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Medicine

STUDY OF CLINICAL PROFILE OF PATIENTS WITH ACUTE CORONARY SYNDROME WITH SPECIAL REFERENCE TO DIABETES MELLITUS

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ABSTRACT

BACKGROUND: Acute Coronary Syndrome (ACS) comprising of STEMI, NSTEMI, and unstable angina is the leading cause of morbidity and mortality in the world. HbA1c can be used as a biochemical marker to differentiate chronic hyperglycemia from stress hyperglycemia in the setting of ACS. Therefore, this study was planned to find out the prognostic value of HbA1c at the time of admission in preventing the complications and to see the outcome in patients after ACS. **AIMS AND OBJECTIVES:**
1) To study the chemical, biochemical, and angiographic profiles of diabetic patients presenting with acute coronary syndrome.
2) To evaluate and assess the conventional risk factors in patients of acute coronary syndrome with diabetes mellitus.
MATERIALS AND METHODS: All the patients whose age was ≥18 years and fulfilling the inclusion criteria were included in the study. All required investigation was done and data were collected. All the patients were divided into two groups based on HbA1c and the patients followed until discharge from the hospital or mortality. **Results:** A total of 50 ACS patients were taken. Out of them, maximum (34%) were in the age group of 41-50 years with 52% males and 48% females. The most common complication was heart failure (15.3%) and arrhythmias (15.3%) with equal prevelance, thromboembolism (2%), pericarditis (2%), and stroke (1%). Mortality was present in 20.8% of the patients in group A and 30.8% of group B patients. Group A comprised 24 patients with HbA1c < 10.2% and Group B comprised 26 patients with HbA1c ≥ 10.2%.. STEMI was more common in Group A and NSTEMI and unstable angina were more common in Group B . **CONCLUSION:** We concluded from our study that there is a significant correlation of HbA1c with post ACS complications like thromboembolism, heart failure, arrhythmias and the hospital stay and mortality after ACS

KEYWORDS : Acute coronary Syndrome, Diabetes Mellitus, Hyperglycemia.

INTRODUCTION

Acute coronary syndrome (ACS) signifies clinical symptoms which are compatible with acute myocardial ischemia and includes the variants of clinical conditions scaling from unstable angina (UA) to non-ST segment elevation myocardial infarction (NSTEMI) to ST-segment elevation myocardial infarction (STEMI). Unstable angina and NSTEMI are nearly similar conditions: their clinical presentation and pathophysiology are almost similar, but their severity differs. A diagnosis of NSTEMI is established when the ischemia is severe enough to cause myocardial damage causing the release of a biomarker of myocardial necrosis into the circulation (cardiac-specific troponins T or I, or muscle and brain fraction of creatine kinase [CK-MB]. On contrary, the patient is said to have UA if no such biomarker is present in the bloodstream even after hours of the onset of ischemic chest pain.

The presence of unstable angina can be:
(1) rest angina (lasting >20 minutes),
(2) if the onset is recent (<2 months previously) severe angina, and
(3) a pattern of occurrence is ascending (increasing in intensity, duration, frequency, or any combination of above factors).
(4) Diabetes if uncontrolled leads to certain complications deteriorating the patient to such an extent that ends up with multiorgan failure. The microangiopathic changes in Diabetes are seen due to changes in the microvasculature, producing extracellular matrix protein synthesis, and capillary basement membrane thickening. These changes along with exponential end products of glycation, oxidative stress, and new vessel formation in vasa vasorum can lead to macrovascular complications. Raised blood sugar levels are the main cause of changes in both small and large blood vessels.

(5) Glycated hemoglobin (HbA1c) is a chemically linked sugar molecule. In the human bloodstream, most of the monosaccharides like glucose, galactose, fructose bind with the hemoglobin in a non-enzymatic manner. Among the bound monosaccharides it was found that fructose was 13% and 21% was galactose, but the rest and major monosaccharide was glucose. This gives indirect evidence that glucose is the primary metabolic fuel in humans.

(6) In Diabetes the formation of the sugar-Hb linkage indicates the presence of excessive sugar in the bloodstream of a human and A1C is of specific interest because it is easy to test.

(7) Glycation is a process by which sugars attach to hemoglobin. HbA1c is a measure of the beta-N-1-deoxy fructose component of hemoglobin in the bloodstream.

HbA1c can be used as a diagnostic test for diabetes mellitus as it measures the three months average blood sugar levels and helps in assessing glycemic control. The reason behind this is that the average lifecycle of RBCs is only three months. As the plasma levels of glucose increase, the levels of HbA1c also increase. Higher the HbA1c levels, poorer the glycemic control, and more are the chances of cardiovascular disease, nephropathy, neuropathy, and retinopathy. IDENTIFYING PATIENTS FOR ANGIOGRAPHY AND REVASCULARIZATION

The patient's clinical characteristics and the results of non-invasive testing are used to identify patients likely to benefit from coronary angiography followed by revascularization of appropriate lesions. In patients with chronic coronary syndrome (CCS), there are two primary indications for this:

1) Angina that significantly interferes with a patient's lifestyle despite maximal tolerable medical therapy.

2) Patients with clinical characteristics and results of non-invasive testing that indicate a high likelihood of severe ischemic heart disease (ex. imaging or strongly positive treadmill test suggesting a large amount of viable myocardium at risk).

Additionally, patients with depressed left ventricular systolic function (ejection fraction <50 percent) and moderate risk criteria on non-invasive testing with demonstrable ischemia may benefit from coronary angiography.

Revascularization is performed in appropriate patients in whom angiography reveals anatomy for which revascularization has a proven benefit or in whom medical therapy has failed. Indications for angiography and revascularization and the choice of technique are discussed elsewhere.

MATERIALS AND METHODS

A total of 50 patients admitted to the medical wards and ICCU in the department of General Medicine MMIMSR with the acute coronary syndrome (ACS) with prior history of diabetes mellitus were included in the study.

STUDY DESIGN: HOSPITAL-BASED PROSPECTIVE OBSERVATIONAL STUDY

1. This was the hospital-based prospective observational study in which the patients with the mentioned criteria were included. On

arrival to the hospital and before any intravenous (IV) therapy was started, venous blood was drawn for blood sugar and HbA1c determination.

2. All patients who presented with chest pain were screened for the study and the patients with newly diagnosed ACS were included in the study. Only patients with HbA1C > 6.5 were included.

3. A total of 50 patients were compared and a relationship between HbA1c and outcome in ACS patients was established.

4. The patients were followed up for 7 days for any complications of ACS like heart failure, arrhythmias, pericarditis, cardiac arrest, myocardial rupture, stroke, ventricular aneurysm, and death.

STUDY DURATION: October 2019 to May 2021 (18 months)

ETHICAL CONSIDERATION:

Ethical approval was obtained from The Institutional Review Board as per letter no. 1213 and the protocol of the study was approved. Consent for the participation in the study was obtained from all the patients or their relatives. Those not willing to participate in the study were excluded. This study utilized only data that was bound to be collected from the participants as part of their clinical evaluation.

INCLUSION CRITERIA:

1. Patients with Acute Coronary Syndrome (including Acute myocardial infarction (AMI) both ST elevation (STEMI) and non-ST elevation (NSTEMI) and unstable angina) presented within 48hrs.
2. Age > 18yrs.
3. Patients with HbA1c > 6.5.
4. Patients who were willing to participate.

EXCLUSION CRITERIA:

1. Patients who refused to participate.
2. Patients with stable angina.
3. Patients with moderate to severe anemia.

DATA COLLECTION

A total of 50 patients with the acute coronary syndrome (ACS) in the Department of General Medicine in MMIMSR confirmed by ECG and cardiac enzymes who met the inclusion and exclusion criteria were included.

Each patient in the study was explained the aims and objectives of the study and was required to sign an informed consent written in the patient's vernacular language before his /her inclusion. They were worked up in detail, regarding their symptoms and clinical presentation. Detailed physical examination of the patients including general and systemic examination was done.

The term ACS is applied to patients in whom there is a suspicion or confirmation of myocardial ischemia. There are three types of ACS: ST-segment elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina (UA). The first two are characterized by a typical rise and/or fall in troponin with at least one value > 99 percent upper reference limit (URL) (Braunwald and Morrow 2013).

UA is considered to be present in patients with ischemic symptoms suggestive of an ACS without elevation in biomarkers with or without ECG changes indicative of ischemia (Cannon et al. 1997).

UA and NSTEMI are frequently indistinguishable at initial evaluation and ST-segment and/or T wave electrocardiographic changes are often persistent in NSTEMI, while they are usually transient in UA (Habib et al. 2020).

ST-segment depression is defined by a horizontal or down-sloping ST-segment that is depressed ≥0.05 mV below the baseline, measured at 0.08 seconds after the J point, in two contiguous leads. The TP segment should be used as the baseline, and the PR interval used only if there is no obvious TP segment. The strongest correlation with ischemia is with a down sloping or horizontal ST-segment depression.

The ST-segment elevation is considered to be pathologic if the ST-elevation, measured at the J point, must be ≥0.1 mV, except for leads V2 to V3, where it needs to be ≥0.2 mV in men ≥40 years, ≥0.25 mV in men <40 years, and ≥0.15 mV in women (Braunwald and Morrow 2013). However, the ST-segment elevation can be caused by states other than myocardial ischemia.

The joint European Society of Cardiology/American College of Cardiology Foundation/American Heart Association/World Heart Federation (ESC/ACCF/ AHA/WHF) committee for the Fourth Universal Definition of MI recommended the following ECG criteria for the diagnosis of non-ST elevation MI: new horizontal or down sloping ST-depression ≥0.5 mm in two contiguous leads and/or T inversion >1 mm in two contiguous leads with prominent R wave or R/S ratio >1 (Habib et al. 2020).

Isolated T wave changes in the absence of ST changes are less frequently seen with acute ischemia, except for the presence of symmetrically inverted T waves after an episode of clinical ischemia (Wellens sign), which suggests proximal left anterior descending stenosis. T wave inversions are defined as ≥0.1 mV in two contiguous leads.

The diagnosis of ACS was also done by Roche's cardiac Troponin T sensitive test which is a rapid card-based visual test. It is based on qualitative detection of troponin in anticoagulated (EDTA or heparin) venous whole blood and it is a proven test strip technology that gives results in 15-20 minutes.

Standard 12 lead ECG was recorded on ECG machine of BPL company, model number CARDIOLINE ECG200+ in all the 100 ACS patients and diagnosis of ACS was done based on ECG findings such as new-onset LBBB, Q waves, ST elevation, and non-ST elevation and were then classified into ST-elevation MI(STEMI), non-ST elevation MI(NSTEMI) and T wave inversions.

Laboratory measurements were done on blood samples drawn as soon as possible after admission.

HbA1c was measured using a high-performance immunoturbidimetry test using anti HbA1c cross-linked antihuman hemoglobin A1c mouse monoclonal antibody on MMIMSR laboratory machine (Erba Mannheim XL). This method is standardized according to the approved IFCC reference method.

CPK-MB was measured using an MBI Flex reagent cartridge on the MMIMSR laboratory machine (Dimension RxL Max) with a normal range between 7- 25U/L and diagnosis of ACS was made if the CPK-MB was elevated 3 times the upper limit of the normal range.

STATISTICAL ANALYSIS

The data collected was compiled on an excel sheet and was analyzed statistically by using SPSS version 21.0 software. The Chi-square test was used for qualitative variables. Mean and standard deviation was calculated for quantitative variables. Independent t-test and Mann-Whitney test were used to compare the means of quantitative variables. P-value of < 0.05 was taken as significant.

FUNDING

The parameters that were used in the study were routinely obtained in all the patients admitted with ACS, hence no extra funding was required for the completion of this work.

Results:

A total of 50 ACS patients were taken. Out of them, maximum (34%) were in the age group of 41-50 years with 52% males and 48% females. The maximum number of patients (88%) were overweight according to the BMI scale. The maximum risk factor was smoking (64%) among all the subjects. A total of 50 ACS patients were taken and the vitals were assessed and it was observed that systolic BP was deranged in 40(80%) of the subjects and normal in 10 (20%) of the subjects, diastolic BP was deranged in 23(46%) of the subjects and normal in 27(54%) of the subjects, respiratory rate was deranged in 13(26%) of the subjects and normal in 37(74%) of the subjects, heart rate was deranged in 5 (10%) of the subjects and normal in 45 (90%) of the subjects and temperature was within normal limits in all the patients.

The mean Systolic BP was 111.8 ± 34.68 mm of Hg, mean Diastolic BP was 69.20 ± 17.12 mm of Hg, mean Heart rate was 83.46 ± 10.08, mean Respiratory rate was 20.12 ± 2.24 and the mean Temperature (in Fahrenheit) was 98.65 ± 0.55 in all the study subjects.

Fig. 1

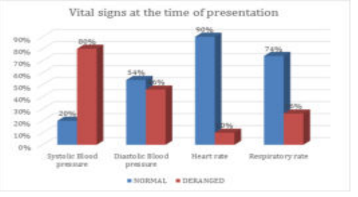

Table 4: Distribution of anthropometric parameters of study subjects.

Anthropometric parameters	Frequency	Percentage
Body mass index(kg/m²)		
18.5-24.9{Normal BMI}	2	4.00%
25-29.9(Overweight}	44	88.00%
>=30{Obese}	4	8.00%
Mean ± SD	27.27 ± 1.72	
Median (IQR)	26.89 (26.07-28.45)	
Range	24.28-31.64	
Weight (in kg)		
Mean ± SD	76.80 ± 10.55	
Median (IQR)	76(67.75-84)	
Range	60-102	
Height (in meter)		
Mean ± SD	1.67 ± 0.09	
Median (IQR)	1.68(1.58-1.76)	
Range	1.53-1.82	

Fig. 2

A total of 50 ACS patients were taken and BMI was measured on presentation. Out of 40, 2 (4%) had normal BMI, 44 (88%) were overweight and 4 (8%) were obese with a mean BMI of 27.27 ± 1.72 kg/m2. The mean height and weight among the study subjects were 1.67 ± 0.09 meters and 76.80 ± 10.55 kg respectively.

Among the 50 ACS patients, 58% had STEMI, 28% had unstable angina and 14% had NSTEMI. Trop T was positive in 100% of patients. Total cholesterol was increased by 42%, Triglycerides were increased by 46%, HDL was decreased by 6% and LDL was increased in 40% in total 50 of the studied patients. RBS on presentation was increased in 4% and normal in 96% of the patients. The mean duration of hospital stay was 2 ± 0.5 days. Complications of ACS were present in 60% of the patients and no complications were present in 40% of the patients. A total of 50 subjects of ACS were taken and all the subjects were divided into 2 groups based on HbA1c <10.2and HbA1c ≥10.2and type of complications were observed between the 2 groups. Over all more complications were present in the Group B and the heart failure which was not found to be significant.

The most common complication was heart failure (15.3%) and arrhythmias (15.3%) with equal prevelance, thromboembolism (2%), pericarditis (2%), and stroke (1%). Mortality was present in 20.8% of the patients in group A and 30.8% of group B patients. Group A comprised 24 patients with HbA1c < 10.2% and Group B comprised 26 patients with HbA1c ≥ 10.2%. STEMI was more common in Group A and NSTEMI and unstable angina were more common in Group B which was statistically significant with a p-value of 0.002. Urea, creatinine, and Triglycerides were more deranged in Group B which was statistically significant. Patients in Group B had a statistically significant duration of hospital stay as compared to Group A. More complications were present in Group B as compared to Group A (30 vs. 20) which was statistically significant with a p-value of 0.300. Heart failure was the most common complication in Group B, 4(15.3%) along with arrhythmias 4(15.3%) whereas the most common complication in Group A was thromboembolism and stroke with equal prevalence i.e.,3 (12.5%). More mortality was observed in Group B as compared to Group A 13 (30.8%) vs. 5 (20.8%) which was not statistically significant.

CONCLUSION: We concluded from our study that there is a significant correlation of HbA1c with post ACS complications like thromboembolism, heart failure, arrhythmias and the hospital stay and mortality after ACS. Hence glycated hemoglobin at admission, representing chronic hyperglycemia is a good predictor of cardiovascular outcome in patients of ACS. HbA1c helps us to differentiate on admission hyperglycemia due to stress from chronic hyperglycemia in ACS patients and hence early detection of this biochemical marker may help to predict a higher incidence of complications and mortality after ACS.