

Correlation between White Blood Cell Count and Myocardial Infarction Mortality in Patients admitted at Tertiary Care Center of Philippines

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ABSTRACT

Introduction: Coronary artery disease (CAD) continues to be a major cause of morbidity and mortality in developed as well as developing countries. This study aims to find out the correlation between elevated WBC and AMI mortality and also to enhance as an independent marker for higher risk for in-hospital patients which would finally help for risk stratification and better care for such presentation.

Methods: This is a retrospective research evaluating all adult patients with AMI who were admitted to Rizal Medical Center from January 1, 2016 to December 31, 2017. Clinical data were retrieved from the Medical Records Section and Department of Laboratory Medicine. Detailed history, physical examination and relevant investigations such as complete blood count and electrocardiographic results were reviewed. All data was managed by Microsoft Excel for windows and after collecting a sample size of 225 cases. Analysis was executed using SAS Software Version 9.3.

Results: Relationship existed between clinical outcome and white blood cell count. The patients with elevated WBC on comparison to patients with normal WBC had 3 times more risk of dying (discharged(5.8%)/died(18.7%), p value 0.028. The mean WBC for favourable clinical outcome was 11.87 ± 4.85 S.D which is lower as compared to the poor clinical outcome averaged 13.87 ± 6.20 S.D. ($p .028 < .05$).

Conclusion: The results indicate that patients with elevated white blood cell count would be more likely to have poor clinical outcome compared to patients who have normal white blood cell count. White blood cell count within 24 h of admission for an AMI is a strong and independent predictor of in-hospital mortality.

Keywords: Clinical Outcome; Myocardial Infarction; WBC.

INTRODUCTION

Coronary artery disease (CAD) continues to be a major cause of morbidity and mortality in developed as well as developing countries. The extent of myocardial damage after an acute myocardial infarction (AMI) prognosticates for morbidity and mortality in early post-infarct period, as also the overall quality of life afterwards. The time course of bio-marker (protein) release during acute myocardial infarction provides diagnostic information which in turn is helpful in evaluating therapeutic interventions (mechanical or pharmacological). WBC has been proven to be elevated during the course of AMI however increased WBC as an independent marker for in-hospital

mortality after AMI is not yet clear. Markers of inflammation, both generalized and specific, can be used to predict the risk of cardiovascular events. Elevations in WBC count have been consistently associated with the development of acute myocardial infarction (AMI) as well as with mortality in patients with known coronary artery disease.

A study conducted in United States by Barron et al. examined the association between white blood cell (WBC) count on admission and 30-day mortality in patients with AMI suggested that an increased WBC count is translated with significantly increased risk

risk of in hospital mortality where the lowest quintile patients were three times more likely to die at 30 days than those with highest quintile.¹ Similar Studies conducted previously also demonstrated that higher number of WBC among AMI patients at admission are associated with high mortality.^{2,3} Journal of American College of Cardiology already reported that an increased WBC count was associated with lower rates of coronary patency and increased thrombus burden in patients with AMI treated with thrombolytics.¹ Another study with impact of Leukocyte count on Mortality and Bleeding in patients with myocardial infarction undergoing primary percutaneous coronary interventions with conclusions as elevated Leukocyte is an independent predictor of infarct size, as assessed by peak creatinine phosphokinase level, and a 1-year cardiac mortality, non-cardiac mortality and, and major bleeding.⁴ These is also an evidence of association of the neutrophil-lymphocyte ratio (NLR) with outcomes in patients admitted for an Acute Coronary Syndrome where an elevated NLR taken within 24 hours of presentation is a useful marker to predict in-hospital mortality, development or worsening of CHF, and development of shock, re-infarction, and arrhythmias.⁵ The WBC determined during hospital admission in STEMI & Non-STEMI patients are also associated with long term mortality.⁶

Along with these evidences, this study aims to find out the correlation between elevated WBC and AMI mortality and also to enhance as an independent marker for higher risk for in-hospital patients.

METHODS

This was a retrospective study of 225 patients with acute myocardial infarction from December 2016 to December 2017 conducted at Rizal Medical Center, Department of Health, Philippines. The inclusion criteria were 18 years and older, all patients with a discharge/death diagnosis of Acute Myocardial Infarction admitted to Intensive Care Unit. Exclusion was of Septic Shock, with septic component from bacterial infections: Community Acquired Pneumonia/Hospital Acquired, Urosepsis, Active infections relevant to history and clinical examination, chronic kidney disease, myeloproliferative disorders and malignancy, thyroid/parathyroid disease. The primary end points, where overall death or discharged with the diagnosis of AMI. To facilitate analysis, Leukocyte values were categorized into three category-low normal being the reference group and high. The main outcome variable was all-cause vascular mortality. The main contributor to overall vascular mortality was death due to Myocardial infarction.

Clinical data of all the patients were retrieved and documented from the medical records section and Department of Laboratory Medicine. Detailed history, physical examination and relevant investigations, including ECG, Troponin I and leukocyte count results, were reviewed and eligibility criteria applied upon. Relationship between historical characteristics of patients and Leukocyte levels were investigated and the demographic profile of patients included in the study was determined. The correlations -predictive power of leukocyte count and hazard ratios were determined.; All clinical analysis and comparisons were executed using SAS Software Version 9.3. To test whether leukocyte count and acute myocardial infarction has significant association, Chi-Square Test for Independence were executed and the correlations were estimated.

RESULTS

A total of 225 patients were enrolled in the study and the demographic characteristics of the cohorts, divided into low, normal and high levels of WBC count. Mean age of patients with normal WBC was 63.83 ± 12.36 , with the highest mean age range. Patients with high WBC count were three times more likely to die on comparison with those having normal WBC (5.8% vs 18.7%, p value 0.028). The risk factors such as hypertension, age, gender, previous ACS and current CHF were tabulated. Majority of patients (93.8%) had hypertension. There was no significant correlation noted among patients with diabetes mellitus (p .530 > .05) or hypertension (p .368 > .05) when grouped according to white blood cell count. After adjusting all the risk factors, WBC count was found to be a strong predictor of in-hospital mortality (Table 1). There was no significant difference between age when patients were categorized according to white blood cell count (p value .856 > .05). There was no significant difference between gender and white blood count of patients with acute myocardial infarction (p value .198 > .05).

Table 2 presents the medical history of patients with AMI. Majority of the patients with AMI had hypertension (93.8%). There was no significant difference between hypertension (p .368 > .05) or diabetes mellitus (.53 > .05) when acute myocardial infarction patients were grouped according to white blood cell count. There was no significant difference between previous history of acute coronary syndrome (p .930 > .05) or congestive heart failure (p .930 > .05) and white blood cell count.

Most cases (53.3%) of patients diagnosed with acute myocardial infarction had NSTEMI. In this group,

Table 1: Demographic Characteristics of Patients with Acute Myocardial Infarction

Variable	White Blood Cell Count				P
	Low	Normal	High	Total	
Age					.856§
Mean±SD	59.83±6.43	63.83±12.36	62.36±13.03	-	
Sex					.198‡
Male	2(0.9%)	46(20.4%)	94(41.8%)	142(63.1%)	
Female	4(1.8%)	31(13.8%)	48(21.3%)	83(36.9%)	

Table 2: Comorbidities with Acute Myocardial Infarction

Historical Data	White Blood Cell Count				P
	Low	Normal	High	Total	
Hypertension					.368‡
Absent	1(.4%)	3(1.3%)	10(4.4%)	14(6.2%)	
Present	5(2.2%)	74(32.9%)	132(58.7%)	211(93.8%)	
DM					.530‡
Absent	6(2.7%)	64(28.4%)	117(52%)	187(83.1%)	
Present	0(0%)	13(5.8%)	25(11.1%)	38(16.9%)	
Previous ACS					.230‡
Absent	6(2.7%)	51(22.7%)	97(43.1%)	154(68.4%)	
Present	0(0%)	26(11.6%)	45(20%)	71(31.6%)	
CHF					.930‡
Absent	5(2.2%)	68(30.2%)	124(55.1%)	197(87.6%)	
Present	1(.4%)	9(4%)	18(8%)	28(12.%)	

Table 3: Correlation between Acute Myocardial Infarction-related Mortality and White Blood Cell Count.

Historical Data	White Blood Cell Count				Mean±SD	P
	Low	Normal	High	Total		
Diagnosis						.170‡
STEMI	2(.9%)	30(13.3%)	73(32.4%)	105(46.7%)	13.12±5.56	
NSTEMI	4(1.8%)	47(20.9%)	69(30.7%)	120(53.3%)	11.71±4.94	
Clinical Outcome						.028§
Died	1(.4%)	13(5.8%)	42(18.7%)	56(24.9%)	13.87±6.20	
Discharged	5(2.2%)	64(28.4%)	100(44.4%)	169(75.1%)	11.87±4.85	

DM:Diabetes Milletus, ACS:Acute Coronary Syndrome, CHF:Congestive Heart Failure
Chi Square Test was used and level of significance was taken at < .05

most patients had high WBC count (69; 30.7%). On the other hand, 105 patients (46.7%) with acute myocardial infarction had STEMI, with 73 patients (32.4%) having high WBC. No correlation was found with WBC and diagnosis (p .170 > .05). In terms of clinical outcome, most patients were alive (169; 75.1%). The 56 patients (24.9%) who died of AMI, 42 patients (18.7%) had high WBC count. Correlation was found between clinical outcome when

patients were grouped according to WBC count (p .028 < .05), which supports the alternate hypothesis of the study.

DISCUSSION

Positive correlation existed between white blood cell count and mortality among myocardial infarction cases. Patients with high WBC count were three times more

likely to die on comparison with those having normal WBC (5.8% vs. 18.7%: p value: 0.028). White blood cell count within 24 h of admission for an AMI is a strong and independent predictor of in-hospital mortality. The mean WBC for favorable clinical outcome was 11.87 ± 4.85 S.D which is lower as compared to the poor clinical outcome 13.87 ± 6.20 S.D. (p value 0.028 < 0.05). A group of researchers initially explained the relationship between WBC count and coronary artery disease.⁷ The researchers found that elevated levels of WBC count has direct association with increased risk of AMI and in the investigation of other group, they were the first to document an elevation in WBC count as a predictor of all-cause mortality in patients who survived an AMI.⁸ Numerous other studies subsequently confirmed this observation.⁹ However, there is a lack of data to completely describe the short term prognostic significance of the WBC count measured during the acute phase of myocardial infarction.¹⁰

The present investigation when compared to a research "The Association Between White Blood Cell Count and Acute Myocardial Infarction Mortality in Patients 65 Years of Age: Findings From the Cooperative Cardiovascular Project" with results as on relation to those patients with lowest quantile to the highest levels of WBC count were three times more likely to die at 30 days (10.3% vs. 32.3%; p value 0.001) shows similar findings- Patients with high WBC count were three times more likely to die on comparison with those having normal WBC (5.8% vs 18.7%: p: 0.028).¹ The findings of this study is also supported by other group of investigators where patients who had acute myocardial infarction and whose white blood cell count is elevated had an increased risk for poor clinical mortality compared to those who have normal white blood cell count.¹¹ The potential deleterious roles of the WBC count in promoting blood coagulation, mediating micro vascular no reflow, and causing myocyte dysfunction have been reported.⁸ Inflammation associated with AMI is frequently marked by a peripheral leukocytosis and relative neutrophilia.¹²

In line with patient demographics, patients it was found that patients who have been noted to have acute myocardial infarction were those in the older age group. The data obtained in the present study was found to be in line with other findings where myocardial infarction was generally common among those in the older age group. In the investigations reviewed it was found that patients with acute myocardial infarction were generally of advanced age.¹³ The results were further supported by other authors who found that patients with acute myocardial infarction were had a mean age range of 65

to 70 years old.¹⁴ Further, the data disclosed that most patients with acute myocardial infarction were males. In a series of investigation analyzed, male patients almost always dominated the prevalence of acute myocardial infarction cases compared to the female group.¹⁵

CONCLUSION

The study revealed that positive relationship existed between clinical outcome and white blood cell count. Patients with elevated white blood cell count would be more likely to have poor clinical outcome compared to patients who have normal white blood cell count. Hence recommends white blood count is an independent risk factor.

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