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Correlation of Early WBC Count with Ejection Fraction in STEMI Patients: A Prospective Study

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Abstract: ***Background: Elevated White Blood Cell Count (WBC-C) in the setting of acute myocardial infarction (AMI) has been linked to adverse cardiovascular outcomes. This study explores the relationship between WBC-C within the first 24 hours of chest pain onset and ejection fraction in ST-segment elevation myocardial infarction (STEMI) patients. Methods: A cohort of 49 STEMI patients presenting within 24 hours of symptom onset was enrolled. WBC count and ejection fraction were assessed immediately upon admission. Upon presentation, the white blood cell (WBC) count was promptly assessed using standard laboratory techniques. Simultaneously, echocardiography was performed to measure the ejection fraction, providing an immediate snapshot of cardiac function.Statistical analyses evaluated the correlation between ejection fraction and WBC count. Results: The cohort demonstrated diverse age distribution, with the majority falling within the 41–60-year range. Males constituted the majority with 35 participants (71.4%), while females accounted for 14 participants (28.6%). Ejection fraction varied across three categories: <40%, 41-50%, and 51-60%. Anterior Wall Myocardial Infarction (AWMI) was identified in 53.1%, while 46.9% presented with Inferior Wall Myocardial Infarction (IWMI). A significant negative correlation emerged between ejection fraction and WBC count (Pearson Correlation = -0.462, p-value = 0.001). Conclusion: This study uncovers a significant link between early WBC count and ejection fraction in STEMI patients. Lower ejection fractions align with higher WBC counts, indicating heightened inflammation. These findings inform risk assessment and tailored treatments. Further research is needed for broader clinical application and mechanistic insights.***

Keywords: STEMI, WBC count, Myocardial infarction, Leukocyte, Inflammation, Ejection fraction

1. Introduction

Within acute myocardial infarction (AMI), an augmented white blood cell count (WBC-C) has demonstrated an association with unfavourable cardiovascular outcomes, suggesting its involvement in reparative physiological processes and pathological mechanisms. Consequently, WBC-C has garnered significant interest among researchers as a prospective stratification parameter due to its straightforwardness, cost efficiency, and widespread accessibility [1] [2] [3].

AMI, an outcome of ischemic disorders, exhibits a pronounced inflammatory component within its pathophysiological cascade. This is characterized by elevated levels of nuclear factor κB (NF-κB) and proinflammatory cytokines, along with the adhesion of polymorphonuclear leukocytes [4]. Moreover, there is a notable surge in leukocyte count following the onset of ischemic symptoms, particularly in cases involving substantial injuries [5]. These observations have prompted the exploration of potential anti-inflammatory targets for therapeutic intervention in cardiovascular disease [6].

Given the existence of this mechanism, current research is dedicated to investigating the blood leukocyte count. Its role extends beyond being established as an inflammatory marker, a well-documented fact, and now encompasses efforts to establish its correlation with cardiac events [7], heightened mortality rates [8-10], and the severity of myocardial infarction [11, 12]. Moreover, studies have demonstrated that an elevated white blood cell count indicates a heightened period of risk for recurrent ischemic events. Notably, this increase precedes the actual risk by a week and is linked to escalated in-hospital mortality rates [13-16].

Given the gap in findings, the current study aims to find the correlation between the WBC count taken within the first 24 hours of the onset of chest pain and ejection fraction in STEMI. This is one of the first studies to be conducted with findings concerning the 24-hour state of patients with STEMI.

2. Materials and Methods

The prospective study enrolled 49 patients diagnosed with ST-segment elevation myocardial infarction (STEMI) who presented to the medical facility within 24 hours following the onset of chest pain.

Inclusion criteria
Patients with STEMI presented within 24 hours of onset of chest pain were included.

Exclusion criteria
Patients with an active infection and other causes which led to elevated WBC levels were excluded.

Data Collection:
Upon presentation, the white blood cell (WBC) count was promptly assessed using standard laboratory techniques. Simultaneously, echocardiography was performed to measure the ejection fraction, providing an immediate snapshot of cardiac function.

Statistical Analysis:
Subsequently, the obtained data on ejection fraction and WBC count were subjected to rigorous statistical analysis.

This involved employing appropriate correlation analyses to determine the presence and magnitude of any potential associations between ejection fraction and WBC count.

Ethical Considerations:
The study adhered to all relevant ethical guidelines and obtained necessary approvals from the institutional review board. Informed consent was obtained from all participating patients.

3. Results

The cohort comprised 49 individuals with ST-segment elevation myocardial infarction (STEMI). Age-wise distribution indicated: <40 years (8.2%), 41-50 years (30.6%), 51-60 years (34.7%), 61-70 years (18.4%), and >71 years (8.2%). Males constituted the majority with 35 participants (71.4%), while females accounted for 14 participants (28.6%).Ejection fraction was stratified into three categories: <40% (32.7%), 41-50% (38.8%), and 51-60% (28.6%). Anterior Wall Myocardial Infarction (AWMI) was identified in 26 individuals (53.1%), while 23 individuals (46.9%) presented with Inferior Wall Myocardial Infarction (IWMI) [Table 1].

Table 1: Patient characteristics

		Count	Column N %
Age group	<40	4	8.2%
	41-50	15	30.6%
	51-60	17	34.7%
	61-70	9	18.4%
	>71	4	8.2%
Gender	Female	14	28.6%
	Male	35	71.4%
EF (%)	<40	16	32.7%
	41-50	19	38.8%
	51-60	14	28.6%
Diagnosis	AWMI	26	53.1%
	IWMI	23	46.9%

A significant negative correlation emerged between ejection fraction and WBC count (Pearson Correlation = -0.462, p-value = 0.001). This denotes that a decrement in ejection fraction is associated with an elevation in WBC count [Table 2 and Figure 1].

Table 2: WBC Count correlation with EF

		EF (%)
WBC count	Pearson Correlation	-0.462
	P value	0.001

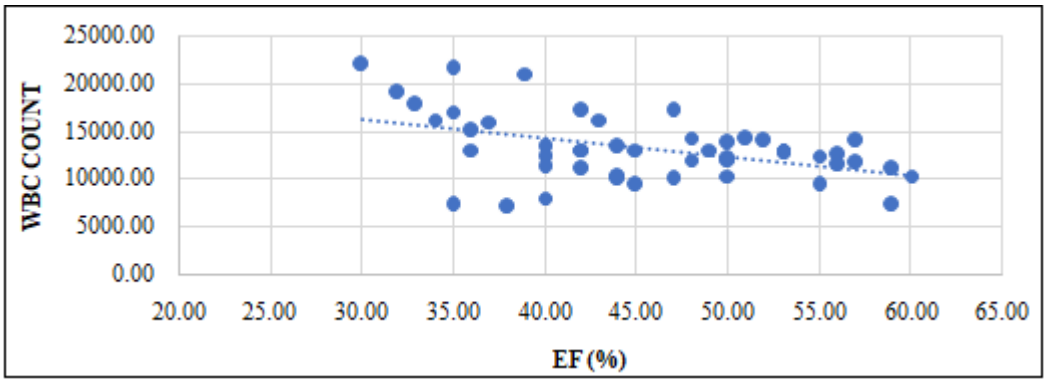

Figure 1: Correlation between WBC count and EF

4. Discussion

The present study indicated that WBC taken during the first 24 hours in patients with STEMI was strongly and independently associated with low ejection fraction. The inverse correlation between ejection fraction and WBC count underscores a pivotal association between cardiac functionality and inflammatory response in STEMI patients. Lower ejection fractions, indicative of compromised cardiac contractility, corresponded with escalated levels of white blood cells. This correlation potentially signifies an augmented state of inflammation in individuals with impaired cardiac function. These findings hold clinical relevance for risk stratification and tailored therapeutic approaches for STEMI patients, highlighting the intricate interplay between cardiac performance and inflammatory processes. Further elucidation of this correlation's underlying mechanisms is imperative for developing targeted therapeutic interventions.

Similar findings were also reported by Nunez et al.," revealed that the risk gradient levels off beyond the 10 × 109/l threshold, effectively delineating individuals within cohort at risk of future events. This prompts our suggestion, in the interest of expediency, for adopting a binary categorization of WBC-C as a prognostic indicator [15].

Numerous mechanisms have been postulated to elucidate the correlation between (WBC-C) and mortality. The leukocytic reaction following STEMI constitutes a pivotal facet of the systemic inflammatory response to injury. This response orchestrates the reparative endeavour to initiate the replacement of the infarcted region with collagen. Consequently, it stands to reason that the extent of myocardial necrosis corresponds proportionally to the magnitude of the leukocytic response observed at both systemic and localized levels [16] [17].

Navinan et al. extended the research on myocardial infarction, STEMI, and its correlation with WBC count, which represented that inflammatory responses and their indicators appear to operate independently of patient-specific factors like the extent of coronary involvement, acquired risk factors, and lifestyle habits. Notably, diabetes mellitus may exert an augmenting influence on inflammation in STEMI, as evidenced by its significant correlation with C-reactive protein (CRP) levels and

leukocytosis. Furthermore, inflammation demonstrates a concordance with cardiac morbidity, as evidenced by a significant correlation between left ventricular dysfunction and the inflammatory marker CRP. Markers of inflammation such as CRP and leukocytosis may serve as indicators of clinical morbidity and could suggest unfavourable prognostic outcomes. A more robustly powered study, coupled with high-sensitivity CRP and increased frequency of analyses with extended follow-up, may elucidate these associations [17].

The study conducted by Baron et al. also reported similar findings where a significant association was reported among 975 patients with acute myocardial infarction and white blood cell count. An elevated WBC level was associated with decreased epicardial blood flow, myocardial perfusion, thromboresistance, and a greater incidence of new congestive heart failure and death [1].

Based on the literature and results, it is evident that WBC can pose as one of the prognostic markers for predicting ejection fraction and help in enabling better cardiovascular care. However, further long-term studies, including more patients, are needed to substantiate the findings.

The present study highlights a significant and independent association between WBC-C, measured within 24 hours of admission in patients with STEMI, and low ejection fraction. This correlation underscores the crucial interplay between cardiac function and the inflammatory response in STEMI patients. Lower ejection fractions, indicative of compromised cardiac contractility, are correlated with elevated levels of white blood cells, signifying an augmented state of inflammation in individuals with impaired cardiac function. These findings hold clinical relevance for risk stratification and tailored therapeutic approaches for STEMI patients, emphasizing the intricate interplay between cardiac performance and inflammatory processes.

5. Conclusion

In conclusion, this study underscores the potential utility of WBC-C as a prognostic marker for predicting ejection fraction in STEMI patients, offering potential implications for enhanced cardiovascular care. However, continued research efforts are essential to corroborate and refine these observations in a broader clinical context.

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