

## Prognostic Importance of White Blood Cell Count and Plasma Glucose Level on Admission in Acute Myocardial Infarction

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### Abstract

**Background:** Coronary artery disease (CAD) is the leading cause of morbidity and mortality worldwide. During recent years, many studies are directed towards the evidence that the concomitant occurrence of high white blood cell count and hyperglycemia in patients with an acute myocardial infarction (MI) enhances the risk of mortality and morbidity, with or without diabetes. **Aims and objectives:** To determine the relationship of admission white blood cell count and plasma glucose levels in hospital mortality in non-diabetic myocardial infarction patients. **Methods:** A study of 100 non-diabetic acute myocardial infarction patients was carried out in the Medicine department, Guru Nanak Dev Hospital attached to Government Medical College, Amritsar. Patients were divided among following groups - admission plasma glucose level as low (<140 mg %), medium (140-180 mg %), high (>180 mg %) and white blood cell count as high (>11000cu/mm), low (<11000cu/mm). All cases were examined and investigated and followed up for any complication like cardiogenic shock or death during their hospitalization period. Data derived was analyzed using appropriate statistical methods across the groups. **Conclusion:** It was concluded from the study that in non-diabetic patients on admission high WBC count and hyperglycemia are independently associated with a higher risk of in-hospital mortality.

**Keywords:** Acute myocardial infarction, Hyperglycemia, Diabetes, Cardiogenic shock

### INTRODUCTION

Coronary artery disease (CAD) is the most common type of cardiac disease and the leading cause of morbidity and mortality worldwide. Deaths related to CAD occur 5 to 10 years earlier in

Indian sub-continent than in Western countries.<sup>[1]</sup>

The morbidity and mortality of a diabetic patient suffering an acute myocardial infarction (AMI) is more than that of a non-diabetic patients.<sup>[2]</sup> Elevated glucose levels on admission in

non-diabetic patients with AMI are independently associated with large infarct size and a higher mortality rate when compared with patients with normal glucose levels.<sup>[3,4]</sup> The pathological mechanism of hyperglycemia induced by AMI is explained as following- stress during the myocardial infarction as a possible reason.<sup>[5]</sup> A positive association between hyperglycemia at the time of the event and subsequent mortality from AMI has frequently been reported.<sup>[6,7]</sup> Evidence also supports the prognostic value of baseline glucose levels among acute myocardial infarction (AMI) patients in the reperfusion era.<sup>[8,9]</sup>

One of such baseline parameters used to determine the severity of AMI is white blood cell count. Leukocytosis contributes to severe myocardial infarction by involving pathologic processes such as inflammation leading to hypercoagulable condition and microvascular obstruction.<sup>[10]</sup>

## MATERIALS AND METHODS

The present prospective study was conducted on 100 patients of both genders with acute myocardial infarction attending medical emergency of Guru Nanak Dev Hospital Amritsar, attached to Govt. Medical College Amritsar. Patients were grouped on the basis of admission White blood cell counts as -Low <11000cu/mm, High >11000cu/mm and plasma glucose level as-Low <140mg/dl, Medium 140-180mg/dl, High >180 mg/dl groups. Presence and severity of heart failure as

outcome in acute myocardial infarction patients was measured using the Killip's classification.<sup>[11]</sup>

The patients with preexisting diabetes, who received dextrose containing fluids before admission, post-surgical patient and those taking drugs e.g. corticosteroids, barbiturates, oral contraceptives etc. were excluded from our study. ECG, RBS, HbA1c, WBC count, TROP-T, CPK-MB and Lipid profile were performed. Patients were followed throughout the hospital stay for any complication like cardiogenic shock or death.

The above data were collected and tabulated and comparison of admission RBS and white blood cell count with in-hospital mortality was analyzed using version 22 of the Statistical Package for Social Sciences (SPSS, published IBM Inc.). Chi-square test and one-way analysis of variance (ANOVA) tests were performed. Bivariate correlation using Pearson's method was used to identify different correlates of death as outcome.

## RESULTS

A total of 100 patients included in the study were divided on the basis of admission RBS as groups- Low<140mg/dl (51 patients), Medium 140-180mg/dl (25patients), High >180mg/dl (24 patients) and based on admission WBC count as groups - Low<11000 cu/mm (41patients), High >11000cu/mm (59 patients). Mean age of patients in present study was 60.19±10.47 years with female

predominance and female to male ratio was 1.17:1.

**Table 1:** Correlation of Various Clinical Parameters and Mortality

VARIABLE	N	P [WBC GROUP]	P [RBS GROUP]
Mean Age	100	>0.01	0.115
Systolic BP	100	0.0001*	0.059
Diastolic BP	100	0.014*	0.076
Mean RBS	100	0.001*	0.0001*
Mean WBC Count	100	<0.001*	0.006*
HbA1c	100	0.281	0.0001*
Hypertension	100	0.04*	0.652
Prior IHD	100	0.001*	0.001*
Killip 1 & 2	100	0.04*	0.476
Killip 3 & 4	100	0.001*	<0.0001*

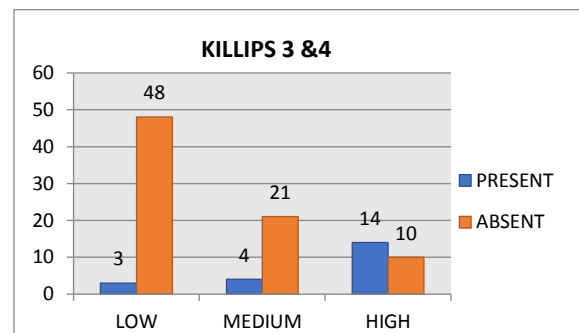
Mean systolic BP at admission in Low RBS group was 135.96 mmHg in medium RBS group 130.88mmHg, High RBS group 113.91mmHg (p=0.059) and in Low WBC group was 140.32 mmHg as compared to High WBC group 120.37mmHg (p=0.0001\*).

18% patient had history of prior IHD and there was statistically significant (p=0.001\*) difference in both WBC groups and RBS groups. Mean RBS at time of admission among both WBC group (p= 0.001\*) and in RBS group (p = 0.0001\*), difference was found to be statistically significant.

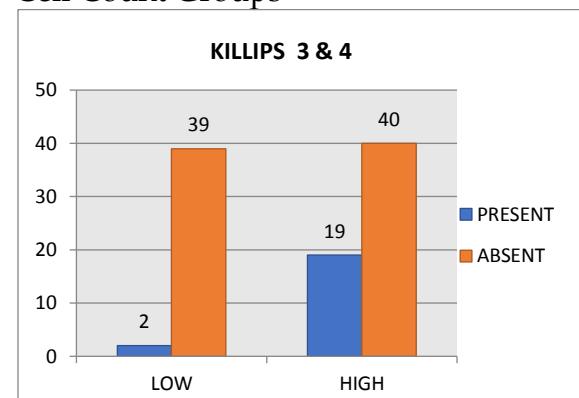
Mean WBC count at admission among groups were, in low WBC group 8701.51±1354.55 cu/mm, high WBC group 12233.45±1038.84cu/mm,

(p=0.001\*) and in RBS groups were, low RBS group 10206.19±1786.02cu/mm, medium group 11071.4±2075.85 cu/mm, high group 12947.70±20cu/mm (p=0.006\*), difference was found to statistically significant in all groups. There was no statistically significant difference found in Trop-T and CPKMB values across both groups. Killip class 3 and 4 of heart failure in both RBS groups and WBC groups the difference was found to be statistically significant (p=0.0001\* and 0.001\* respectively) as shown in graph 1 & 2 below.

**Graph 1:** Presence of Killips 3 & 4 In Patients Within Different Groups Based On Plasma Glucose Levels.



**Graph 2:** Presence of Killips 3 & 4 in Patients within Different White Blood Cell Count Groups



In the present study, we observed that significantly high mortality rates associated with high plasma glucose levels (58.3%) as compared to low plasma glucose group (1.9%) and with high WBC group (25.4%) as compared to low WBC group (2.4%) as shown in the table 2 below.

**Table 2:** Comparison of Outcome of Patients In Terms Of Hospital Mortality within the Study Population

Mortality	WBC Groups		Plasma Glucose Groups		
	Low	High	Low	Med	High
Yes	1	15	1	1	14
No	40	44	50	24	10
P Value	0.002*		0.0001*		

## DISCUSSION

We observed that patients with high RBS and high WBC group were found to have lower systolic BP and diastolic BP at the time of admission. The difference in SBP and DBP within WBC group was statistically significant but no significant difference in RBS groups. Association of CK-MB and TROP T levels with severity of AMI across the groups was statistically not significant contrary to the study by Suleiman et al,<sup>[12]</sup> who observed higher level of enzymes in patients with 16 higher admission RBS values. Further, Prior history of IHD was maximum in high plasma glucose level group i.e. 10 (41.6%) and the difference among other

groups was statistically significant. We also observed that high mortality rates were associated with high WBC count groups in comparison to low WBC count groups (25.4% vs 2.4%) suggesting that there is an association between an increased WBC and a higher incidence of heart failure and mortality in study population. Barron HV et al,<sup>[13]</sup> & Shahriari Ahmadi A et al,<sup>[14]</sup> also indicated higher mortality rate in patients with leucocytosis (WBC>15000/ $\mu$ l) within the first month of MI and up to six-month follow-up period (P<0.001) respectively. In our study, we observed that significantly high mortality rates associated with high plasma glucose levels (58.3%) in patients with acute myocardial infarction in comparison to low plasma glucose levels (1.9%). Suleiman et al,<sup>[12]</sup> & Patel M et al,<sup>[15]</sup> also demonstrated that admission blood glucose level after AMI is an independent predictor of long-term mortality in patients with and without known diabetes. In present study Killip class 3 and 4 of heart failure in both RBS groups and WBC groups the difference was found to be statistically significant (p = 0.0001\* and 0.001\* respectively). Pathria A et al,<sup>[16]</sup> reported that combination of WBC count and plasma glucose levels showed increased mortality in patients who had a high WBC count and high glucose levels compared to other groups.

## CONCLUSION

From the results of our study we concluded that even in nondiabetic



patients, hyperglycemia and raised WBC count on admission are independently associated with a higher risk of in hospital mortality and heart failure.

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