Original Article

Association Between Neutrophil to Lymphocyte Ratio and Severity of Coronary Artery Disease in Acute Myocardial Infarction Patients

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Abstract:

Background: Acute myocardial infarction is one of the leading causes of death across the world. Determination of severity is important in patients with acute myocardial infraction for the therapeutic decision making. Neutrophil to Lymphocyte Ratio (NLR) has been proposed as a new prognostic marker in patients with acute MI. Several international studies have found to compare the relation between NLR and severity of coronary artery disease. In these studies, they demonstrated that the NLR is higher in severe CAD. In our country no such study has been done yet to predict the severity of coronary artery disease by estimating NLR in acute MI patients. Moreover, NLR is cheap, easily available, non-invasive and routinely done procedure.

Objectives: This study was conducted to find out the association of NLR to severity of CAD in acute MI patients.

Methods: This observational cross sectional analytical study was carried out in the Department of Cardiology, Dhaka Medical College Hospital, SSMC and Mitford Hospital and NICVD, Dhaka from March 2021 to February, 2022. Patients with acute MI (STEMI and NSTEMI) were approached for this study according to inclusion and exclusion criteria. They were divided into two groups according to NLR: Group A NLR >2.5 and Group B NLR ≤2.5. Coronary angiogram was done during index hospitalization. The severity of coronary artery disease was assessed by Vessel score and Gensini score. According to Gensini score was non severe (≤50) severe (>50).

Results: Among 70 patients in our study 30 (42.8%) were in the high NLR group (Group A) and 40 (57.14%) were in low NLR group (Group B). In group A mean NLR was 5.15 ± 2.21 and in group B mean NLR was 1.65 ± 0.35, this difference was statistically significant. Severe coronary artery disease in terms of vessel score and Gensini score was significantly higher in group A than group B (p value 0.001). We found strong positive correlation between NLR and Gensini score (r= 0.7, p= 0.001), and moderate positive correlation between NLR nad vessel score (r= 0.5, p= 0.001). With the increase of NLR, vessel score and Gensini score increases demonstrating more severe CAD. Simple logistic regression analysis of variables of interest revealed that hypertension (p=0.003), diabetes mellitus (p=0.008), dyslipidaemia (p=0.007), WBC count(p=0.034), Neutrophil count (p=0.000), Lymphocyte count (p=0.000), NLR (p=0.000), LVEF (p=0.001) were independent predictor of severe coronary artery disease with odds ratio (OR) being 5.32, 3.88, 4.42, 1.00, 1.20, 0.834, 2.28, 0.805 respectively. In multivariate logistic regression analysis, after adjustment of confounding, hypertension (p=0.028, OR=5.87) and NLR (P=0.004, OR=1.81) remain independent predictor of severe CAD. In ROC curve analysis, the AUC of NLR for predicting severity of CAD is 0.8 with p value < 0.001, 95% CI (0.78-0.96) and with 75% sensitivity and 86.5% specificity. So, from this study, it is evident that NLR is directly associated with coronary artery disease severity.

Conclusion: Increased NLR was associated with angiographically severe coronary artery disease in acute Myocardial Infarction patients and this association is independent of conventional cardiovascular risk factors.

Key words: *NLR: Neutrophil to Lymphocyte Ratio; CAD: Coronary Artery Disease*

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Introduction:

Cardiovascular diseases (CVDs) are the leading cause of death globally and major contributor of disability. An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global death, of these 85% due to heart attack and stroke. Three quarters of CVD death take place in low and middle-income countries[1].

CAD is growing by epidemic proportion day by day in Bangladesh[2]. The exact prevalence of coronary artery disease in Bangladesh is not known. Only a limited number of small-scale epidemiological studies are available[3]. Recent data indicates CAD prevalence in Bangladesh is between 1.85% and 3.4% in rural and 19.6% in urban population[4].

The dynamic nature of the CAD process results in various clinical presentations, which can be conveniently categorized as either acute coronary syndromes (ACS) or chronic coronary syndromes (CCS).

ACS are further classified into ST-elevation MI (STEMI), Non-ST elevation MI (NSTEMI) and Unstable angina (UA). (5) Acute myocardial infarction is the most severe manifestation of coronary artery disease.

Atherosclerosis plays a dominant role in the pathophysiological process of CAD and atherosclerosis are closely associated with inflammation.(6) Atherosclerosis is primarily an inflammatory disease and the role of inflammation in the process of initiation, progression and plaque de-stabilization in atherosclerosis has been well studied.(7) Evidence from various studies has demonstrated that increased levels of inflammatory markers are associated with increased rates of cardiac events in patients with CAD. (8) Different white blood cell (WBC) subtypes play crucial role in the pathogenesis of atherogenesis and atherothrombosis.[9]

The role of inflammatory markers in cardiovascular diseases has been studied extensively and a consistent relationship between various inflammatory markers and cardiovascular diseases has been established in the past. Among these C reactive protein (CRP), Highly sensitive CRP, Fibrinogen, Interleukin -6 (IL-6), Monocyte/ Macrophage colony stimulating factor (MCSF), Tumor necrosis factor alpha, Lipoprotein associated phospholipase A2 and Interlukin-1 isoform are noteworthy.

Recently neutrophil to lymphocyte ratio has emerged as a new addition to the long list of these inflammatory markers. (10) It has also predictive value of cardiovascular events in patients with covid 19 infection.[11] Normal NLR is roughly 1-3. We use cut off point for defining high NLR is 2.5 from study done by Kaya et al.(12) NLR is calculated by dividing the number of neutrophils by the number of lymphocytes, computed from same blood sample collected at admission.[13]

NLR is a combination of two independent marker of inflammation: neutrophil as a marker of ongoing non-specific inflammation and lymphocytes as a marker of the regulatory pathway. A higher NLR indicates a higher level of inflammation and integrates the predictive risk of these 2 leucocytes subtypes into a single risk factor.(14) As a representative indicator of inflammation, a high NLR is recognized as an independent risk factor for the progression of atheromatous plaque lesions, severity of CAD,[15] in stent restenosis, cardiac death after percutaneous coronary interventions or coronary artery bypass surgery and incidents of cardiac events in ACS.(16)

Coronary angiography is the gold standard for the clinical judgement of CAD whereas the Gensini score is a quantitative indicator for the estimation of the severity of coronary artery stenosis on the basis of coronary angiography.

Previous study has shown that higher the NLR, higher the severity of CAD in chronic stable angina patients. So, purpose of our study is to demonstrate relation between NLR and severity of CAD in acute MI patients.

Methods:

This cross-sectional observational study was carried out in the Department of Cardiology of DMCH, Sir Salimullah Medical College and Mitford Hospital and National Institute of Cardiovascular Diseases, Dhaka from March,2021 to February, 2022. Patients with acute myocardial infarction who undergone coronary angiogram during the study period were selected by purposive sampling. Patients who underwent prior PCI and/or CABG, patients with heart failure - NYHA class III, IV, hematological diseases, malignancy, chronic kidney disease, chronic liver disease, ongoing infection, chronic inflammatory disease, autoimmune disease, pregnancy were excluded from the study. Total 70 cases were included in the study and were divided into two groups on the basis of NLR cut off level 2.5: Group A (NLR >2.5) and Group B (NLR $\leq$2.5). After taking informed written consent from each patient meticulous history was taken and detailed clinical examination was performed and recorded in predesigned structured proforma. Levels of hemoglobin, white blood cells, neutrophils, lymphocytes, other differentials of white blood cells and platelets were determined by automated hematology analyzer. Serum creatinine, random blood sugar, fasting lipid profile and other screening tests for coronary angiogram were done.

Coronary angiogram was done by conventional method in the same hospital setting. Severity assessment was done by Gensini score and vessel score.

NLR was calculated by dividing the number of neutrophils by the number of lymphocytes, from peripheral blood sample. Angiographic pattern and severity of coronary artery disease were assessed by interpretation of coronary angiogram by visual estimation by two cardiologists. Severity of coronary stenosis was graded according to the number of major epicardial vessel with significant stenosis (vessel score) and Gensini score.

In vessel score, significant coronary artery disease was defined as > 70% stenosis in any of the three major epicardial coronary arteries or a left main coronary artery stenosis > 50%. Angiograms revealing coronary artery stenosis < 70% in major epicardial coronary arteries were termed non-obstructive CAD. Extent of coronary artery disease was defined as significant single, double or triple vessel coronary artery disease. Score ranged from 0 to 3 depending on the number of vessels involve. Left main coronary artery was scored as single vessel disease.

i) Score 0 = no vessel involvement, ii) Score 1 = single vessel involvement, iii) Score 2 = double vessel involvement, iv) Score 3 = triple vessel involvement.

The Gensini score was developed by Gensini and takes into consideration the geometrical severity of lesions by angiography, the cumulative effects of multiple obstructions, and the significance of jeopardized myocardium. A nonlinear score was assigned to each lesion based on the severity of stenosis as indicated by the reduction of lumen diameter. A multiplier was applied to each lesion score based upon its location in the coronary tree depending on the functional significance of the area supplied by that segment. The final Gensini score was the sum of the lesion scores. The score assessed 14 coronary artery segments, which were scored according to their anatomical importance (ranging from 0.5 to 5) multiplied by the score regarding the maximum degree of obstruction. The points of the 14 segments were summed up to yield a final score.

Total Gensini score was calculated as:

% of stenosis	Score
1-25%	1
26-50%	2
51-75%	4
76-90%	8
91-99%	16
100%	32

Vessel (S) involved	Vessel multiplier score
Left Main	5
Proximal LAD / LCX	2.5
Mid LAD/Mid LCX	1.5
Distal LAD/ Distal LCX /First Diagonal/ First OM/RCA/PDA/PLV	1
Second Diagonal/Second OM	0.5

Total Gensini score = Sum of (Score for % of stenosis X Score for Vessel(s) involved)

Interpretation of coronary angiogram will be made as the Gensini score. According to Gensini score, CAD was categorized as non-severe CAD (≤50), severe CAD (>50).

SPSS 23 was used for data analysis. Continuous variables were expressed as mean ± SD and categorical variables as frequency and percentage. The Kolmogorov-Smirnov test was used to verify the normality of distribution of continuous variables. Quantitative variables were analyzed by student's t test and Man Whitney U test. Categorical variables were analyzed by Chi-square test. To test association between NLR and coronary artery disease severity Spearman's rank order correlation test were used. Simple logistic and multivariate logistic regression analysis were done to evaluate the independent predictor of severe CAD and results are shown as odds ratio and 95 % confidence intervals. P value < 0.05 was considered significant and p value <0.001 was considered as highly significant. ROC curve analysis was done to see the sensitivity and specificity of detecting severe CAD by NLR cut-off value 2.5.

Results:

This cross-sectional observational study was conducted in the department of cardiology, DMCH, SSMCH, NICVD from March 2021 to February 2022. The main objective of this study was to find out the association between neutrophil to lymphocyte ratio (NLR) and coronary artery disease severity in acute MI patients. Among the total 70 patients' group-A had 30 and group- B had 40 patients. The mean age differences between the group were statistically significant (p=0.014). Male: Female ratio was 10.6:1. Among the conventional CVD risk factors, hypertension, diabetes and dyslipidemia were significantly high in group-A (p<0.05). No significant difference (p>0.05) between two groups was found in case of smoking and family history of CAD (Table I).

The differences in mean hemoglobin, RBS and serum creatinine levels between two groups were insignificant (p>0.05). In lipid profile study, HDL was significantly low in group A

(p<0.01). LDL and serum TG were significantly higher in group-A (p value 0.001). Patients of group-A showed significantly higher mean WBC counts (p<0.01). Mean count of neutrophil and lymphocyte were statistically significant (p<0.001) across the group. The Mean NLR was 5.15 ± 2.21 in group-A & 1.65 ± 0.35 in group-B and the difference was statistically significant (p=0.001). Mean LVEF also showed statistically significant difference between two groups (p<0.001) (Table II).

This study shows that in “vessel score 0” and “vessel score 3” categories there was significant difference in patient number between the groups, and it was low in group A in “vessel score 0” (p value 0.01) and high in case of “vessel score 3” (p value 0.001). (Table 3)

According to Gensini score we found that severe CAD was significantly higher in group A than group B (p value 0.001). (Table IV)

There was a positive correlation between NLR and coronary artery disease severity in terms

of vessel score (r=0.54). It was observed statistically significant (p=0.001) by Spearman’s

rank order correlation test (figure 1). There was also a moderately positive correlation between NLR and coronary artery disease severity in terms of Gensini score (r =0.7). With the increase of NLR Gensini score increases. It was found statistically significant (p=0.001) by Spearman rank order correlation test. (Figure 2).

Table-I

Demographic and risk factors variables of study patients (N=70)

Variables	Group A (n=30)	Group B (n=40)	P value
Age, mean ± SD,yrs	53.47±10.2	47.68±9.16	0.014^{S}
SexMaleFemale	27(90%)	37(92.5%)	0.71^{NS}
	3(10%)	3(12.5%)	
Smoker,n(%)	16 (53.3%)	16(40%)	0.335^{NS}
Hypertension,n(%)	25 (83.3%)	19 (47.5%)	0.002^{S}
Diabetes Mellitus,n(%)	20 (66.67%)	16 (40%)	0.03^{S}
Dyslipidaemia,n(%)	25 (83.3%)	18 (45%)	0.001^{S}
Family history of CAD,n(%)	3 (10%)	7 (17.5%)	0.378^{NS}

Group A= NLR > 2.5; Group B= NLR ≤2.5; s =significant; ns = not significant
p value reached from Students t -test and Chi square test.

Table-II

Laboratory characteristics of study patients (N=70)

Variables	Group A n =30 Mean ± SD	Group B n =40 Mean ± SD	P value
Hb (gm/dl)	12.20 ± 1.58	12.91 ± 1.58	0.069^{ns}
WBC Count	10675 ± 2727.4	8865 ± 2855.08	0.009^{s}
Neutrophil Count	77.53 ± 5.03	56.45 ± 4.59	0.001^{s}
Lymphocyte Count	17.53 ± 6.30	33 ± 5.33	0.001^{s}
NLR	5.15 ± 2.21	1.65 ± 0.35	0.001^{s}
RBS (mmol/l)	8.31 ± 2.36	7.67 ± 2.9	0.33^{ns}
Total Cholesterol (mg/dl)	229.30 ± 59.7	209.9 ± 40.25	0.10^{ns}
LDL (mg/dl)	125.6 ± 26.23	104.02 ± 23.45	0.001^{s}
HDL (mg/dl)	32.33 ± 3.49	35.07 ± 3.87	0.003^{s}
Serum TG (mg/dl)	185.73 ± 65.3	137.7 ± 37.8	0.001^{s}
Serum Creatinine (mg/dl)	1.25 ± 1.4	0.9 ± 0.2	0.247^{ns}
Gensini score	69.93 ± 33.26	25.23 ± 17.33	0.001^{s}
LVEF	47.13 ± 4.60	51.95 ± 5.81	0.001^{s}

Group A= NLR > 2.5; Group B= NLR ≤2.5
s =significant; ns = not significant
p value reached from Students t -test / Man Whitney U test.

Table-III

Distribution of the study patients according to Vessel Score (N=70)

Severity of CAD (Vessel Score)	Group A(n =30)		Group B (n =40)		P value
	Number	%	Number	%	
Score 0	0	0	7	17.5	0.01^{s}
Score 1	6	20	14	35	0.17^{ns}
Score 2	7	23.33	15	37.5	0.2^{ns}
Score 3	17	56.67	4	10	0.001^{s}

Group A= NLR > 2.5
Group B= NLR ≤2.5
s =significant
ns = not significant
p value reached from Chi square test.

Table-IV

Distribution of study patients according to Gensini Score (N=70)

Severity of CAD (Gensini Score)	Group A (n =30)		Group B (n =40)		P value
	Number	%	Number	%	
Non severe CAD (score ≤50)	5	12.50	32	80	
Severe CAD (Score >50)	25	83.33	8	20	0.001^{s}

Group A= NLR > 2.5
Group B= NLR ≤2.5
s =significant
ns = not significant
p value reached from Chi square test.

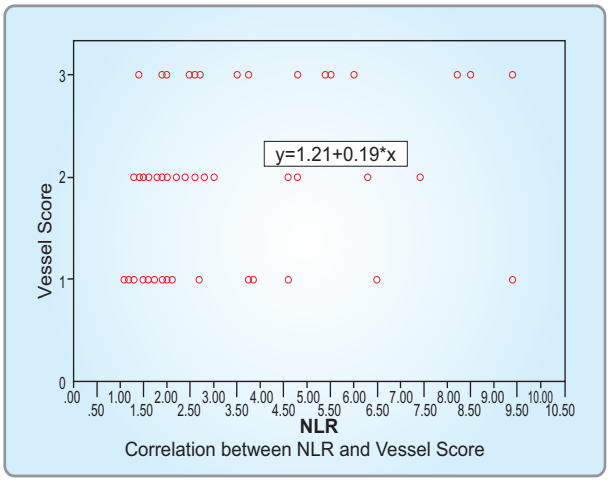

Fig.1: *Scatter diagram showing correlation between NLR and vessel score by Spearman's rank order correlation test.*

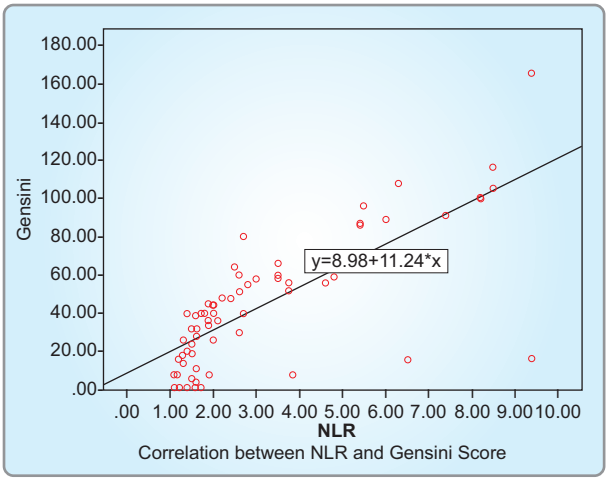

Fig.2: *Scatter diagram showing correlation between NLR and Gensini score by Spearman's rank order correlation test.*

In ROC curve analysis, the AUC of NLR for predicting severity of CAD is 0.8 with p value< 0.001, 95% CI (0.78-0.96). NLR cut-off value 2.5 can predict severe CAD with 75% sensitivity and 86.5% specificity (Figure 3).

Simple logistic regression analysis of variables showed that hypertension, diabetes, dyslipidemia, WBC count and NLR were the significant predictor of severe CAD with ORs being 4.03, 5.326, 3.89, 4.42, 0.83, 2.28 respectively (Table V). In multiple logistic regression analysis hypertension and NLR were found independent predictors of severe CAD with ORs being 5.87 and 1.813 respectively. (Table VI).

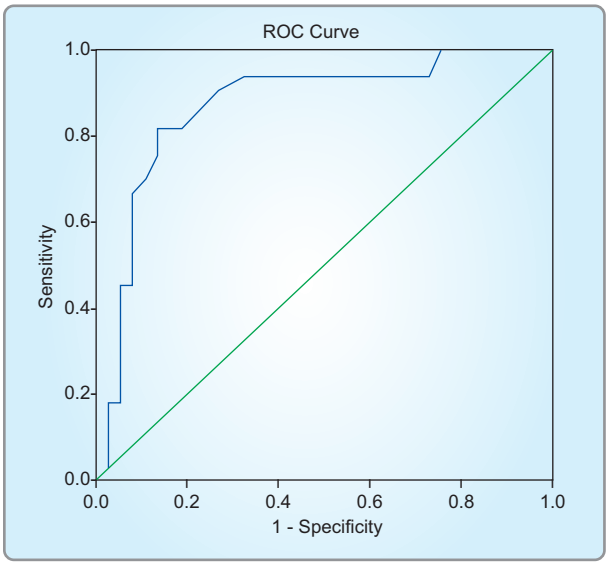

Fig.3: *The receiver-operating characteristics curve (ROC) analysis of NLR for predicting severe CAD.*

Table-V

Simple logistic regression analysis of determinants of severe CAD.

Variables of interest	β	S. E	P value	OR	95 % CI
Smoking	.067	.458	.890 ^{ns}	1.069	0.414 – 2.76
Hypertension	1.71	0.583	0.003^{s}	5.326	1.762 – 17.336
Diabetes Mellitus	1.358	0.515	0.008 ^{s}	3.889	1.417 – 10.674
Dyslipidaemia	1.486	0.556	0.007^{s}	4.421	1.488 – 13.13
WBC Count	0.000	0.000	0.034^{s}	1.00	1.00 – 1.00
Neutrophil Count	0.185	0.039	0.000 ^{s}	1.204	1.116 – 1.298
Lymphocyte Count	1.81	.041	0.000 ^{s}	0.834	0.769 – 0.905
NLR	0.826	0.224	0.000 ^{s}	2.284	1.472 – 3.446
LVEF	0.216	0.063	0.001^{s}	0.805	0.712 – 0.911

Dependent variable: Severe CAD (Gensini score > 50)
Independent variables: Smoking, Hypertension, Diabetes mellitus, Dyslipidaemia, WBC count, neutrophil count, Lymphocyte count, LVEF and NLR.
s =significant

Table-VI

Multivariate logistic regression analysis of determinant of severe coronary artery disease.

Variables of interest	β	S. E	P value	OR	95 % CI
Hypertension	1.77	0.801	0.028^{s}	5.87	0.93 – 21.49
Diabetes mellitus	1.025	0.749	0.171	2.78	0.642– 12.09
Dyslipidaemia	1.028	0.763	0.178	2.797	0.627 – 12.47
LVEF	0.085	0.078	0.277	0.919	0.789 – 1.09
NLR	0.595	0.211	0.004^{s}	1.813	1.19 – 2.74

Dependent variable: Severe CAD (Gensini score > 50)
Independent variables: Hypertension, Diabetes mellitus, Dyslipidaemia, LVEF and NLR.
s =significant.

Discussion:

The mean age of study patients was 50.16 ± 9.9 years ranging from 24 to 70 years. The mean age of group A patients was 53.47±10.2 years and that of group B was 47.68±9.16 years. The mean age of group A patients was significantly higher than group B. In a similar study conducted by Datta et al [15] mean age was significantly (p=0.001) higher in high NLR (>2.38) group. It was evident from the study that group A patients tended to be older than group B.

The distribution of risk factors for coronary artery disease in the present study revealed that the most common risk factors, such as hypertension present in 83.33% (25) patients in group A and 47.5% (19) in group B, and the difference between two groups was statistically significant (p=0.002). Study conducted by Datta et al [15] shown that prevalence of hypertension was more in high (> 2.38) NLR group. Dyslipidaemia was found in 83.33% (25) patients in group A and 45% (18) patients in group B and the difference between the groups was statistically significant (p value 0.001).

Diabetes mellitus was found 66.67% (20) and 40% (16) patients in group A and B respectively and the difference was statistically significant (p value=.03). Lou et al [17] also showed that NLR is higher among diabetic patients. We didn't find any statistically significant difference of smoking and positive family history of premature CAD between the groups, which is consistent with previous study conducted by Dutta et al [15].

In group A the mean WBC count was 10675 ± 2727.4 (/ mm^3) and in group B mean WBC count was 8865 ± 2855.08(/mm^3) and this difference was statistically significant(p=.009). In a similar study conducted by Zhang et al [18] found mean WBC count 9.9 ± 3.1(K/μL) in higher NLR group and 8.3 ± 2.8 (K/μL) in lower NLR group and the difference was statistically significant. Mean neutrophil count was 77.53 ± 5.03(/mm3) and 56.45 ± 4.59(mm3), mean lymphocyte count was 17.53 ± 6.30(mm3) and 33 ± 5.33 (mm3), mean NLR was 5.15 ± 2.21 and 1.65 ± 0.35 in group A and group B respectively and the differences in values between the groups were statistically significant (p value<0.001). In a similar study done by Zhang et al [18] found mean neutrophil and NLR were higher, and lymphocyte was lower in high NLR group than in low NLR group.

In lipid profile study, no significant difference in mean total cholesterol but significant difference in mean LDL, HDL and Triglyceride level was observed. Kaya et al [12] also showed HDL was significantly lower in higher NLR group. Wang et al[19] showed association of dyslipidaemia with high NLR.

In our study we found the mean value of serum creatinine was 1.25 ± 1.4 mg/dl and 0.9 ± 0.2 mg/dl in group A and group B respectively and the difference was not statistically significant (p =.247). Chen et al [20] showed no significant difference in serum creatinine between low (≤2.76) and high (>2.76) NLR group. Mean left ventricular ejection fraction was 47.13 ± 4.60(%) in group A and 51.95 ± 5.81(%) in group B, the difference was statistically significant. LVEF was significantly lower in high NLR group. Chen et al [20] and Dutta et al [15] also showed significant difference in LVEF in low and high NLR group.

According to distribution of vessel score among sample population, 0% (0) patient has vessel score "0" in group A and 17.5% (7) in group B, 56.67% (17) patients and 10% (4) patients have vessel score "3" in group A and group B respectively. The difference between groups was statistically significant, meaning that group A patients have more severe involvement of coronary disease than group B in terms of vessel score.

According to Gensini score, severe CAD was present in 83.3% (25) patients in group A and 20.0% (8) patients in group B and the difference between two groups was statistically significant. Severe coronary artery disease was significantly higher in group A than group B.

Mean Gensini score was 69.93 ± 33.26 and 25.23 ± 17.33 in group A and group B respectively and the difference between groups was statistically significant. All these findings were consistent with study done by Dutta et al [15] and Zhang et al [18].

A positive correlation between NLR and severity of CAD in terms of Gensini score and vessel score was found in our study. Correlation co-efficient between NLR and Gensini score was 0.691 (p=.001) and correlation co-efficient between NLR and vessel score was 0.541 (p=.001) and these were statistically significant. With the increase of NLR, Gensini score and vessel score also increased, indicating more severe CAD. These positive correlations were in agreement with other similar studies done by Kaya et al [21] and Dutta et al [15].

In this study, binary logistic regression analysis of variables likely to cause severe CAD was done and it revealed that hypertension, dyslipidaemia, diabetes mellitus, total WBC count, neutrophil count, lymphocyte count, NLR, LVEF were independent predictor of severe CAD. Hypertension, dyslipidaemia total WBC count and NLR were found as independent predictor of severe CAD

by Datta et al also. Elbasan et al[22] also showed LVEF as independent predictor of severe CAD. However, smoking was not found independent predictor of CAD, which is also consistent with previous study done by Datta et al.

In multivariate logistic regression analysis, after adjustment of confounding, NLR and hypertension were found the independent predictor of severe coronary artery disease with OR 1.81 and 5.87 & 95% confidence interval (1.19– 2.74) and (1.21-28.5) respectively. Dutta et al (15)& Kaya et al (12) also found NLR as an independent predictor of severe CAD.

By ROC curve analysis, our study found NLR > 2.5 value can predict severe CAD in terms of Gensini score with improved sensitivity and specificity (75% sensitivity, 86.5% specificity) than previous study by Kaya et al (21).They found NLR > 2.5 predicted severe atherosclerosis with sensitivity of 62% and specificity of 69%.

PPV and NPV of NLR for prediction of severe CAD according to Gensini score were 83% and 87% respectively and accuracy 85%.

Conclusion:

From this study it may be said that increased neutrophil to lymphocyte ratio is associated with angiographically severe coronary artery disease in acute myocardial infarction patients. So, this parameter might be useful for risk prediction of acute MI patients. Patients with acute MI, with NLR level of more than 2.5, warrants more attention by the physicians and Cardiologists in terms of more aggressive medical management and interventional treatment.

Limitations:

Although the result of the study supports the hypothesis, there are some facts to be considered which might affect the results.

1. Relatively small sample size
2. The assessment of the severity of CAD was performed by coronary angiography, which has got its inherent limitations. Intravascular ultrasound may be more sensitive in the assessment of the severity of CAD.
3. The other synchronous inflammatory biomarkers of the patients were not evaluated in the study.
4. Cross-sectional study design was used in this study which was not ideal for proving cause or effect relationship between NLR and severe CAD.

Conflict of Interest – None.

References:

1. Cardiovascular diseases (CVDs) [Internet]. [cited 2021 Dec 30]. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
2. Khanam F, Hossain MB, Mistry SK, Afsana K, Rahman M. Prevalence and Risk Factors of Cardiovascular Diseases among Bangladeshi Adults: Findings from a Cross-sectional Study. J Epidemiol Glob Health [Internet]. 2019 Jul 18 [cited 2022 Jan 6];9(3):176–84. Available from: https://www.atlantis-press.com/journals/jegh/125913526
3. Ziaul Islam Chowdhury M, Ashiqul Haque M, Farhana Z, Mustufa Anik A, Hoque Chowdhury A, Mahfuja Haque S, et al. Vascular Health and Risk Management Dovepress Prevalence of cardiovascular disease among Bangladeshi adult population: a systematic review and meta-analysis of the studies. Vasc Health Risk Manag [Internet]. 2018 [cited 2021 Dec 30];14–165. Available from: http://dx.doi.org/10.2147/VHRM.S166111
4. Monwarul Islam AKM, Majumder AAS. Coronary artery disease in Bangladesh: A review. Indian Heart Journal. 2013.
5. Fuster V, Moreno PR, Fayad ZA, Corti R, Badimon JJ. Atherothrombosis and high-risk plaque: part I: evolving concepts. J Am Coll Cardiol [Internet]. 2005 Sep 20 [cited 2019 Oct 20];46(6):937–54. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16168274
6. Akyel A, Yayla Ç, Erat M, Çimen T, Doðan M, Açýkel S, et al. Neutrophil-to-lymphocyte ratio predicts hemodynamic significance of coronary artery stenosis. Anatol J Cardiol [Internet]. 2016 Dec 1 [cited 2022 Jan 3];15(12):1002. Available from: /pmc/articles/PMC5368453/
7. Suyasa PGEA. Association between neutrophil to lymphocyte ratio on admission and grace mortality risk score among acute myocardial infarction patient at BRSUD Tabanan in 2017. IOP Conf Ser Mater Sci Eng. 2018;434(1).
8. Cheng B, Guo T meng, Ke L, Yang B, Li W zhu, Qi B ling, et al. Prognostic Value of Neutrophil to Lymphocyte Ratio for In-hospital Mortality in Elderly Patients with Acute Myocardial Infarction. Curr Med Sci. 2018;38(2):354–9.

9. Sharma K, Patel AK, Shah KH, Konat A. Is Neutrophil-to-Lymphocyte Ratio a Predictor of Coronary Artery Disease in Western Indians? 2017; Available from: https://doi.org/10.1155/2017/4136126

10. Gibson PH, Cuthbertson BH, Croal BL, Rae D, El-Shafei H, Gibson G, et al. Usefulness of Neutrophil/Lymphocyte Ratio As Predictor of New-Onset Atrial Fibrillation After Coronary Artery Bypass Grafting. American Journal of Cardiology. 2010 Jan 15;105(2):186–91.

11. Zhan L, Liu Y, Cheng Y, Guo W, Yang J. Predictive value of neutrophil/lymphocyte ratio (NLR) on cardiovascular events in patients with COVID-19. Int J Gen Med. 2021;14:3899–907.

12. Kaya A, Kurt M, Tanboga IH, Iºik T, Günaydin ZY, Kaya Y, et al. Relation of neutrophil to lymphocyte ratio with the presence and severity of stable coronary artery disease. Clinical and Applied Thrombosis/Hemostasis. 2014;20(5):473–7.

13. Park JS, Seo KW, Choi BJ, Choi SY, Yoon MH, Hwang GS, et al. Importance of prognostic value of neutrophil to lymphocyte ratio in patients with ST-elevation myocardial infarction. Medicine (United States). 2018;97(48).

14. Tamhane UU, Aneja S, Montgomery D, Rogers EK, Eagle KA, Gurm HS. Association between admission neutrophil to lymphocyte ratio and outcomes in patients with acute coronary syndrome. Am J Cardiol [Internet]. 2008 Sep 15 [cited 2022 Jan 3];102(6):653–7. Available from: https://pubmed.ncbi.nlm.nih.gov/18773982/

15. Datta RK, Rashid MM, Azam M, Ulubbi MS, Siddiqui MKR, Karmaker P, et al. Association between Neutrophil to Lymphocyte Ratio and Severity of Coronary Artery Disease in Chronic Stable Angina. Cardiovascular Journal. 2018 Apr 6;10(2):164–70.

16. Li X, Ji Y, Kang J, Fang N. Association between blood neutrophil-to-lymphocyte ratio and severity of coronary artery disease Evidence from 17 observational studies involving 7017 cases. Medicine (United States). 2018 Sep 1;97(39).

17. Lou M, Luo P, Tang R, Peng Y, Yu S, Huang W, et al. Relationship between neutrophil-lymphocyte ratio and insulin resistance in newly diagnosed type 2 diabetes mellitus patients. BMC Endocr Disord [Internet]. 2015 Dec 12 [cited 2022 Jan 5];15(1). Available from: https://pubmed.ncbi.nlm.nih.gov/25887236/

18. Zhang GY, Chen M, Yu ZM, Wang XD, Wang ZQ. Relation between neutrophil-to-lymphocyte ratio and severity of coronary artery stenosis. Genetics and Molecular Research [Internet]. 2014 Nov 11 [cited 2021 Jun 10];13(4):9382–9. Available from: https://pubmed.ncbi.nlm.nih.gov/25501149/

19. Wang Y, Liu Y, Kong X, Wang W, Fan F, Zhang Y, et al. Association of peripheral differential leukocyte counts with dyslipidemia risk in Chinese patients with hypertension: Insight from the china stroke primary prevention trial. J Lipid Res [Internet]. 2017 Jan 1 [cited 2022 Jan 5];58(1):256–66. Available from: http://www.jlr.org/article/S002222752031453X/fulltext

20. Chen C, Cong BL, Wang M, Abdullah M, Wang XL, Zhang YH, et al. Neutrophil to lymphocyte ratio as a predictor of myocardial damage and cardiac dysfunction in acute coronary syndrome patients. Integr Med Res [Internet]. 2018;7(2):192–9. Available from: https://doi.org/10.1016/j.imr.2018.02.006

21. Kaya H, Ertaº F, Islamoçlu Y, Kaya Z, Atilgan ZA, Çil H, et al. Association between neutrophil to lymphocyte ratio and severity of coronary artery disease. Clinical and Applied Thrombosis/Hemostasis [Internet]. 2014 Jan 11 [cited 2021 Jun 10];20(1):50–4. Available from: https://journals.sagepub.com/doi/full/10.1177/1076029612452116

22. Elbasan Z, Gü M, Yýldýz A, Akpýnar O, Kemal Icen Y, Turkoglu C, et al. Neutrophil to Lymphocyte Ratio Is Associated with the Severity of Coronary Artery Disease in Patients With ST-Segment Elevation Myocardial Infarction.