Original Article

Prognostic Importance of White Blood Cell Count and Plasma Glucose Levels at Admission in Acute Myocardial Infarction

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Abstract

Introduction: An increase in white blood cell (WBC) count and a high plasma glucose level are frequently observed in patients with acute myocardial infarction. WBC count is a simple marker of inflammation, which plays an important role in acute coronary syndrome. It is seen that WBC count plays a potential role in promoting blood coagulation, mediating microvascular reflow, and causing myocyte dysfunction.

Materials and Methods: About 100 consecutive patients presenting with acute myocardial infarction admitted to New Civil Hospital, Surat, from September 2014 to September 2015 were studied. The study were carried out on patients presenting with complains suggestive of acute myocardial infarction presenting within 48 h in Emergency Department of New Civil Hospital, Surat. After the patient was stabilized, qualifying patients underwent detailed history and clinical examination. The WBC count and plasma glucose levels were measured at the time of admission.

Results: In present study, 36 (36%) out of 100 patients were found to be dyslipidemic and prior ischemic heart disease about 12 (12%) out of 100.

Conclusion: WBC count and plasma glucose level at admission has a prognostic importance as independent and joint variables in predictors for short-term outcome in the form of in-hospital mortality in acute myocardial infarction cases.

Key words: Acute Myocardial Infarction, Plasma Glucose, White Blood Cell

INTRODUCTION

An increase in white blood cell (WBC) count and a high plasma glucose level are frequently observed in patients with acute myocardial infarction. WBC count is a simple marker of inflammation, which plays an important role in acute coronary syndrome. It is seen that WBC count plays a potential role in promoting blood coagulation, mediating microvascular reflow, and causing myocyte dysfunction.[1,2]

In addition, a high blood glucose level has been associated with an increased risk of mortality and morbidity in patients with acute myocardial infarction, regardless of their diabetic status. Acute hyperglycemia can induce oxidative stress and activate coagulation, endothelial dysfunction, and inflammation. Therefore, both inflammation and hyperglycemia have at least partly similar pathogenic mechanisms that might increase myocardial injury.[3-6]

Although predictive utility of an elevated WBC count and hyperglycemia in relation to survival after acute myocardial infarction have been studied independently, but a joint study of WBC count and blood glucose levels together in predicting in-hospital outcomes is lacking.[7]

Purpose

This study is done to know the prognostic importance of WBC count and blood glucose at admission in acute myocardial infarction.

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MATERIALS AND METHODS

About 100 consecutive patients presenting with acute myocardial infarction admitted to New Civil Hospital, Surat, from September 2014 to September 2015 were studied.

Sample size has been calculated with OpenEpi Software with prevalence rate of congenital heart disease in India of 13.2% at a permissible error of 8%, so the size of sample works out to be 119, i.e., *n* = 119,out of which 19 patients denied to be the part of study.

The study were carried out on patients presenting with complains suggestive of acute myocardial infarction presenting within 48 h in Emergency Department of New Civil Hospital, Surat. After the patient was stabilized, qualifying patients underwent detailed history and clinical examination. The WBC count and plasma glucose levels were measured at the time of admission.

Inclusion Criteria
All acute myocardial infarction patients having:
a. Chest pain lasting more than 20 min
b. Diagnostic electrocardiogram (ECG) changes with characteristic ECG alterations consisting of new pathological Q waves or ST segment and T wave changes
c. Elevated creatine kinase MB levels >2 times the upper limit of normal.

Exclusion Criteria
All patients who did not fulfil the inclusion criteria.

Study End Points and Definitions
The primary end point of the study is all cause mortality during the period of stay in the hospital. Plasma glucose is the nonfasting glucose level measured at the time of admission. It is estimated by glucose oxidase glucose peroxidase technique.

Statistical Method
Data entered in MS Excel Spreadsheet and analyzed with the help of OpenEpi and SPSS V.16 software.
1. Descriptive statistics explained by frequency and percentage
2. Categorical variable explained by Chi-square test (test of significance)
3. Continuous variable explained by *t*-test and ANOVA (test of significance).
4. Multivariate analysis tests to determine the association between WBC count and blood glucose levels with in hospital mortality.

Patient's confidentiality:
• Eligible patients were given unique I.D no
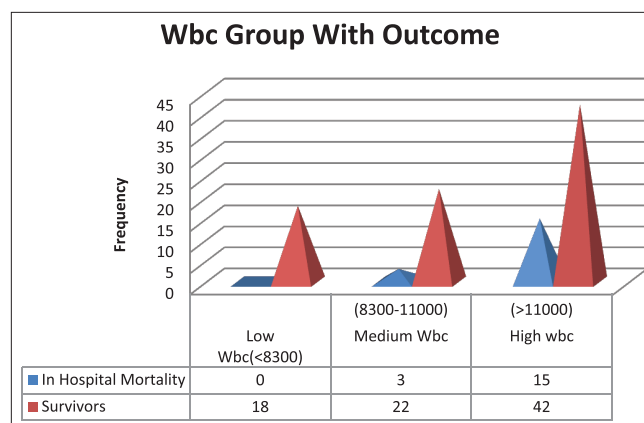• All the details of the patient were kept strictly confidential.

RESULTS

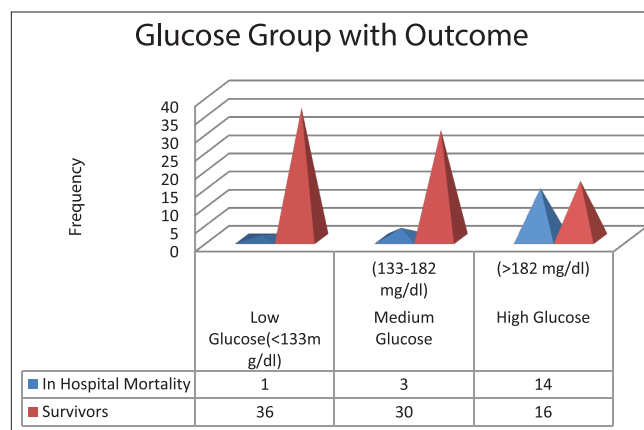Results are been depicted in form of tables and graphs below (Tables 1-3), (Graphs 1-3).

Multivariate analysis showed that plasma glucose levels and WBC count are independent predictors of in-hospital mortality.

DISCUSSION

When a combination of these two variable, i.e., WBC count and plasma glucose levels were taken, we found that there is an increased mortality in patients who had a high WBC count and high glucose levels compared to

Wbc Group With Outcome	Low Wbc(<8300)	(8300-11000) Medium Wbc	(>11000) High wbc
In Hospital Mortality	0	3	15
Survivors	18	22	42

Graph 1: Shows various groups of white blood cell count and outcome in terms of mortality

Glucose Group with Outcome	Low Glucose(<133mg/dl)	(133-182 mg/dl) Medium Glucose	(>182 mg/dl) High Glucose
In Hospital Mortality	1	3	14
Survivors	36	30	16

Graph 2: Shows various groups of glucose and outcome in terms of mortality

Table 1: Relation between risk factors and in-hospital mortality in glucose group

Variable	Low (<133 mg/dl) *n*=4	Med (133-182 mg/dl) *n*=4	High (>182 mg/dl) *n*=10	*P* value
Age	59.3+11.1	63+10.4	58.18+11.9	More than 0.05
Diabetes	0	1	7	<0.05
Hypertension	0	1	8	<0.05
Smoker	0	3	7	<0.05

Table 2: Relation of the risk factors and in-hospital mortality in WBC count group

Variable	Low WBC (<8300) *n*=1	Med WBC (8300-11,000) *n*=5	High WBC (>11,000) *n*=12	*P* value
Age	50.8+8.1	52+11.4	60.8+10.1	<0.05
Diabetes	0	1	9	<0.05
Hypertension	1	0	7	<0.05
Smoker	0	1	9	<0.05
Prior IHD	0	1	10	<0.05
Killip Class>2	1	0	7	<0.05
ST segment elevation	0	3	10	<0.05
Thrombolysis	0	1	9	<0.05

WBC: White blood cell, IHD: Ischemic heart disease

Table 3: Multivariate analysis assessing predictors for in-hospital mortality

Variable	Chi-square	*P* value
Kilip class	62.495	<0.05
Age	2.57	>0.05
WBC count	8.67	<0.05
Plasma glucose	4.94	<0.05
Prior IHD	30.017	<0.05
Smoker	0.98	>0.05
Diabetes mellitus	15.229	<0.05
Hypertension	4.16	<0.05
ST elevation	6.24	<0.05
Thrombolysis	0.36	>0.05

IHD: Ischemic heart disease, WBC: White blood cell

JOINT EFFECTS OF W.B.C. COUNT AND PLASMA GLUCOSE ON IN HOSPITAL MORTALITY

	Low PG	Med PG	High PG
Low Wbc	0	0	0
Med Wbc	0	1	1
High Wbc	3	3	10

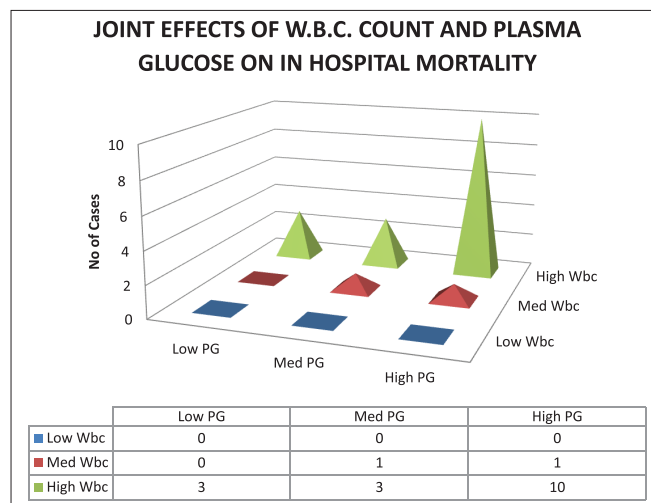**Graph 3: Joint effects of white blood cell count and plasma glucose on in hospital mortality**

other groups of patients. The comparison of WBC count and glucose levels with left ventricular ejection fraction of those patients who survived showed a stepwise decrease in predischarge left ventricular ejection fraction. In a study done by Ishihara *et al.*[1] in 2006, there was a total of 218 deaths (5.9%). The patients with a high WBC count had a two-fold increase in hospital mortality compared with those with a low WBC count and patients with high glucose level had a 2.7-fold increase in mortality compared to the low plasma glucose level. When a combination of different strata for each variable was made, it showed that patients with a high WBC count and high plasma glucose levels had the highest risk compared with those with low WBC and low plasma glucose level. Moreover, in another study done in 2005, the patients with high WBC count and high glucose level were found to have a higher risk of mortality compared to the above study (18% vs. 11.8%). It described a 9.4-fold higher mortality in patients with high WBC count and high glucose level at admission compared to those with low values. In present study 18% (18 out of 100) cases found to be diabetic.[8] As insulin deficiency hampers lipid metabolism and increases the amount of lipid, mainly free fatty acids in circulation. It also causes microangiopathies leading to impaired perfusion to target organs. Mechanism leading to accelerated atherosclerosis is hyperlipidemia along with increase in glycosaminoglycans.[9,10]

In present study, 36 (36%) out of 100 patients were found to be dyslipidemic and prior ischemic heart disease about 12 (12%) out of 100.

CONCLUSION

WBC count and plasma glucose level at admission has a prognostic importance as independent and joint variables in predictors for short-term outcome in the form of in-hospital mortality in acute myocardial infarction cases.

This study used simple variables such as plasma glucose levels and WBC count to predict near future consequences in a patient with myocardial infarction and vital interventions should be done at apt time.

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