RESEARCH ARTICLE

The relationship between neutrophil to lymphocyte ratio (NLR) with rehospitalisation and mortality in patients with acute coronary syndrome (ACS)

Jesse Lesmana, Achmad Lefi

Abstract

Objective: To determine the relationship of neutrophil-to-lymphocyte ratio with re-hospitalisation rate and death in acute coronary syndrome patients.

Methods: The retrospective, observational, analytical study was conducted at Surabaya Hospital, East Java, Indonesia, and comprised data of acute coronary syndrome patients from January to December 2021. Neutrophil-to-lymphocyte ratio values taken during each admission were noted, and divided into 3 groups; <3, 3-5 moderate, and >5 high. Data was also noted for the frequency of rehospitalisation and mortality from the institutional medical records. Data was analysed using SPSS 23.

Results: Of the 102 patients, 83(81.4%) were males and 19(18.6%) were females. The overall mean age was 56.78±11.53 years. There were 48(47%) patients with low neutrophil-to-lymphocyte ratio, and 27(26.5%) each in the moderate and high categories. There was a strong relationship between neutrophil-to-lymphocyte ratio and mortality (p=0.038). The relationship between neutrophil-to-lymphocyte ratio and rehospitalisation was not significant (p=0.264).

Conclusion: The neutrophil-to-lymphocyte ratio was associated with mortality during treatment, but was not associated with the incidence of rehospitalisation in acute coronary syndrome patients.

Key Words: Incidence, Prognosis, Coronary, Mortality, Rehospitalisation.

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Introduction

Cardiovascular disease (CVD) is the leading cause of death globally, and its incidence is expected to increase.[1-3] Based on World Health Organisation (WHO) data, there were 17.5 million deaths due to CVD in 2012, 17.9 million in 2016, and the number is expected to rise to 23 million by 2030.[2] In Indonesia, ischaemic heart disease (IHD) was the leading cause of morbidity and mortality in 2006 which increased by 10.5% in 2016, with an estimated incidence of 200 events per 100,000 population per year.[4,5]

Acute coronary syndrome (ACS) is a manifestation of coronary heart disease (CHD) where there is decompensation of the heart due to narrowing or blockage (atherosclerosis) in the coronary arteries, which causes ischaemic heart muscle and impaired heart function. ACS classification can be in the form of unstable angina pectoris (UAP), non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI) based on electrocardiogram (ECG) examination and changes in cardiac enzyme values. The risk factors for ACS have been divided into modifiable factors, such as diabetes mellitus (DM), stress, cholesterol, hypertension (HTN) and active smoking, and non-modifiable factors, such as family history of CVD, age and race.[6,7]

Neutrophil-to-lymphocyte ratio (NLR) is a non-specific marker of inflammation that is simple, and affordable, and is widely used as it has a predictive value for prognosis, especially the incidence of ACS.[8,9] A 2016 study in India showed that NLR had a positive predictive value (PPV) on the prognosis of ACS patients over a period of 6 months. The study also proposed a limiting NLR value of >5.25 which is associated with a high mortality rate in the first 6 months after the ACS event.[10] An increase in the inflammatory response correlates with the extent of myocardial damage, leading to impaired cardiovascular function, and to an increase in mortality and morbidity due to ACS complications during hospitalisation.[11,12] An increase in leukocytes and neutrophils indicates a worse prognosis that is characterised by an increase in rehospitalisation rates and ventricular dysfunction that ends in acute heart failure in ACS.[13]

Increased NLR value in ACS clinically has a predictive value related to ACS complications. Most such complications related to the structure and function of the heart can be evaluated by echocardiographic examination.

Department of Cardiology, PHC Surabaya Hospital, Indonesia.

Correspondence: Achmad Lefi, **Email:**achmadlefi@gmail.com

The current study was planned to determine the relationship of NLR with the frequency of rehospitalisation and mortality in ACS patients.

Patients and Methods

The retrospective, observational, analytical study was conducted at Surabaya Hospital, East Java, Indonesia, and comprised data of ACS patients from January to December 2021. Data was retrieved after approval from the institutional ethics review committee. ACS was categorised into STEMI, NSTEMI and UAP cases. Those with active or chronic infection, autoimmune condition with or without immunosuppressant therapy, cancer, haematological disorders, chronic renal or liver diseases were excluded.

NLR data was taken at the time of hospital admission, and was divided into 3 groups; <3 low, 3-5 moderate, and >5 high. Data on the incidence of rehospitalisation comprising patients who returned for treatment with reinfarction or ACS complications was noted along with mortality data during treatment.

Data was analysed using SPSS 23. Coefficient gamma test was used to evaluate the relationship between variables. P<0.05 was considered statistically significant.

Results

Of the 102 patients, 83(81.4%) were males and 19(18.6%) were females. The overall mean age was 56.78±11.53 years. Overall, 15(14.7%) patients had comorbid HTN and 11(10.8%) had DM. There were 74(72.5%) UAP, 25(24.5%) NSTEMI and 3(2.9%) STEMI cases. There were 48(47%) patients with low NLR, and 27(26.5%) each in the moderate and high NLR categories.

Mortality was encountered in 7(6.9%) cases and rehospitalisation was needed by 3(2.9%) patients.

Table-1: Relationship between NLR and mortality in ACS patients.

Symmetric Measures				
	Value	Asymptotic Standardised Errora	Approximate Tb	Approximate Significance
Ordinal by Ordinal				
Gamma	.710	.207	2.074	.038
Spearman Correlation	.243	.093	2.505	.014c
Interval by Interval				
Pearson's R	.253	.096	2.620	.010c
N of Valid Cases	102			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

NLR: Neutrophil-to-lymphocyte ratio, ACS: Acute coronary syndrome patients.

There was a strong relationship between NLR and mortality (p=0.038) (Table 1). The relationship between NLR and rehospitalisation was not significant (p=0.264) (Table 2).

Table-1: Relationship between NLR and mortality in ACS patients.

Symmetric Measures				
	Value	Asymptotic Standardised Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal				
Gamma	-.486	.381	-1.116	.264
Spearman Correlation	-.093	.070	-.929	.355[c]
Pearson's R	-.096	.063	-.968	.335[c]
N of Valid Cases	102			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

NLR: Neutrophil-to-lymphocyte ratio, ACS: Acute coronary syndrome patients.

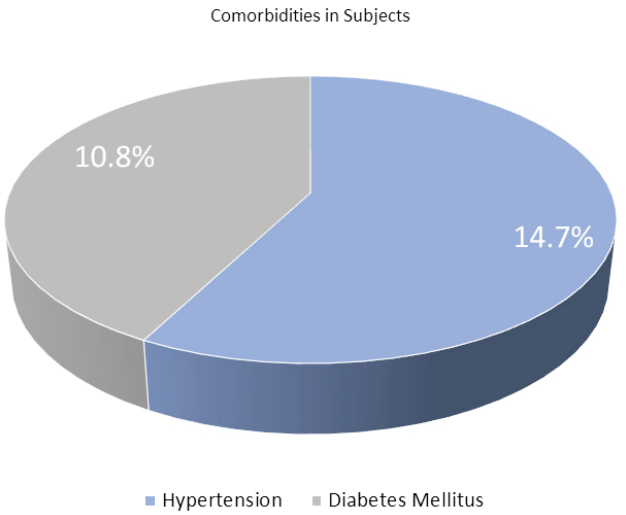

Figure: Comorbidities in acute coronary syndrome (ACS) patients.

Discussion

Most patients suffering from ACS in the current study were males (81%), and the overall mean age was 556.78±11.53 years. Both these findings were in line with an earlier study.[14] HTN (13%) and DM (11%) were the two leading comorbidities. Literature has shown that the burden of health risks in Indonesia involves HTN and DM.[4,5]

The most common diagnosis was UAP, followed by NSTEMI and STEMI. This was similar to an earlier study.[5] Different results were reported by a study in India, where more subjects were diagnosed with STEMI compared to

other diagnoses.[10] Differences in diagnosis may vary between locations of health facilities and characteristics of the surrounding community.

NLR values have been widely reported to have a relationship with the incidence of death and also rehospitalisation in ACS patients.[15,16] In the current study, the high NLR group was associated with mortality during hospitalisation, and can be concluded that higher NLR value at the time of initial hospital admission meant higher risk of mortality during hospitalisation in ACS patients.

A scoring system known for predicting ACS mortality in 6 months was found to be directly proportional to the NLR value, indicating that higher NLR value meant higher mortality risk.[17-19] Another study reported that NLR 6.5 increased the risk of mortality by 120% both in the short and long terms.[15] One study[12] showed that NLR 5.5 had a 4-fold risk of death during hospitalisation, especially in NSTEMI cases, while another study[20] found that NLR 5.77 had a predictive value for in-hospital mortality.

Mortality in ACS patients can also be caused by complications like acute heart failure.[21-23] A study[21] concluded that higher NLR values were associated with increased inflammatory markers in heart failure patients which increased mortality risk. The NLR value on early hospital admission has a predictive value of mortality during the hospitalisation period and after discharge in patients with IHD developing acute heart failure.[23,24]

The NLR value in the current study had a weak and non-significant relationship with the incidence of rehospitalisation. A study found that high NLR increased the risk of reinfarction and rehospitalisation in ACS patients by 3 folds.[25] Results of a meta-analysis from China showed that NLR values were associated with the number of rehospitalisation was not statistically significant.[13]

Conclusion

NLR was associated with mortality during hospitalisation and ACS treatment, but was not associated with the frequency of rehospitalisation.

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