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Original Research Article

# Angiographic Severity of CAD in Patients with Acute Coronary Syndrome in Correlation to their Glycaemic Status in Tertiary Care Centre of Bihar

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**Abstract**

**Background:** Interventional studies have established that cardiovascular complications are mainly or partly dependent on sustained chronic hyperglycemia. This glycemic disorder can be estimated as a whole from the determination of hemoglobin A1c (HbA1c) level, which integrates both basal and postprandial hyperglycemia. The incidence of cardiovascular complications has been identified as depending on HbA1c and on fasting and/or postprandial hyperglycemia

**Aim and Objectives:** To assess the Angiographic severity of study subjects with acute coronary syndrome and its associations with glycemic status of study subjects.

**Methodology:** The present study is a cross-sectional study. This study was conducted on 100 patients with ACS among which 50 patients who are diabetics and other 50 patients who are non-diabetics admitted in Department of Cardiology, Narayan medical college Jamuhar, Rohtas, South Bihar. Patients who matched the inclusion and exclusion criteria were selected randomly during period of approximately one and a half years formed the study group

**Results:** In non-diabetic group out of 50 study subjects 23 had single vessel disease, 13 subjects had double vessel disease, and 14 subjects had triple vessel involved whereas in diabetic group out of 50 study subjects 23 subjects had single vessel involvement, 5 subjects had double vessel involvement and 22 subjects had triple vessel involvement. On applying chi-square it was non-significant with p value-0.069. In non-diabetic group gensini score was 42.38±28.34, whereas in diabetic group it was 51.28±32.49, on applying t test it was non-significant with p value 0.15.

**Conclusions:** The severity and extent of CAD in diabetics was more compared to non-diabetics. Involvement and occlusion of vessels were more commonly seen in diabetic patients. The incidence of triple vessel or multivessel disease was significantly higher in diabetics. Patients with poor glycemic control with elevated levels of HbA1c had diffuse pattern of atherosclerotic disease and high levels of HbA1c mildly correlated with gensini score.

**Keywords**: CAD, Angiography, HBA1C, Diabetes

## Background

Atherosclerotic vascular diseases, which comprises coronary heart disease and cerebrovascular disease is a major global health burden. They constitute 21.9 per cent of total deaths globally and are projected to increase further to 26.3 per cent by 2030. The prevalence of diabetes is a global health burden. The overall prevalence is expected to rise from 285 million in 2010 to 438 million by the year 2030 [1]. It is well recognized that patients with type 2 diabetes mellitus (DM) exhibit a higher incidence of acute vascular events and of cardiac death than non-diabetic patients. This has been related to the presence of more intense pro-inflammatory, pro-oxidant, and pro-thrombotic stimuli in the former [2].

Interventional studies have established that cardiovascular complications are mainly or partly dependent on sustained chronic hyperglycemia. This glycemic disorder can be estimated as a whole from the determination of hemoglobin A1C (HbA1c) level, which integrates both basal and postprandial hyperglycemia. The incidence of cardiovascular complications has been identified as depending on HbA1c and on fasting and/or postprandial hyperglycemia, whether these parameters were investigated concomitantly or separately [3].

One of the main macrovascular changes associated with diabetes include aggravated atherosclerosis and several vascular beds carry this atherosclerotic burden, that is., abdominal aorta, coronary arteries, carotid arteries, and popliteal arteries. Estimation of arterial atherosclerotic burden is being investigated as a surrogate marker for evaluation of the risk of coronary artery disease (CAD) and also as a screening tool.6 Atherosclerosis is a diffuse process, the central mechanism in peripheral arterial disease (PAD) and CAD being accelerated atherosclerosis is caused by endothelial dysfunction and dyslipidemia. PAD is associated with an increase in the incidence of multivessel and severe CAD and is a risk factor for major adverse cardiovascular events [4].

The prevalence of Coronary Heart Disease rises from 2% to 4% in the general population to as high as 55% among adult diabetic patients. The overall mortality from heart disease is twice as great in men and is 4 to 5 times higher in women with DM than without DM. Cardiovascular disease represents over one-half of all deaths in both type 1 and type 2 DM [5].

Diabetic patients when compared to non-diabetic have an increased risk of developing vascular complications and have two to the four-fold risk of developing coronary artery disease. The state of chronic hyperglycemia has been now measured by HbA1c, which averages the blood sugar levels of both fasting and postprandial states. Presenting high blood sugar levels has been considered as an independent risk factor of death in patients with or without diabetes. High blood sugar levels at admission can either be diabetes or due to stress hyperglycemia or impaired glucose tolerance. Hence, it is important to study the spectrum of clinical presentation and the patterns of involvement of coronary artery disease in both diabetics and non-diabetics [6].

This study was conducted with the aim to assess the Angiographic severity of study subjects with acute coronary syndrome and its associations with glycemic status of study subjects. Also an attempt was made to find, how ACS in diabetics differ from that of non-diabetics, with special interest on their angiographic profile

## Material and Methods

The present study is a cross-sectional study. This study was conducted on 100 patients with ACS among which 50 patients who are diabetics and other 50 patients who are non-diabetics admitted in Department of Cardiology, Narayan medical college Jamuhar, Rohtas, South Bihar. Patients who matched the inclusion

and exclusion criteria were selected randomly during period of approximately one and a half years formed the study group.

**Inclusion Criteria**

Group 1(Diabetic): Previously known diabetic or first time detected diabetic by American Diabetes Association (ADA) criteria presenting with ACS

Group 2(Non-Diabetic): Cases presenting with acute coronary syndrome that is non-diabetic or not fulfilling ADA criteria.

**Exclusion Criteria**

Patients having impaired fasting glucose presenting with ACS, Following investigations were done after selection: Fasting blood glucose levels by collection method, Random blood glucose levels, HbA1c in diabetic and newly detected diabetes mellitus patients, Complete haemogram, Blood urea, Serum creatinine, Lipid profile, Cardiac enzymes-CPK-MB/LDH/SGOT, ECG, 2D ECHO, Treadmill Test (TMT) and Coronary Angiogram.

Patients coming with complaints of acute chest pain, breathlessness were diagnosed to have ACS based on ECG and cardiac enzymes. RBS, FBS were done for all the patients. HbA1c was sent in patients who's RBS or FBS was in higher range to confirm newly detected diabetes and in all diabetic patients to know the glycemic control.

Patients with ACS, both diabetics and non-diabetics were treated and once they were stabilized were taken up for coronary angiography which was performed by the standard Judkin's technique after adequate preparation. The indication for performing coronary angiography was unstable angina NSTEMI and STEMI and post infarct angina.

Severity of lesions as noted in angiography was graded as follows:

Grade 0: No disease

Grade 1: Intimal disease <50% stenosis

Grade 2: 50-69% stenosis

Grade 3: 70-95% stenosis

Grade 4: 96-99% stenosis

Grade 5: Total occlusion

Coronary artery narrowing of more than or equal to 70% was considered as significant stenosis.

HbA1c was done in all the diabetics' patients and in newly detected T2DM patients. We classified the diabetic patients with their HbA1c control as <7 is good control, 7 – 8.5 is fair control and >8.5 poor control. Depending on the angiographic findings, further treatment was planned whether the patient requires medical line of management, PTCA or CABG. Angiographic parameters and further treatment required were compared between diabetic patients and non-diabetic patients with ACS.

**Statistical Analysis**

Categorical data was expressed as number and percentages. Chi-square test was used to determine any significant difference between two groups. A p-value of less than 0.05 was considered for statistical significance. Chi-square test: O: Observed frequency E: Expected frequency Fisher's exact probability test. F = PA or PB PA = Probability A PB = Probability B

**Result**

Figure 1 Shows Distribution of study subjects as per age in both the groups, the mean age in the diabetic group was 56.54±8.42 yr whereas in non-diabetic grp it was 60.42±10.15 yrs. On applying T test it was significant with p value 0.04.

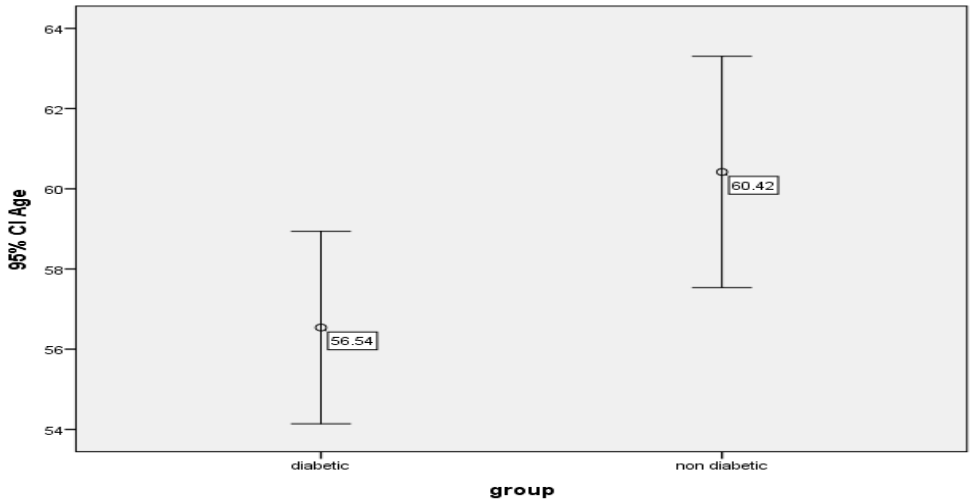


**Figure 1: Distribution of study subjects as per age in both the groups**

**Table 1: Distribution of study subjects as per gender in both the study group**

| | | Group | | Total |
|---|---|---|---|---|
| | | Diabetic | Non diabetic | |
| Sex | Male | 36 | 18 | 54 |
| | Female | 14 | 32 | 46 |
| Total | | 50 | 50 | 100 |
| Chi-square value- 13.04, p value-0.0, significant | | | | |

Table 1 shows Distribution of study subjects as per gender in both the study group, in diabetic group 36 male were present whereas in non-diabetic group only 18 male were present. On applying chi-square there is significant difference between two groups with p value 0.0

**Table 2: Distribution of study subjects as per the type of MI**

| | | Group | | Total |
|---|---|---|---|---|
| | | Diabetic | Non Diabetic | |
| STEMI | Absent | 27 | 11 | 38 |
| | Present | 23 | 39 | 62 |
| Total | | 50 | 50 | 100 |
| Chi-Square Value- 10.86, P Value- 0.001, Significant | | | | |

Table 2 shows Distribution of study subjects as per the type of MI, In diabetic group out of 50 23 study subjects had STEMI whereas in non-diabetic group 39 study subjects were had STEMI. This higher value of STEMI in non-diabetic is statistically significant with p value-0.001.

**Table 3: Associations of vessel involved and diabetic status of study subjects**

| | | Group | | Total |
|---|---|---|---|---|
| | | Non-Diabetic | Diabetic | |
| Vessel | Single | 23 | 23 | 46 |
| | Double | 13 | 5 | 18 |
| | Triple | 14 | 22 | 36 |
| Total | | 50 | 50 | 100 |
| Chi-square value- 5.33, p value – 0.069, non-significant | | | | |

Table 3 shows associations of vessel involved and diabetic status of study subjects, In non-diabetic group out of 50 study subjects 23 had single vessel disease, 13 subjects had double vessel disease, and 14 subjects had triple vessel involved whereas in diabetic group out of 50 study subjects 23 subjects had single vessel involvement, 5 subjects had double vessel involvement and 22 subjects had triple vessel involvement. On applying chi-square it was non-significant with p value-0.069

**Table 4: Associations of Gensini score and diabetic status of study subjects**

| Group | Mean | N | Std. Deviation |
|---|---|---|---|
| Non- Diabetic | 42.38 | 50 | 28.341 |
| Diabetic | 51.28 | 50 | 32.491 |
| Total | 46.83 | 100 | 30.660 |
| T test applied, t value- 1.46, p value- 0.15, non-significant | | | |

Table 4 shows Associations of Gensini score and diabetic status of study subjects, in non-diabetic group gensini score was 42.38±28.34, whereas in diabetic group it was 51.28±32.49, on applying t test it was non-significant with p value 0.15.

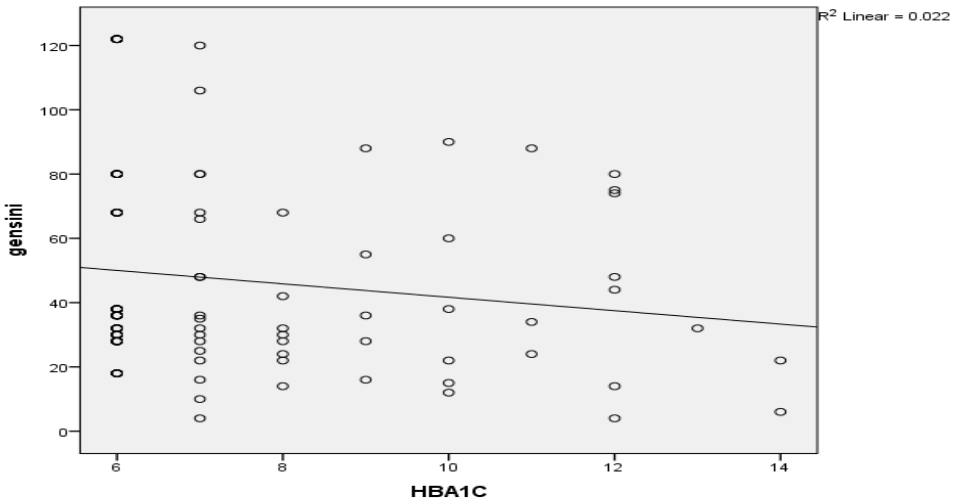


**Figure 2: Association of Gensini score and HBA1C**

Figure 2 shows Association of Gensini score and HBA1C, on applying regression analysis we found there is mild association with R square 0.022

**Table 5: Blood investigation of diabetic and non-diabetic study subjects**

| Group | | Total Cholesterol | TGL | HDL | LDL | EF |
|---|---|---|---|---|---|---|
| Non-Diabetic | Mean | 179.74 | 141.10 | 37.58 | 127.86 | 59.08 |
| | N | 50 | 50 | 50 | 50 | 50 |
| | Std.Deviation | 47.196 | 58.816 | 12.244 | 42.636 | 11.257 |
| Diabetic | Mean | 199.30 | 158.02 | 34.64 | 129.04 | 54.20 |
| | N | 50 | 50 | 50 | 50 | 50 |
| | Std. Deviation | 42.859 | 38.035 | 4.763 | 29.674 | 13.859 |
| | | TValue-2.17, P Value-0.03 | T Value-1.71,P Value-0.09 | T Value-1.58,P Value-0.11 | T Value-0.16,P Value-0.87 | T Value-1.93,P Value-0.056 |

Table 5 shows Blood investigation of diabetic and non-diabetic study subjects, The mean total cholesterol was 179.74±47.19 in non-diabetic group whereas 199.30±42.86 in diabetic group with significant difference having p value-0.03, mean triglyceride level was 141.10±58.82 in non-diabetic group whereas 158.02±38.03 with non-significant difference having p value 0.09, HDL was 37.58±12.24 in non-diabetic group whereas 34.64±4.76 in diabetic group, with non-significant difference (p value= 0.11), LDL was also higher in diabetic group but non-significant( 127.86±42.64 vs 129.04±29.67, p value-0.87)

## Discussion

A total of 100 patients (50 diabetics and 50 non-diabetics) admitted with acute coronary syndrome during the study period were analysed. We compared the mean age, sex, risk profile, lipid abnormalities, clinical profile, type of ACS among each group. Correlation between glycemic status according to FBS, PPBS, HbA1c levels and severity of CAD assessed by gensini score were analysed.

In our present study the mean age in the diabetic group was 56.54±8.42 yr whereas in non-diabetic group it was 60.42±10.15 yrs. On applying T test it was significant with p value 0.04. In the *GUSTO-1*[7] trial, it was observed that diabetic patients were younger when compared to non-diabetic patients; similar results were observed in our study. Study by Srinidhi Hegde *et al* [8] shows that the peak incidence of ACS in diabetics with poor glycemic control was in the third and fourth decade as compared to fifth and sixth decade in non-diabetics. This finding correlated with DiabCare Asia--India Study: diabetes care in India–current status [9].

In the present study in diabetic group 36 male were present whereas in non-diabetic group only 18 male were present. On applying chi-square there is significant difference between two groups with p value 0.0. Study by Srinidhi Hegde *et al* [8] shows in their study the incidence of ACS in males was 68% in diabetics and 80% in non-diabetics. In females the incidence of ACS was 32% in diabetics and 20% in non-diabetics. The risk of developing ACS in females was more in diabetics compared to non-diabetics. This risk was doubled when the female patients had features of syndrome X.

In both the groups, ST elevation myocardial infarction was the most common type of ACS. In diabetic group out of 50 study subjects 23 study subjects had STEMI whereas in non-diabetic group 39 study subjects were had STEMI. This higher value of STEMI in non-diabetic is statistically significant with p value-0.001. This may indirectly denote that prothrombotic mechanisms may be responsible for ACS among these groups.

The mean total cholesterol was 179.74±47.19 in non-diabetic group whereas 199.30±42.86 in diabetic group with significant difference having p value-0.03, mean triglyceride level was 141.10±58.82 in non-diabetic group whereas 158.02±38.03 with non-significant difference having p value 0.09, HDL was 37.58±12.24 in non-diabetic group whereas 34.64±4.76 in diabetic group, with non-significant difference (p value= 0.11), LDL was also higher in diabetic group but non-significant( 127.86±42.64 vs. 129.04±29.67, p value-0.87)

A role for LDL in diabetic patients in promoting coronary heart disease in recent clinical trials, e.g., the Scandinavian Simvastatin survival Study (4S) [10], the Cholesterol and recurrent Events (CARE) trial [11] and the Long-Term Intervention with Pravastatin in Ischemic Disease (LIPID) [12] has been well established. All these trials have shown that aggressive LDL-lowering therapy reduces recurrent CHD events in patients with diabetes.

Multi vessel involvement was more in diabetics. In non-diabetic group out of 50 study subjects 23 had single vessel disease, 13 subjects had double vessel disease, and 14 subjects had triple vessel involved whereas in diabetic group out of 50 study subjects 23 subjects had single vessel involvement, 5 subjects had double vessel involvement and 22 subjects had triple vessel involvement. On applying chi-square it was non-significant with p value-0.069. There are a number of studies showing higher involvement of multi vessel disease in Diabetes [13].

Similar results have been found in other studies using gensini score. Study by Srinidhi hegde *et al* [8] shows coronary angiography revealed that the incidence of multivessel disease in diabetics was much higher (50%) compared to non-diabetics which was only 16%. This finding correlates with the other study by Singh RB,Niaz MA *et al* [14], showed higher incidence of MVD in diabetics (57.3%) compared to 41.3% in non-diabetics. In another study conducted at CMC Vellore also showed that MVD was more common in diabetics (87.5% Vs. 79.6%) in two separate groups of 516 diabetic and non-diabetic patients.

In a study by Henry *et al*. [15], showed patients with diabetes had moderate (50% to 75% narrowing) stenosis much more frequently than patients without diabetes (50.6 versus 30.3%, $p < 0.001$). Moreover, diabetes mellitus was an independent risk factor for moderate stenosis. The lesions were more frequently located on distal arteries; more frequently had a pattern of three-vessel disease, and had a trend toward more diffuse disease. Sousa JM *et al*. [16] showed severe three-vessel disease was significantly more frequent in diabetic patients (28% x 10%), as well as totally occluded vessels: 51 (23%) x 54 (14.3%), $p < 0.005$. Additionally, ejection fraction < 50% was more common in diabetic patients confirming the diffuse pattern of atherosclerotic disease in diabetic patients.

When comparing the association between HbA1c levels to the severity of CAD in diabetic patients, there was no statistically significant correlation between them. But among pre-diabetics there was a positive linear correlation identified between the HbA1c levels and gensini score. In non-diabetic group gensini score was 42.38±28.34, whereas in diabetic group it was 51.28±32.49, on applying t test it was non-significant with p value 0.15. Ayhan *et al* [17] had found positive linear correlation between hbA1c levels and severity of CAD in diabetes patients, our study did not show any relation between them.

## Conclusions

The severity and extent of CAD in diabetics was more compared to non-diabetics. Involvement and occlusion of vessels were more commonly seen in diabetic patients. The incidence of triple vessel or multivessel disease was significantly higher in diabetics. Patients with poor glycemic control with elevated levels of HbA1c had diffuse pattern of atherosclerotic disease and high levels of HbA1c mildly correlated with gensini score. Hence, routine HbA1c levels to be measured and adoption of lifestyle changes and medications that decrease cardiovascular complications and morbidity from diabetes mellitus.

## Limitation

1. Number of patients in the study is small. Hence more studies on pre-diabetics and non-diabetics are needed in future
2. Duration of study is short, Hence follow up of patients was not included in the study
3. Possible underlying mechanism (such as insulin resistance, pro-thrombotic work up) in Pre-diabetic patients was not studied. Large prospective studies in pre-diabetic patients are needed in future for better understanding and planning managementstrategies.

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