diabetics.

Treatment was given as per standard institute protocol and patients will be fallowed up till discharge and all complications like Arrhythmias, Heart failures, Cardiogenic shock, Accelerated Hypertension, Ketoacidosis will be noted.

All patients underwent routine investigations including

- Haemoglobin
- Complete Blood Count
- Random Blood Sugar Levels (on admission)
- Renal function tests
- Electrocardiogram
- Chest x-ray

- CPK-MB
- HbA1c levels (on admission and irrespective of fasting status of the patient)

Samples were collected after signing a consent for HbA1c levels.

- 2D-Echocardiography for type of Ventricular Dysfunction (Systolic/ Diastolic)

We studied patients of more than 18 years of age who are diagnosed as Acute Coronary Syndrome

- ST segment elevation acute myocardial infarction (STEMI)
- non-ST segment elevation acute myocardial infarction (NSTEMI)
- Unstable Angina (UA)

On the basis of:

- Clinical history
- Examination
- ECG changes
- Biochemical markers and admitted in Krishna Charitable Hospital, Karad.

Inclusion Criteria

- Age above 18 years
- Clinical History (with or without co-morbidities e.g. Ischemic Heart Disease, Diabetes Mellitus, Strokes, Peripheral Thromboembolic Diseases etc.)
- General and Systemic Examination
- ECG changes showing ST elevation MI, non-ST elevation MI and Ischemias
- Positive/ Negative cardiac markers for STEMI / NSTEMI and UA

Exclusion Criteria

- CONGENITAL HEART DISEASE
- PATIENTS IN SEPSIS
- H/O HAEMOGLOBINOPATHIES
- H/O OR CURRENTLY SUFFERING FROM HYPOTHYROIDISM

Chronic Alcoholic or Alcoholic Liver Disease

RESULTS

Table 1: Age and sex wise distribution of Diabetes and Non-diabetes cases under study

Age in years	Diabetes (n=50)			Non-diabetes (n=50)		
	Male	Female	Total	Male	Female	Total
< 30	1	0	1	3	0	3
30-40	3	0	3	3	1	4
40-50	6	2	8	5	2	7
50-60	7	6	13	8	4	12
60-70	11	5	16	7	4	11
>70	8	1	9	9	4	13
Total	36 (72%)	14(28%)	50	35 (70%)	15 (30%)	50
Mean ± SD		58.33±11.15			58.58±16.77	

There were 72% males and 28% females in group A, while 70% males and 30% females in group B. The mean age for Acute Coronary Syndrome in diabetic patients was 58.33 years and non-diabetics it was 58.58 years

Table 2: Distribution of mean and SD values of various parameters inDiabetes and Non-diabetes cases

Parameters	Diabetes (n=50)	Non-diabetes (n=50)	Z test value	'p' value and result
	Mean ± SD	Mean ± SD		
HbA1C	8.06±1.44	6.50±1.01	6.69	p<0.01, highly significant
Random BSL	259.71±123.97	160.47±76.31	4.82	p<0.01, highly significant
CPKMB	81.75±24.49	65.19±25.24	3.33	p<0.01, highly significant

By applying Z test of difference between two sample means there is a highly significant difference between mean HbA1C, random BSL, and CPKMB parameters when diabetes group compared with Non-diabetes group (i.e. (p<0.01).

Table 3: Troponin-I in Diabetes and Non-diabetes cases

Troponin-I	Diabetes (n=50)	Non-diabetes (n=50)
Positive	38(76%)	25(50%)
Negative	12(24%)	25(50%)

Value of $\times^2 = 6.178$, d.f. =1, p= 0.0065, highly significant

By applying Chi-square test there is a highly significant association between Troponin-I in Diabetes and non-diabetes cases

Table 4: Complications in Diabetes and Non-diabetes cases

Complications	Diabetes (n=50)	Non-diabetes (n=50)	Z test value	'p' value and result
Arrhythmias	20(40%)	13(26%)	2.26	p<0.01, highly significant
Heart Failure	15 (30%)	7(14%)	0.80	p>0.05, not significant
Cardiac Arrest	17 (34%)	5(10%)	5.53	p<0.01, highly significant
Accelerated Hypertension	10 (20%)	8 (16%)	0.52	p>0.05, not significant
Shock	19(38%)	4(8%)	3.60	p<0.01, highly significant
Diabetic Ketoacidosis	5(10%)	1(2%)	1.71	p>0.05, not significant

By applying Z test of difference between two sample proportions there is a highly significant difference between proportion of complications Arrhythmias, Cardiac Arrest, and Shock when diabetes group compared with Non-diabetes group (i.e. ($p<0.01$) and no significant between proportion of complications Heart failure, Accelerated Hypertension, and Diabetic Ketoacidosis ($p>0.05$).

DISCUSSION

In our study, the mean age for Acute Coronary Syndrome in diabetic patients was 58.33 years and non-diabetics it was 58.58 years which is comparable with Nseem *et al* [14] with mean age of diabetic patients of 52.8 years and non-diabetics 54.6, Maity Ak *et al* [15] with mean ages of 56.3 and 57.8 of diabetic and non-diabetic patients. Our study also showed that males were more susceptible for ACS in both the groups. i.e. Diabetic males 72% (36/50) and non-Diabetics 70% (35/50) admitted in particular period of this study. In this study, the correlation between HbA1C and Acute Coronary Syndrome was seen even among Non-Diabetic Group (B). The mean HbA1C in this group was 6.5% with +0.6 of SD which is higher than a ADA recommended normal value i.e. 5.6%. It is comparable with Mani *et al* study[1] who reported mean HbA1C of 5.7%. Considering the admission Blood Sugar Levels (Random) in patients admitted with Acute Coronary Syndrome in our Hospital, the Group. A patients (diabetics) had mean BSL of 298.83 with ± 135.62 SD in which mean HbA1C was 8.06 ± 1. In Group B patients (non-diabetics) had mean BSL 160.47±76.31 in which mean HbA1C was 6.50±1.01.

In our study 15/50 (30%) diabetic patients and 7/50 (14%) patients had heart failure fallowing acute coronary syndrome. In 15 diabetic patients, 14 (94%) had HbA1c >7%. Out of 14 patients, 12 (85%) had LV systolic dysfunction on 2-D Echocardiography and 2 (15%) had LV diastolic dysfunction. In 7 non-diabetic patients with heart failure fallowing ACS, 3 (42%) had HbA1C >7%. All of them (100%) had LV diastolic dysfunction on 2-D Echocardiography. This shows the incidence of LV systolic dysfunction is more common and significant in diabetics with HbA1C >7% than non-diabetics. Whereas diastolic dysfunction is more common in non-diabetics with HbA1C >7%. In this study, 20/50 (40%) diabetic patients had arrhythmias fallowing acute coronary syndrome. Out of them 19 (95%) had HbA1c >7%. On further observations, 17 (89%) patients of them had tachyarrhythmias, while only 2 (11%) had CHB (bradyarrhythmias) in which both of them succumbed. While in group of patients with tachyarrhythmias, 6 (35%) died. Sewdarsen M *et al*[17] also reported comparable findings with our study, they reported 48% of diabetic patients had arrhythmias compared to 12% of non-diabetic patients. Cardiac arrest was seen in 34% of diabetic patients compared to 10% of non- diabetics, accelerated hypertension seen in 20% of diabetic patients compared to 16% of non- diabetics, shock was seen in 38% of diabetic patients compared to 4% of non-diabetics. All these complications are seen more commonly in diabetic patients as compared to non-diabetic patients. Similar findings are reported by many studies. [16- 19].In non-diabetic patient's group, 13 (26%) had arrhythmias. Out of which 6 had (46%) had HbA1C >7%. All of them had tachyarrhythmias. In this group 4 (66%) patients died with serious tachyarrhythmias like ventricular tachycardia/ fibrillation. This study showed that the complications of Acute Coronary Syndrome are more common and fatal in diabetics with poor glycemic control and HbA1C >7. But the incidence of same complications when studied in non-diabetics are showing significant figures with HbA1C >7. Tenenbaum A *et al* [18] and Levobitz ME *et al* [19] also reported similar findings. Hence, the severity of a disease (ACS) can be monitored even in non-diabetic patients by estimating the HbA1C value on admission.

CONCLUSION

- Glycosylated haemoglobin (HbA1c) >7% is a significant and early predisposing factor for developing acute sever coronary events like ST-elevation and non-ST-elevation Myocardial Infarction in diabetic and non-diabetic patients.
- High HbA1C >7 is also a significant marker in both the groups as predisposing factors for conditions which are associated with Acute Coronary Syndrome like Hypertension, Ischemic Heart Disease, Strokes and Chronic Kidney

Disease and subsequently high incidence of complications of Acute Coronary Syndrome.

- Heart Failures, Cardiogenic Shock and Arrhythmias are common complications seen in ACS with HbA1C >7 % in diabetics and non-diabetics.
- Admission Hyperglycemia is a poor prognostic marker than Glycosylated Haemoglobin in ACS.

REFERENCES

1. Original Article, Impact of HbA1c on Acute Cardiac States, Journal Of Association Of Physicians, India. June 2011 vol.59 Vinita Elizabeth Mani, Mary John, Rajneesh Calton
2. Proenca MC, Martinsesilva J. Glycosylated haemoglobin – structure, importance and methods of determination. Acta med Port 1981; 3(3): 233-7.
3. Weykamp CW, Penders TJ, Muskiet FAJ, Vanderslik W. Influence of haemoglobin variants and derivatives on glycohaemoglobin determinations as investigated by 102 laboratories using 16 methods. Clin Chem 1993; 39: 171723.
4. Hemoglobin A1c Is Associated With Increased Risk of Incident Coronary Heart Disease Among Apparently Healthy, Nondiabetic Men and Women Leah E. Cahill, Frank B. Hu, Kathryn M. Rexrode, JoAnn E. Manson and Eric
   The Journal of the American Heart Association is published by the American Heart Association, 7272
5. Umpierrez GE, Isaacs SD, Bazargan N, Youx, Thaler LM, Kitachi AE *et al*. Hyperglycemia: an independent marker of in hospital mortality in patients with undiagnosed diabetes. J Clin Endocrinol Metab 2002; 87: 978-82.
6. Davidson Mb, Schriger DL, Peters AL, Lorber B. Relationship between fasting plasma glucose and glycosylated haemoglobin: Potential for false positive diagnoses of type 2 diabetes using new diagnostic criteria. JAMA 1999; 281: 1203-10.
7. Capes SE, Hunt D, Malmberg K, Pathak P, Gerstein HC. Stress hyperglycemia and increased risk of death after MI in patients with and without diabetes: a systemic overview. Lancet 2000; 355: 773-8.
8. Libby P. Mechanisms of acute coronary syndromes. The New England journal of medicine. 2013 Aug 29;369(9):883.
9. Roberts R, Fromm RE. Management of acute coronarysyndromes based on risk stratification by biochemical markers: an idea whose time has come. Circulation 1998; 98:1831-3.
10. Mair J, Morandell D, Genser N, Lechleitner P, Dienstl F, Puschendor FB. Equivalent early sensitivities of myoglobin, creatinine kinase MB mass, Creatinine kinase isoform ratios and cardiac Troponins I and T for acute myocardial infarction. Clin chem 1995; 41:1266-72.
11. Apple FS, Falahati A, Paulsen PR, Miller EA, Sharkey SW. Improved detection of minor ischemic myocardial injury with measurement of serum cardiac troponin I. Clin chem 1997; 43:2047-51.
12. Husband DJ, Alberti KGMM, Julian DG. Stress hyperglycemia during acute myocardial infarction: An indicator of preexisting diabetes? Lancet 1983; 2403:237-41
13. Karlsberg RD, Cryer PE, Roberts R. Serial plasma catecholamine response early in the course of clinical acute myocardial infarction relationship to infarct extent and mortality. Am Heart J 1981; 102:24-9.
14. Naseem A, Moin S. Comparison of Diabetics and Non diabetics presenting with acute myocardial infarction. J Coll Physicians Surg Pak 2002; 12(6):356-60.
15. Maity AK, Sen AK, Chhetri MK. Profile of coronary problems in myocardial infarction in diabetic and non diabetics. JIMA 1980; 84:37-40.
16. Williams SB, Goldfine AB, Timimi FK, Ting HH, Roddy MA, Simanson DC *et al*. Acute hyperglycemia attenuates endothelium dependent vasodilatation in humans in vivo. Circulation 1998; 97: 1695-01.
17. Sewdarsen M, Vythilingum S, Jilal I, Becker PJ. Prognostic importance of admission plasma glucose in diabetic and non diabetic patients with acute myocardial infarction. QJ Med 1989; 265: 461-6.
18. Tenenbaum A, Motro M, Fisman EZ, Boykov, Mandelzweig L, Feicher - Feiss H *et al*. Clinical impact of borderline and undiagnosed diabetes mellitus in patients with coronary artery disease. Am J Cardiol 2000; 86: 1363-6.
19. Levobitz ME. Acute metabolic response to acute myocardial infarction: Changes in glucose utilization and secretion of insulin and growth hormone. Circulation 1969; 39: 171-84.
20. Oswald GA, Smith CCT, Betteridge DT, Yudkin JS. Determinants and importance of stress hyperglycemia in non diabetic patients with myocardial infarction. BMJ 1986; 293: 917-22. 81.

Source of Support: None Declared
Conflict of Interest: None Declared