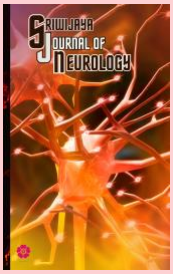

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The Relationship between Neutrophil Lymphocyte Ratio in Head Injured Patients and Patient Outcomes

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A B S T R A C T

Introduction: Head injury causes microglial activation and release of proinflammatory cytokines. One of the inflammatory markers that can be used is the neutrophils to lymphocytes ratio (NLR). Within 24 hours after brain injury, the number of circulating neutrophils was markedly increased compared to the uninjured control group. This study aimed to determine the relationship between ratios of neutrophil-lymphocyte head injury patients with patient outcomes at Dr. M Djamil General Hospital, Padang, Indonesia. **Methods:** This study was a cross-sectional analytic observational study. A total of 36 research subjects participated in this study. Observations on sociodemographic, clinical, and laboratory data were carried out in this study. Data analysis was carried out using SPSS using univariate and bivariate. **Results:** The majority of study subjects with a good Glasgow outcome scale had a neutrophil-lymphocyte ratio <7.35. Meanwhile, research subjects with Glasgow the poor outcome scale had a neutrophil-lymphocyte ratio ≥7.35, $p<0.05$. **Conclusion:** There is a relationship between the neutrophil-lymphocyte ratio and the outcome of head injury patients at Dr. M Djamil General Hospital, Padang, Indonesia.

1. Introduction

Head injury is one of the major causes of disability and death in the world. Head injuries can cause cognitive and functional limitations, so patients will suffer for the rest of their lives. The incidence of head injuries worldwide in 2010 was around 2.5 million cases and has resulted in an estimated economic cost of nearly 76.5 billion US dollars. Every year in the United States, there are 1.7 million cases of head injury, with a death rate of 52,000 people.[1-5]

A head injury causes microglial activation and the release of proinflammatory cytokines and other neurotoxic products that produce free radical compounds. These free radical compounds cause tissue damage.[11] Elevated leukocyte and neutrophil counts are usually considered nonspecific indicators of infection, inflammation, tissue necrosis, bleeding, or stressful conditions. One of the inflammatory markers that can be used is the neutrophils to lymphocytes ratio (NLR). Neutrophils have the ability to damage the blood-brain barrier by releasing metalloproteinases, proteases, TNF α, and reactive oxygen species (ROS). Neutrophils cause neuronal cell death using the same mediators that damage the blood-brain barrier. Within 24 hours after brain injury, the number of circulating neutrophils was markedly increased compared to the uninjured control group.[6-12] This study aimed to determine the relationship between the ratio of neutrophil lymphocytes in head injury patients and patient outcomes at Dr. M Djamil General Hospital, Padang, Indonesia.

2. Methods

This study was an analytic observational study with a cross-sectional approach and used secondary data from medical records at the medical records installation of Dr. M Djamil General Hospital, Padang, Indonesia. A total of 36 research subjects participated in this study, where the research subjects met the inclusion criteria. The inclusion criteria for research subjects in this study were head injury patients treated at Dr. M Djamil General Hospital, Padang, Indonesia., for the period January – December 2022, and complete medical record data. This study was approved by the medical and health research ethics committee at Dr. M Djamil General Hospital, Padang, Indonesia.

This study made observations on the sociodemographic data, clinical data, and laboratory data of the research subjects. Data analysis was carried out using SPSS 25 for Windows software. Univariate analysis was performed to present the frequency distribution of each data variable test. Bivariate analysis was performed to determine the relationship between ratios of neutrophil lymphocytes with head injury patient outcomes, $p<0.05$.

3. Results and Discussion

Table 1 presents the characteristics of the research subjects. The research subjects had an average age of 40 years, where the youngest was 14 years old, and the oldest was 76 years. The majority of research subjects have male gender.

Table 1. Characteristics of research subjects.

Characteristics	Total	%
Age (years)		
Mean	40	
Min-max	14-76	
Gender		
Male	22	61,1
Female	14	38,9
Total	**36**	**100**

Table 2 presents the relationship between the neutrophil-lymphocyte ratio in head injury patients using the Glasgow outcome scale. The majority of study subjects with a good Glasgow outcome scale had a neutrophil-lymphocyte ratio <7.35. Meanwhile, research subjects with Glasgow the poor outcome scale had a neutrophil-lymphocyte ratio ≥7.35, $p<0.05$.

Table 2. Relationship between the neutrophil-lymphocyte ratio in head-injured patients and the patient's Glasgow outcome scale.

Neutrophil-lymphocyte ratio	Glasgow outcome scale		*P-value
	Good n (%)	Poor n(%)	
< 7,35	14(38,9)	2(5,6)	0,005
≥ 7,35	7(19,4)	13(36,1)	

*Chi-square test, p<0,05.

The inflammatory response itself has an important role in brain tissue damage in head injury patients with intracerebral hemorrhage. The brain responds to head injury through the production of inflammatory mediators that cause infiltration of various inflammatory cells (neutrophils and lymphocytes) into the brain tissue. Other studies have shown that using an NLR cut-off of 7.35 is the same as this study. Where

in the study, it was found that the high NLR group was associated with a poor short-term survival rate in intracerebral hemorrhage patients. A high NLR is also associated with a lower GCS score.[13-18]

There is evidence to suggest that NLR is a significant predictor of patient morbidity and mortality. The neutrophil-lymphocyte ratio is a biomarker that provides important information about inflammatory activity and is a prognostic indicator in patients with ischemic stroke, hemorrhagic stroke, glial tumors, and status epilepticus. Previous studies also found a relationship between NLR and GOS in patients with moderate-to-severe head injuries but with a lower NLR cut-off of 6.05. The difference in NLR values is influenced by the region and research subjects. A few days after a head injury, ROS production will decrease. Disturbance in ROS production may be one of the mechanisms underlying the increased susceptibility of traumatic head injury patients who are hospitalized to infection and will have an effect on the outcome of head-injured patients. The NLR value is taken from a laboratory examination, the leukocyte count is a routine laboratory examination, it is easy to obtain and calculate, and the cost is relatively cheap. The NLR examination is also an objective test to predict head injury outcomes compared to the GCS, which is commonly used to predict head injury outcomes. Knowing the NLR value early can be an indicator for doctors for intensive care of patients with head injuries and predict patient outcomes.[19-24]

4. Conclusion

There is a relationship between the neutrophil lymphocyte ratio with head injury patient outcomes at Dr. M Djamil General Hospital, Padang, Indonesia.

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