Section: General Medicine

Original Research Article

A STUDY OF IMPORTANCE OF PROGNOSTIC VALUE OF NEUTROPHIL TO LYMPHOCYTE RATIO IN PATIENTS WITH STEMI

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Abstract

Background: Cardiovascular disease has now become the leading cause of death worldwide over the last decade. One of the most widely used inflammatory biomarkers, Neutrophil to Lymphocyte ratio has been proved to be associated with increased adverse clinical outcomes in STEMI. **Objectives:** To evaluate the prognostic value of neutrophil to lymphocyte ratio in patients with acute ST elevation myocardial infarction. **Materials and Methods:** A Prospective observational study was conducted between April 2021 to March 2022, at Government Thiruvarur Medical College and Hospital for 150 STEMI patients. Based on inclusion and exclusion criteria, participants were selected and subjected to investigation. Data was collected, entered in MS Excel and analysed using SPSS. Appropriate statistics were done. **Results:** Mean age of the patients was 31.3 years, among which 83.3% were males. About 41.3% were alcoholics, 38% were smokers, 35.3% were diabetics, 32.7% were hypertensive and 23.3% had dyslipidemia. About 32.7% had hypotension, 11.3% had cardiogenic shock, 21.3% had arrhythmia, 78.7% had LVSD. Ejection fraction is reduced in 73.3%. About 66% had NLR more than 3. There was no significant influence of age, gender, hypertension, diabetes, dyslipidemia, smoking and alcohol consumption on the NLR ratio. NLR value in relation to complications was statistically significant. **Conclusion:** Mean age of the patients was 31.3 years, among which 83.3% were males. About 41.3% were alcoholics, 38% were smokers, 35.3% were diabetics, 32.7% were hypertensive and 23.3% had dyslipidemia. About 32.7% had hypotension, 11.3% had cardiogenic shock, 21.3% had arrhythmia, 78.7% had LVSD. Ejection fraction is reduced in 73.3%. About 66% had NLR more than 3. There was no significant influence of age, gender, hypertension, diabetes, dyslipidemia, smoking and alcohol consumption on the NLR ratio. NLR value in relation to complications was statistically significant.

INTRODUCTION

Cardiovascular disease has now become the leading cause of death worldwide over the last decade. It is estimated that about 17.3 million deaths and 330 million disability adjusted life- years lost in 2013.[1], that is around 32% of all the deaths and 13% of all the DALYs lost that year.

Between 1990 and 2013, deaths from cardiovascular disease increased from 26% to 32% of all deaths globally, indicating a rapid epidemiologic transition, particularly in low- and middle- income countries. The cardiovascular disease mortality rate is 38% in high income countries.

Cardiovascular disease accounts for 27% of all deaths in the South Asian region, among which coronary heart disease is the leading cause of mortality in 2013- about 15% of total deaths or 2 million deaths and more than half of CVD mortality. The rise in CHD mortality contributes to the economic burden in the Indian subcontinent.

Worldwide, CVD is largely driven by modifiable risk factors, such as smoking, lack of physical activity and diets high in fat and salt. Elevated levels of blood pressure and cholesterol remain the leading

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causes of CHD; Tobacco, obesity and physical inactivity remain important contributors as well.

One of the most widely used inflammatory biomarkers, Neutrophil to Lymphocyte ratio has been proved to be associated with increased adverse clinical outcomes in STEMI. As these inflammatory marker values are readily available in routine blood count analysis, NLR may be used as a cost-effective predictor of inflammation and cardiovascular complications.

Recently NLR is found to be very useful in predicting Atrial tachycardia as well as left ventricular ejection fraction. It is also useful in predicting long term mortality in patients hospitalized with ST elevation myocardial infarction and in patients undergoing percutaneous coronary intervention (PCI).

Objectives

To evaluate the prognostic value of neutrophil to lymphocyte ratio in patients with acute ST elevation myocardial infarction.

MATERIALS AND METHODS

Place of study: Government Thiruvarur Medical College and Hospital

Study design: Prospective observational study

Study duration: 1 year between April 2021 to March 2022

Sample size: 150 patients. We enrolled 150 consecutive STEMI patients admitted in our coronary care unit based on the inclusion and exclusion criteria and all of them subsequently underwent thrombolysis with streptokinase and they were monitored for complications.

Inclusion criteria: All patients with STEMI who underwent thrombolysis from both gender, age 40 years and above, admitted under General Medicine (Coronary care unit) during study period.

Exclusion criteria: Inflammatory conditions such as Collagen-vascular disorders, Acute or chronic infectious diseases, Auto-immune diseases, Neoplastic diseases, Chronic hepatic diseases and Renal failure, Thyroid disorders, Left ventricular dysfunction caused by predisposing cardiomyopathy or severe valvular heart diseases and Toxicology related.

Study Tool: Basic details of the patient - Age and Gender, Cardiovascular diseases risk factors (history of diabetes mellitus, hyperlipidaemia, hypertension, cigarette smoking, tobacco usage and alcohol drinking), Laboratory data (triglyceride, total cholesterol, LDL, HDL, fasting and postprandial blood sugar, urea, creatinine, WBC count, platelet count, and NLR were entered into a checklist. NLR values were measured with automated cell counter in the Department of Pathology, Government Thiruvarur Medical College and Hospital and echocardiogram was also done.

Some definitions:

Acute STEMI is defined when a patient had typical cardiac chest pain for at least 30 minutes with >-1 mm ST elevation at the J-point in at least two contiguous leads other than leads V2 and V3, where following cutoff points apply: >-2mm in men >-40years; >-2.5 mm in men <40 years, or >- 1.5mm in women regardless of age.[2]

Hypertension was considered to be present if the systolic pressure was >140 mmHg and/or diastolic pressure was >90 mmHg, for at least two separate measurements, or the previous use of antihypertensive drugs.[3]

Diabetes mellitus was defined as a fasting blood glucose level >126 mg/dL, or current use of a diet or medication to lower blood glucose.

Hyperlipidaemia was defined as serum total cholesterol level of more than 200 mg/dL, LDL cholesterol level of more than 130 mg/dL, HDL cholesterol of less than 40 mg/dL, or triglyceride of higher than 250 mg/dL.

Ethical Clearance: Obtained.

Statistical analysis: Pearson Chi-square tests were used to compare the incidence of categorical variables among groups. Categorical variables were presented as counts and percentages. The two independent sample t tests were used to compare continuous variables between the two groups. Continuous variables were presented as mean (standard deviation) or as median (ranges). Data were entered in excel sheet and calculations by Chi square tests were done using SPSS software. Calculated p-values were considered statistically significant when they were <0.05.

RESULTS

We enrolled 150 consecutive STEMI patients admitted in our coronary care unit based on the inclusion and exclusion criteria and all of them subsequently underwent thrombolysis with streptokinase and they were monitored for complications.

Mean age of the patients was 31.3 years, among which 83.3% were males. About 41.3% were alcoholics, 38% were smokers, 35.3% were diabetics, 32.7% were hypertensive and 23.3% had dyslipidemia. (Table 1)

About 32.7% had hypotension, 11.3% had cardiogenic shock, 21.3% had arrhythmia, 78.7% had LVSD. Ejection fraction is reduced in 73.3%. About 66% had NLR more than 3. (Table 2) (Figure 1).

Table 3 depicts that a total of 33 patients aged between 41 years and 60 years and had a low NLR (< cut off of 3). Of the total 150 patients, 32 patients had above cut - off NLR value and were above 60 yrs. There was no significant influence of age of the patient on the NLR ratio depicted by a P value of 0.326. Among participants in our study there were 125 (83.3%) males and 25 (16.7 %) females. About 64% among male population have raised NLR of

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more than 3.0. 76% among female population have raised NLR of more than 3.0. There was no significant influence of sex of the patient on the NLR ratio depicted by a P value of 0.33.

Among hypertensives, 30.3% have increased NLR value. Among non-hypertensives, 69.7% have increased NLR value. There was no significant influence of hypertensive status of the patient on the NLR ratio depicted by a P value of 0.390. Among diabetics, 38.4% have increased NLR value. Among non-diabetics, 61.6% have increased NLR value. But this is not statistically significant. There was no significant influence of diabetes on the NLR ratio depicted by a P value of 0.276. Among smokers, 37.4% have increased NLR value. Among non - smokers, 62.6% have increased NLR value. But this is not statistically significant. Among alcoholics, 41.4% have increased NLR value. Among non - alcoholics, 58.6% have increased NLR value. But this is not statistically significant. There was no significant influence of alcoholism of the patient on the NLR ratio depicted by a P value of 0.978. Among those with dyslipidaemia, 25.3% have increased NLR value. Among those without dyslipidaemia, 74.7% have increased NLR value. But this is not statistically significant. (Table 4)

Out of 150 patients, post MI complication was observed in 113 subjects (75%) and 37 subjects (25%) were discharged without any complications. Minimum NLR value observed was 1.2 and maximum value observed was 14.7. Hypotension found in 31% of our study population. High NLR seen in more than 90% of people with complications. We divided patients into two groups one with high NLR > 3.0 and other group with low NLR <3.0. 99 patients (66%) had NLR value above 3.0 and remaining 51 (34%) patients had NLR value below 3.0 before analysing for the relation of NLR to different complications. NLR value in relation to complications was statistically significant with p value of 0.001. (Table 5)

Among those with hypotension, 46.5% have increased NLR value. Among those without hypotension, 53.5% have increased NLR value. This is statistically significant with p value less than 0.05. Among those with cardiogenic shock, 17.2% have increased NLR value. Among those without cardiogenic shock, 82.8% have increased NLR value. This is statistically significant with p value less than 0.05. The above table depicts that a total of 32 patients had arrhythmogenic complication. All the 32 patients had a NLR value above the cut - off value of 3. There was a significant influence of NLR of the patient on the incidence of arrhythmias depicted by a P value of 0.001. Among those with LV systolic dysfunction, 88.9% have increased NLR value. Among those without LV systolic dysfunction, 11.1% have increased NLR value. This is statistically significant with p value less than 0.05. Among those with reduced ejection fraction, 88.9% have increased NLR value. Among those with normal ejection fraction, 11.1% have increased NLR value. This is statistically significant with p value less than 0.05. (Table 5).

Among smokers, 40% had increased post MI complications. Among non -smokers, 60% had increased post MI complications. There was no significant influence of smoking status of the patient on the complication depicted by a P value of 0.421. Among alcoholics, 42.5% had increased post MI complications. Among non-alcoholics, 57.5% had increased post MI complications. But this is not statistically significant which was indicated by the P value of 0.619. Among diabetics, 35.4% had increased post MI complications. Among non - diabetics, 64.6% had increased post MI complications. There was no significant influence of diabetic status of the patient on the complication depicted by a P value of 0.977. Among hypertensives, 28.3% had increased post MI complications. Among non - hypertensives, 71.7% had increased post MI complications. This is statistically significant with P value of 0.04. Among patients with dyslipidemia, 23.9% had increased post MI complications. Among non - dyslipidemics, 76.1% had increased post MI complications. There was no significant influence of dyslipidemia on the NLR depicted by a P value of 0.77. (Table 6).

Table 1: Basic details of the participants

Variable	Categories	N	%
Age in years	41-50	52	34.7
	51-60	48	32
	61-70	39	26
	71-80	6	4
	>80	5	3.3
	Mean	31.3 years	SD 4.6 years
Gender	Male	125	83.3
	Female	25	16.7
Diabetes	No	97	64.7
	Yes	53	35.3
Hypertension	No	101	67.3
	Yes	49	32.7
Dyslipidemia	No	115	76.7

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	Yes	35	23.3
Alcoholic	No	88	58.7
	Yes	62	41.3
Smoker	No	93	62
	Yes	57	38

Table 2: Complications and Other parameters

Variable	Categories	N	%
Hypotension	No	101	67.3
	Yes	49	32.7
Cardiogenic shock	No	133	88.7
	Yes	17	11.3
Arrhythmia	No	118	78.7
	Yes	32	21.3
LVSD	No	41	27.3
	Yes	109	78.7
Ejection fraction	Normal	40	26.7
	Reduced	110	73.3
NLR	<3	51	34
	>3	99	66

Table 3: Comparison of NLR with various parameters

Parameter	Category	NLR				Total	Chi square	P value
		≤3	3.1-4	4.1-5	≥5.1			
		N (%)	N (%)	N (%)	N(%)			
Age	41-50	20 (39.2)	11 (33.3)	7 (43.8)	14 (28)	52	13.6	0.326
	51-60	13 (25.5)	14 (42.4)	5 (31.3)	16 (32)	48		>0.05
	61-70	13 (25.5)	8 (24.2)	1 (6.3)	17 (34)	39		
	71-80	3 (5.9)	0	2 (12.5)	1 (2)	6		
	>80	2 (3.9)	0	1 (6.3)	2 (4)	5		
Gender	Male	45 (88.2)	29 (88)	13 (81)	38 (76)	125	3.35	0.33
	Female	6 (11.8)	4 (12)	3 (19)	12 (24)	25		>0.05
p >0.05 (NS) – Not Significant by Applying Chi Square –Test								

Table 4: Comparison of NLR with various parameters

Parameter	Category	NLR		Total	Chi square	P value
		≤3	>3			
		N (%)	N (%)			
Hypertension	No	32 (62.7)	69 (69.7)	101		>0.05
	Yes	19 (37.3)	30 (30.3))	149	0.74	0.39
Diabetes Mellitus	No	36 (70.6)	61 (61.6)	97		>0.05
	Yes	15 (29.4)	38 (38.4)	53	1.18	0.276
Smoking	Yes	20 (39.2)	37 (37.4)	57		
	No	31 (60.8)	62 (62.6)	93	0.04	>0.05
Alcohol consumption	Yes	21 (41.2)	41 (41.4)	62	0.01	> 0.05
	No	30 (58.8)	58 (58.6)	88		0.978
Dyslipidemia	Yes	10 (19.6)	25 (25.3)	115		>0.05
	No	41 (80.4)	74 (74.7)	35	0.6	0.439
p >0.05 (NS) – Not Significant by Applying Chi Square –Test						

Table 5: Comparison of NLR with Post STEMI Complications

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Parameter	Category	NLR		Total	Chi square	P value
		≤3	>3			
		N (%)	N (%)			
Complication	Yes	21 (41.2)	92 (92.9)	113		<0.05*
	No	30 (58.8)	7 (7.1)	37	48.5	0.001*
Hypotension	Yes	**1 (2)**	46 (46.5)	47		
	No	50 (98)	53 (53.5)	103	30.8	<0.05*
Cardiogenic shock	Yes	0	17 (17.2)	17		
	No	51 (100)	82 (82.8)	133	9.87	<0.05*
Arrhythmia	Yes	0	32 (32.3)	32		<0.05*
	No	51 (100)	67 (67.7)	118	20.9	0.001*
LSVD	Yes	21 (41.2)	88 (88.9)	109		
	No	30 (58.8)	11 (11.1)	41	38.5	<0.05*
Ejection fraction	Normal	29 (57)	11 (11.1)	40		

Table 6: Comparison of Risk factors with Complications

Parameter	Category	Complications		Total	Chi square	P value
		Yes	No			
		N (%)	N (%)			
Smoking	Yes	45 (40)	12 (32.4)	57		> 0.05
	No	68 (60)	25 (67.6)	93	0.646	0.421
Alcohol consumption	Yes	48 (42.5)	14 (37.8)	62		>0.05
	No	65 (57.5)	23 (62.2)	88	0.247	0.619
Diabetes Mellitus	Yes	40 (35.4)	13 (35.1)	53		>0.05
	No	73 (64.6)	24 (64.9)	97	0.001	0.977
Hypertension	Yes	32 (28.3)	17 (45.9)	49		<0.05*
	No	81 (71.7)	20 (54.1)	101	3.93	0.04*
Dyslipidemia	Yes	27 (23.9)	8 (21.6)	35	0.08	>0.05
	No	86 (76.1)	29 (78.4)	115		0.77
*p <0.05 (S) – Significant by Applying Chi square Test						

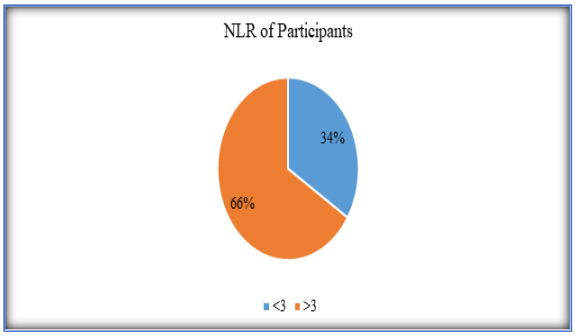

Figure 1: Pie Diagram showing Distribution of NLR

DISCUSSION

Acute myocardial infarction is an inflammatory state, where the count of white blood cells increases. Even-though there are lot of novel inflammatory biomarkers available at present to stratify the severity of patients, Neutrophil to Lymphocyte ratio is the simple, cheaper and widely available marker for risk stratification of acute ST segment elevation myocardial infarction patients. It is widely used as it is independent of total leukocyte count

Neutrophil to lymphocyte ratio is the ratio between absolute number of neutrophils and lymphocytes, from the venous blood sample. We found that high NLR is associated with the post infarction complications but it is not statistically significant.

High neutrophil count in myocardial infarction is an independent predictor of complications such as cardiogenic shock, heart failure, arrhythmias and high in-hospital morbidity and mortality. Hence, our study helps in risk stratification of patients with high neutrophil to lymphocyte ratio and thereby preventing in-hospital mortality from STEMI.

Limitations

We have conducted this study only for short period of time. Hence long term complications in relation to NLR could not be correlated.

There are a lot of novel inflammatory biomarkers available and their association with NLR is not studied.

Patients were not put on Holter monitor to look for arrhythmias. Hence transient and paroxysmal arrhythmias could be missed out in our study.

CONCLUSION

The main aim of our study is to find out the role of NLR as a prognostic marker, especially for risk stratification in post-STEMI patients. Even though

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statistically insignificant, high NLR ratio in our study is associated with Post STEMI complications. Hence inflammation plays a major role in acute myocardial infarction complications. But for better results as well as risk stratification, this study has to be done in multiple centers involving larger study population.

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Conflict of Interest: Nil

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