Original Research Article

A study on prognostic significance of neutrophil-lymphocyte ratio in patients with stemi

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ABSTRACT

Introduction: Atherosclerosis, the clinically manifested form of cardiovascular disease (CVD), mainly accounts for most deaths worldwide. Inflammatory disorders that elevate CVD risk have been associated with circulating inflammatory markers that encompass neutrophil-lymphocyte ratio (NLR), which could be employed as an economical prognostic tool for the diagnosis of the same.
Aim: Hence, this study focused on assessing the extrapolative implication of NLR among ST-Elevation Myocardial Infarction (STEMI) patients.
Materials and Methods: The observational study included 55 STEMI patients (Mean age – 52.08 years) at Thanjavur medical college (December 2015 to February 2016). The patients were delineated into two groups based on NLR values (high >3.0 and low <3.0).
Results: Among the 55 patients, the post-MI complication was observed in 44 subjects, among which 10% of them expressed a high NLR value. A notable proportion of patients displaying arrhythmia and LV dysfunction had higher NLR values.
Conclusion: Henceforth, the study reveals the independent and vital prognostic association between NLR and atherosclerosis that could be designated as a reliable marker in the early diagnosis of the disease as well post MI complications.

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1. Introduction

Atherosclerosis, a condition caused by the hardening of arteries, is the prevailing cause of cardiovascular disease (CVD), slowing the pace of blood flow due to the narrowing of blood vessels resulting from plaque buildup with no initial revealing symptoms.[1] As a consequence of which, oxygen flow to body parts becomes constrained. While at the later stage, the severity of this can result in various manifestations such as stroke, kidney problems, or peripheral artery disease, depending upon the type of artery affected. Although the leading cause of the disease is still unknown, multifactorial risk factors such as family history, unhealthy lifestyle choices, and diabetes are lineated as

significant contraction grounds of the disease. Contributing to over 30% of deaths worldwide, CDV diseases are designated as the primary cause of mortality around the globe.[2] Even though diagnosis could be achieved by means of a physical examination, ECG and quite a few methods, early diagnosis and prevention are the main strategies to lower the risk of CVD.[3]

The extent and degree of atherosclerotic plaque formation largely rely on the inflammatory and the proceeding immunological responses. However, this pathologic process also comprehends scarring and lipid accumulation in the vascular wall leading them to thicken along with a cascade of reactions such as calcification, luminal-stenosis, also thrombosis, fairly in a few cases that might be trailed by a clinically-asymptomatic situation

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instigated by thrombotic sealing.[4] Based on the nature of occlusion of the thrombus, the myocardial infarction (MI) is classified into ST-elevation myocardial infarction (STEMI) and non-Elevation myocardial infarction (NSTEMI). While STEMI denotes acute vessel occlusion, NSTEMI indicates a non-occluding (mural) platelet-rich thrombus.[5] These processes are the origin points to multifaceted coronary medical complications such as myocardial infarction causing abrupt cardiac arrest that might even lead to death.

As a disease evoked by a cascade of inflammatory responses, the incidence of the inflammation encompasses multifaceted connections amid endothelial and smooth muscle cells, platelets, besides leucocytes.[6] The reactions of these connections could be used as a marker in the prognostic pre-determination of the disease. White blood cell count has been consistent as a worthwhile inflammatory biomarker for the clinical prediction of CVD.[7] In such a manner, neutrophil-lymphocyte ratio (NLR) can likewise serve as an indicator of this systemic inflammation, which is calculated by dividing neutrophil counts by lymphocyte.[8] As an added advantage, this ratio could effortlessly be accessible and also at a lower expense.[9] Thus, the NLR has extrapolative supremacy in predicting death, MI besides high-risk coronary artery disease.[10] Hence the subsequent study intended to appraise the extrapolative implication of NLR in STEMI patients.

2. Materials and Methods

The study was carried out in Thanjavur medical college by evaluating 55 patients diagnosed with STEMI from December 2015 to February 2016 with prior informed consent.

Inclusion criteria: STEMI patients who were thrombolysed. Exclusion criteria: Inflammatory conditions, for instance, collagen-vascular disorders, acute/ chronic infectious diseases, renal failure, auto-immune, neoplastic along with chronic and hepatic diseases, thyroid disorders and a history of cardiac valvular disease.

On initial admission, the diagnosis was confirmed and patients were treated as per ACC / AHA protocol.

In addition, the type of chest pain (acute or chronic) and left ventricular ejection fraction (LVEF) were documented in the checklist. Those who were active smokers at the time of thrombolysis or had quit smoking in less than one month preceding the procedure were considered smokers.

Baseline demographic data like age and gender, cardiovascular diseases risk factors (history of diabetes mellitus, hypertension, hyperlipidemia, cigarette smoking, and alcohol drinking), and Laboratory data (triglyceride, fasting blood sugar (FBS), urea, creatinine, WBC count, platelet count, MCV (mean corpuscular volume), and NLR) were entered into a checklist.

We calculated NLR from the above two parameters. The above values were measured with an automated cell counter in the department of biochemistry, Thanjavur medical college. All measurements were performed 30 minutes after blood collection by an automatic blood counter. Echocardiographic examinations were performed according to the guidelines of the American Society of Echocardiography.

3. Results

From December 2015 to February 2016, a total of 83 consecutive ACS patients were assessed. Among them, 71% belonged to STEMI, 18 and 11% to NSTEMI and USA. Midst the 59 STEMI patients, 4 patients were excluded as they were diagnosed with upper respiratory tract (3) and urinary tract (1) infections. This left a final number of 55 patients for evaluation, including 42 males and 13 females with a mean age group of 52.08 years (Table 1). Blood samples from STEMI patients were drawn 6.86 hours right after admission post-onset of symptoms (24-72 hours later). A comorbid analysis revealed that hypertension was predominantly observed (71%), followed by alcoholic history (67%) and smokers besides people with diabetes (64%). Dyslipidemia was observed in the least number of patients (24%) (Table 1).

Table 1: Patient characteristics

Patient characteristics		Frequency	Percentage
Age group	30-40 yrs	4	7%
	40-50 yrs	8	14%
	50-60 yrs	12	22%
	>60 yrs	31	56%
Gender	Male	42	76%
	Female	13	24%
Comorbid	Smokers	35	64%
	Alcoholics	36	67%
	Diabetics	35	64%
	Hypertensives	39	71%
	Dyslipidaemia	15	24%
	MACE events	44	79%
MI	Arrhythmia	5	10%
	Hypotension	10	18%
	Systolic dysfunction	45	82%
Patients with NLR >3		12	22%

Hematological analysis revealed the maximum counts of neutrophils and lymphocytes to reach a maximum of 80 and 39 posts 72 hours that decreased from 89 and 40 at the time of admission, respectively (Table 2). A likely decrease in the total counts was observed that reduced from 15330 to 10000 post 72 hours. NLR also decreased drastically from 11.5 to 5 post 72 hours (Table 2). Based on the final NLR, the patients were categorized under two sections, those with NLR <3 and >3. A lower NLR value was reported in most of the patients (78%). Of the total of 5 patients with electro conductive complications, 2 patients had an NLR value

Table 2: Mean values of haematological parameters

Haematological parameters	Range	Minimum	Maximum	Mean	SD
Neutrophil admission (%)	33	56	89	70.2	8.3
Neutrophil- 24 hrs	44	47	91	69.1	11.8
Neutrophil-72 hrs	24	56	80	66.7	6.8
Lymphocyte admission	33	7	40	25.7	8.1
Lymphocyte-24 hrs	41	6	47	27.3	11.6
Lymphocyte- 72 Hrs	23	16	39	28.9	6.3
Total count: Admission	10280	5050	15330	8.7	2601.7
Total count -24 hrs	8250	4950	13200	8.7	2404.7
Total count – 72 hrs	9000	1000	10000	7.11	1855.2
Ejection fraction	35	25	60	43.2	10.4
NLR admission	9.9	1.6	11.5	3.2	1.8
NLR – 24 hrs	14.1	1.04	15.16	3.6	3.2
NLR-72 hrs	3.5	1.4	5	2.4	0.911

Table 3: Relation of NLR with disease parameters.

S.No	Diseases parameters		NLR <3	NLR >3	Total	P-value
1	Age	<40	4	1	5	0.642
		>40	39	11	50	
2	Sex	Male	2	11	13	0.796
		Female	10	32	42	
3	Alcoholism	Yes	27	9	36	0.657
		No	16	3	19	
4	Smoking	Yes	27	8	35	0.92
		No	16	4	20	
5	Diabetes	Yes	31	4	35	0.033
		No	12	8	20	
6	Hypertension	Yes	29	10	39	0.476
		No	14	2	16	
7	Dyslipidemia	< 250	32	8	40	0.24
		>250	11	4	15	
8	Arrythmias	Yes	3	2	5	0.643
		No	40	10	50	
9	Lvef	Normal	9	2	11	0.906
		Decreased	34	10	44	
10	Hypotension	Yes	10	0	10	0.154
		No	33	12	45	

Table 4: Relation of post-MI complication with disease parameters.

S.No.	Diseases parameters		Post mi complication Yes	Post mi complication No	Total	P-value
1	Alcoholism	Yes	28	8	36	0.831
		No	16	3	19	
2	Smoking	Yes	30	5	35	0.629
		No	14	6	20	
3	Diabetes	Yes	29	6	35	0.726
		No	15	5	20	
4	Hypertension	Yes	31	8	49	0.823
		No	13	3	16	

above the cut-off value of >3 and 3 patients had an NLR value below the cut-off value of <3. There was no significant influence of NLR of the patient on the incidence depicted by a P-value of 0.642.

Among the 55 patients tested, higher NLR (>3) was observed in patients above 0 years of age. However, the statistical analysis revealed no association to be existent between age and NLR. In addition, higher NLR was observed in females compared with that of male patients (3:1). Other parameters such as smoking, alcohol history and comorbid considerations such as diabetes, hypertension besides dyslipidemia did not influence NLR count (Table 3). Regarding post-MI complications, 80% of the patients tested positive, and analysis of post-MI complications with disease parameters revealed the higher risk factor to be hypertension followed by smoking, diabetes and alcoholics (Table 4).

4. Discussion

Cardiovascular disease, the causative of most fatalities worldwide, has been found to affect people of various age groups and all economic levels. Early diagnosis and prevention are the most significant tactic to evade life-threatening complications, history and physical examination and laboratory diagnosis are the most sought diagnostic tools. Owing to the multifactorial grounds of disease incidence and expense for diagnosis, alternative and effective prognostic methods are being sought after. Since CVD is an inflammatory disorder, the association between immune components and their interactions could be used as a marker for earlier detection.[11] STEMI is the most common form of MI and is reported with a higher rate of morbidity and death that also depends upon preliminary clinical staging. Prior detection could ease the disease outcome. Hence the current investigation was intended to assess the prognostic ability of NLR in the prediction of complications in STEMI patients at Thanjavur medical college.

Patients diagnosed with STEMI were grouped based on age, gender, comorbid and MI. A higher incidence of STEMI was observed in patients with age-group above 60, yet statistical analysis revealed no association between age and STEMI incidence. The mean NLR was 3.367. A likely mean value of NLR was also reported by Park et al. (2018).[12] The mean age of the patients was 52.08 years which was also in parallel to the age group reported by Gupta et al. in a study conducted at Jhalawar.[13] The influence of risk factors on MACE events and NLR was also analyzed. While smoking increased the NLR counts and consequently the MI complications, diabetes did not positively influence.

Since neutrophils are short-lived, measurements of counts were taken 24 hours and 72 hours post-admission for a better prognostic determination. The values of hematological parameters increased 24 hours post-admission and gradually decreased after 72 hours. This was also in agreement with the results posted by Nunez et al., who recorded higher counts of neutrophils post 24 hours.[10] The patients who exhibited higher NLRs developed more MI complications. In a similar study conducted by Menon et al., it was proved that patients with greater leukocyte count were at an elevated risk of heart failure besides cardiogenic shock.[14] Barron et al. also proposed a similar association between the elevated levels of leukocytes and the prevalence of congestive heart failure.[15] Proportionality between augmented white blood cell counts with mortality was reported in several other studies. Another correlation between lower ejection fractions (LEF) and high NLR with increased heart failure rates were observed in this study. This was also in parallel to the findings of Chia et al., who reported increased leukocyte and neutrophil counts in patients post primary percutaneous coronary intervention (PCI).[16] They also conveyed that LEF could also be employed as a predictive tool for the prognosis of cardiovascular aftermaths.

The limiting factor of the study was the inability to perform routine holter monitoring and detailed arrhythmia evaluation post 24 hours when patients were shifted from CCU. A statistically insignificant relation between arrhythmias and elevated blood counts was observed in this study. In a likely observation conducted by Chatterjee et al., the development of ventricular arrhythmias was predicted by the upsurged WBC count, neutrophilia, and elevated NLR. Hence, the study exposes the importance and reliability of NLR in the prediction of MI complications.[17] Also, it was found that parameters such as WBC counts and lower EF could also be used as independent predictors of post-infraction complications. However, the study was limited by certain parameters, such as that only in-hospital NLR parameters observed in a very low number of patients were accounted for. Also, the non-evaluation of the correlation between the parameters and clinical prognosis is a limiting factor.

5. Conclusion

Increased NLR was associated with the increased rate of MI complications influenced by risk factors such as smoking and hypertension. Thus, results of the study not only indicate the reliability of using NLR values but also propose a cost-effective method to predict ACS and associated complications. However, further studies that shall include gradually enhanced systematic visions into the pathways leading to lipid accumulation and the roles of vascular cell activation and inflammation provide exciting new avenues for therapeutic intervention.

6. Conflict of Interest

There are no conflicts of interest in this article.

7. Source of Funding

None.

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