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"ROLE OF TOTAL WHITE BLOOD CELL COUNT AND RANDOM BLOOD GLUCOSE LEVELS AT ADMISSION IN PREDICTING THE PROGNOSIS OF ST ELEVATION MYOCARDIAL INFARCTION"

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ABSTRACT

Background : -

Role of admission Total WBC count and random blood glucose levels as independent predictors of adverse outcomes in patients with acute myocardial infarction has been extensively studied. The present study aims at assessing the combined effect of total WBC count and random blood glucose levels in predicting the prognosis of acute ST elevation myocardial infarction in terms of in hospital mortality within 48 hrs.

Material and Methods: -

In our study 100 consecutive patients presenting with acute ST elevation myocardial infarction admitted to MICU/CCU Govt. medical college &Govt General hospital Kadapa from March 2023 to February 2024 were studied. After excluding the patients according to exclusion criteria, those who satisfied the inclusion criteria were subjected to detailed history assessment and clinical examination. Total WBC count and Random blood glucose levels were measured at the time of admission to hospital and patients have been divided into three groups according to their blood glucose levels, each group is further subdivided into three more groups based on their total WBC count.

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Results: -

Patients with elevated random blood glucose levels and high total WBC count showed increase in in-hospital mortality than those with normal random blood glucose levels and total WBC counts. While analysing a combination of different strata for each variable, mortality has shown to be increased in a stepwise manner. Those with high random blood glucose levels and normal/low total WBC count or high total WBC count and normal/low random blood glucose levels had intermediate risk. Also, Multivariate analysis was performed which showed that Total WBC count and Random blood glucose levels are independent prognostic predictors of in- hospital mortality.

Conclusion: -

High Random blood glucose levels and Total WBC count at admission are independently associated with poor prognosis, adverse outcomes and in-hospital mortality in patients with acute STEMI. Such patients should be managed meticulously to improve their outcome.

INTRODUCTION

Acute Coronary Syndrome (ACS) is a leading cause of morbidity and mortality worldwide, driven by sedentary lifestyles, urbanization, and increasing comorbidities.Non-diabetic patients with acute STEMI often show hyperglycemia and insulin resistance due to stress-induced neurohumoral mechanisms. This stress hyperglycemia is linked to poorer outcomes and myocyte damage via reactive oxygen species.Inflammatory markers such as TNF-alpha, IL-1b, IL-6, and hs-CRP rise during myocardial infarction, but the impact of stress hyperglycemia on these markers is not well studied. Elevated WBC counts, a normal response for healing, can exacerbate inflammation and coagulation, harming myocytes if overly elevated.This study aims to evaluate total WBC count and random blood glucose levels as predictors of prognosis and mortality in acute STEMI patients.

AIMS AND OBJECTIVES

AIM: -

To assess the prognostic significance of Total White Blood Cell count and random blood glucose levels at admission in acute ST elevation myocardial infarction within

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48hours in terms of hospital mortality.

OBJECTIVES

To measure total WBC count and random blood glucose levels at admission in patients presenting with ST elevation myocardial infarction.

PATIENTS AND METHODS

SOURCE OF DATA

100 consecutive patients presenting with acute ST Elevation myocardial infarction admitted to MICU/CCU Govt. Medical College & Govt General Hospital from March 2023 to February 2024 were studied.

SAMPLE SIZE

Sample size n= 100

p = prevalence rate

q = 1-p

INCLUSION CRITERIA

Patients admitted in MICU/ICCU

1) Presenting within 48 hours of symptom onset.

2) Anginal Chest pain lasting more than 30 minutes.

3) Characteristic ECG changes with ST segment elevation more than 1mm in limb leads or more than 2mm in two contiguous chest leads.

EXCLUSION CRITERIA

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1) Patients presenting after 48 hours of symptom onset.

2) Patients receiving drugs/iv fluids elevating blood glucose levels.

3) Post surgical or post traumatic up to one month.

4) All patients with Active Infections
5) All known cases of Lymphoproliferative disorders.

6) All known diabetics

COLLECTION OF DATA:

Random blood glucose level was measured at the time of admission. It is estimated by glucose oxidase glucose peroxidase technique.

3ml of EDTA mixed blood sample was collected and subjected to complete blood count – both total and differential count by automated counter.

PATIENT STRATIFICATION:

Patients were grouped into 3 categories according to their admission blood glucose levels,

- Blood glucose Group I: Random blood sugar < 130 mg%,
- Blood glucose Group II: Random blood sugar 131- 180 mg%, and
- Blood glucose Group III: Random blood sugar >I80 mg%

Patients were grouped into 3 categories according to their admission blood glucose levels,

- WBC Group I: Total count < 8000 cells/ cu mm.
- WBC Group II: Total count 8000-11000/ cu mm and

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- WBC Group III: Total count >11000 cu/mm.

STUDY END POINTS:

The primary end point of the study is all cause mortality during the period of stay in the hospital.

STATISTICAL METHODS: Data was analyzed by using following statistical methods,

1. Diagrammatic (bar / pie chart) representation.

2. Mean + standard deviation (SD).

3.Chi square test for noncontinuous variables

4.Analysis of variance for continuous variables

5.Multivariate analysis tests to determine the association between W.B.C count and blood glucose levels.

RESULTS AND STATISTICS:-

TABLE 1:-AGE DISTRIBUTION OF PATIENTS:-

S .No	Age	No. of Patients	%
1	< 40Years	9	9.0
2	41 - 50 Years	18	18.0
3	51 - 60 Years	35	35.0
4	61 - 70Years	26	26.0
5	> 70 Years	12	12.0
6	Total	100	100.0
7	Mean Age	57.68 ± 11.439	

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TABLE 2:- SEX DISTRIBUTION OF PATIENTS:-

Gender	No. of Patients	%
Male	77	77.0
Female	23	23.0
Total	100	100.0

TABLE 3:- DISTRIBUTION OF PATIENTS ACCORDING TO KILLIP CLASS

KILLIPs	No. of Patients	%
Mild	40	40.0
Moderate	38	38.0
Severe	17	17.0
Very Severe	5	5.0
Total	100	100.0

TABLE 4:-DISTRIBUTION OF PATIENTS IN WBC <8000 GROUP:-

		Yes		NO	
		No of Patients	%	No of Patients	%
WBC <8000	RBS<130	18	18.0	82	82.0
	RBS130-180	17	17.0	83	83.0
	RBS>180	9	9.0	91	91.0

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TABLE 5:-DISTRIBUTION OF PATIENTS IN WBC 8000 - 11000 GROUP:-

		Yes		NO	
		No of Patients	%	No of Patients	%
WBC 8000 -11000	RBS<130	18	18.0	82	82.0
	RBS130-180	13	13.0	87	87.0
	RBS>180	7	7.0	93	93.0

TABLE 6:-DISTRIBUTION OF PATIENTS IN WBC >11000 GROUP:-

		Yes		NO	
		No of Patients	%	No of Patients	%
WBC >11000	RBS<130	3	3.0	97	97.0
	RBS130-180	7	7.0	93	93.0
	RBS>180	8	8.0	92	92.0

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TABLE 7:-MORTALITY IN WBC < 8000 GROUP:-

WBC < 8000		Outcome						Chi-square
		Death		Recovery		Total		
		No. of Patients	%	No. of Patients	%	No. of Patient S	%	
RBS<130	Yes	0	.0	18	22.0	18	18.0	$\chi 2$ = 4.819*; (p = 0.028) ; df= 1;
	No	18	100.0	64	78.0	82	82.0	
	Total	18	100.0	82	100.0	100	100.0	
RBS130-180	Yes	0	0.0	17	20.7	17	17.0	$\chi 2$ = 4.496*; (p = 0.034) ; df= 1;
	No	18	100	65	79.3	83	83.0	
	Total	18	100.0	82	100.0	100	100.0	
RBS>180	Yes	4	22.2	5	6.1	9	9.0	$\chi 2$ = 4.686*; (p = 0.030) ; df= 1;
	No	14	77.8	77	93.9	91	91.0	
	Total	18	100.0	82	100.0	100	100.0	

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TABLE 8:-MORTALITY IN WBC 8000-11000 GROUP:-

WBC 8000-11000		Outcome						Chi-square
		Death		Recovery		Total		
		No. of Patients	%	No. of Patients	%	No. of Patients	%	
RBS<130	Yes	0	0.0	18	22.0	18	18.0	χ^2 = 4.819*; (p = 0.028) ; df= 1;
	No	18	100.0	64	78.0	82	82.0	
	Total	18	100.0	82	100.0	100	100.0	
RBS130 -1 80	Yes	2	11.1	11	13.4	13	14.0	χ^2 = 0.130@; (p = 0.719) ; df= 1;
	No	16	88.9	71	86.6	87	86.0	
	Total	18	100.0	82	100.0	100	100.0	
RBS>180	Yes	4	22.2	3	3.7	7	7.0	χ^2 = 7.813*; (p = 0.005) ; df= 1;
	No	14	77.8	79	96.3	93	93.0	
	Total	18	100.0	82	100.0	100	100.0	

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TABLE 9:-MORTALITY IN WBC >11000 GROUP:-

WBC >11000		Outcome						Chi-square
		Death		Recovery		Total		
		No. of Patients	%	No. of Patients	%	No. of Patient S	%	
RBS<130	Yes	1	5.6	2	2.4	3	3.0	$\chi 2$ = 0.493@; (p = 0.483) ; df= 1;
	No	17	94.4	80	97.6	97	97.0	
	Total	18	100	82	100.	100	100.	
RBS130-180	Yes	2	11.1	5	6.1	7	7.0	$\chi 2$ = 0.570@; (p = 0.450) ; df= 1;
	No	16	88.9	77	93.9	93	93.0	
	Total	18	100.	82	100.	100	100.	
RBS>180	Yes	5	27.8	3	3.7	8	8.0	$\chi 2$= 11.666**; (p = 0.001) ; df= 1;
	No	13	72.2	79	96.3	92	92.0	
	Total	18	100.	82	100.	100	100.	

****significant at 0.01 level;**

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TABLE 10:-MORTALITY IN VARIOUS AGE GROUPS:-

Age	Outcome						Chi-square
	Death		Recovery		Total		
	No. of Patients	%	No. of Patients	%	No. of Patients	%	
< 40 Years	0	.0	9	11.0	9	9.0	χ^2= 4.066@; (p= 0.397) ; df= 4;
41 - 50 Years	2	11.1	16	19.5	18	18.0	
51 - 60 Years	7	38.9	28	34.1	35	35.0	
61 - 70Years	7	38.9	19	23.2	26	26.0	
> 70 Years	2	11.1	10	12.2	12	12.0	
Total	18	100.0	82	100.0	100	100.0	

TABLE 11:-MORTALITY IN KILLIP CLASSIFICATION:-

Killip Classification	Outcome						Chi-square
	Death		Recovery		Total		
	No. of Patients	%	No. of Patients	%	No. of Patients	%	
CLASS 1	2	11.1	38	46.3	40	40.0	χ^2 = 28.765**; (p = 0.000) ; df= 3; **significant at 0.01 level; P<0.001
CLASS 2	4	22.2	34	41.5	38	38.0	
CLASS 3	8	44.4	9	11.0	17	17.0	
CLASS 4	4	22.2	1	1.2	5	5.0	
Total	18	100.0	82	100.0	100	100.0	

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DISCUSSION

This study included 100 cases of acute ST elevation myocardial infarction (STEMI) admitted to the MICU/CCU of Government Medical College and Government General Hospital between March 2023 and February 2024. Patients were admitted within 48 hours of symptom onset.

Upon admission, patient history, physical examination findings, random blood glucose (RBS) values, total WBC count, 12-lead ECG, and echocardiograms were recorded. In-hospital complications, including congestive cardiac failure and arrhythmias, were monitored, with death being the study's endpoint.

Data analysis involved admission RBS values, total WBC count, in-hospital complications, ejection fraction, and mortality. Statistical methods included the Chi-square test and one-way ANOVA with post hoc testing to identify differences among three groups stratified by blood glucose and WBC count:

- **Blood Glucose Groups:**
  - Group I: RBS < 130 mg%
  - Group II: RBS 131-180 mg%
  - Group III: RBS > 180 mg%
- **WBC Count Groups:**
  - Group I: < 8000 cells/cu mm
  - Group II: 8000-11000 cells/cu mm
  - Group III: > 11000 cells/cu mm

The study aimed to determine the relationship between these variables and in-hospital outcomes in patients with STEMI.

In this study of 100 acute STEMI patients admitted within 48 hours of symptom onset, we found significant associations between admission blood glucose levels, WBC count, and in-hospital mortality. Patients with RBS > 180 mg% had a mortality rate nearly four times higher than those with lower glucose levels, even after adjusting for other risk factors. These findings align with Qiako et al.'s study, which identified high postprandial glucose as an independent predictor of poor outcomes in non-diabetic myocardial infarction patients.

Patients with high total WBC counts (> 11,000/cu mm) showed mortality rates about ten times higher than those with lower counts. This result is supported by Baranni et al., who associated high WBC counts with greater ST elevation, higher incidence of transmural infarcts, congestive cardiac failure, ventricular tachycardia, and increased one-year mortality.

Multivariate analysis confirmed that both elevated WBC counts and high blood glucose levels are independent risk factors for poor prognosis in acute MI. These results are consistent with previous studies, such as Iseikara et al., who found a two-fold increase in hospital mortality with high WBC counts and a 2.7-fold increase with high glucose levels.

Additional studies, including those by Morghan et al. and Menon et al., have shown that elevated WBC counts correlate strongly with heart failure, cardiogenic shock, and death during hospitalization

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Rafael et al. and Antonio et al. also demonstrated that elevated glucose levels are associated with higher rates of malignant arrhythmias, bundle branch blocks, and in-hospital mortality.

Hoebers et al. and Knudsen et al. have proposed that stress hyperglycemia in MI reflects extensive myocardial damage and stress hormone surges, leading to insulin resistance and poor glucose utilization. Hyperglycemia contributes to oxidative stress, inflammation, endothelial dysfunction, and coagulation activation, exacerbating ischemia.

Clinical studies have shown that tight glycemic control using insulin infusions can reduce mortality in acute MI and critically ill patients, although these treatments carry risks of volume overload and hypo/hyperglycemia.

A meta-analysis of 15 trials by Kosiborod et al. indicated that admission hyperglycemia is a more accurate predictor of morbidity and mortality in non-diabetic MI patients than in diabetic ones. Our study confirms a strong correlation between elevated RBS, high WBC counts at admission, and increased in-hospital mortality in STEMI patients, emphasizing that leukocytosis and hyperglycemia are independent predictors of mortality within the first 48 hours.

CONCLUSION :

The study enrolled 100 STEMI patients within 48 hours of symptom onset, excluding known diabetics, lymphoproliferative disorder cases, and patients with active infections. Patients were categorized by age, sex, Killip classification, random blood glucose (RBS), and total white blood cell (WBC) count. Mortality rates were compared across these categories, revealing no significant differences except in higher Killip classes, where mortality rates were elevated. Patients with RBS > 180mg% and total WBC count > 11,000 showed significantly higher mortality. Multivariate analysis identified high total WBC count and hyperglycemia as independent predictors of in-hospital mortality in STEMI patients.

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