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Investigation of Mean Platelet Volume/Platelet, Neutrophil/ Leucocyte Ratio And Troponin Values in Geriatric Patients Admitted to Hospital with Akut Ischaemic Stroke

Hastaneye Akut İskemik inme ile Başvuran Geriatrik Hastalarda Ortalama Trombosit Hacmi/ Trombosit, Nötrofil/Lökosit Oranı Ve Troponin Değerlerinin Araştırılması

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ABSTRACT

Aim: The aim of this study was to investigate the mean MPV/PLT ratio, NLR and troponin I levels in geriatric patients admitted to hospital with acute ischaemic stroke (AIS) and to evaluate the prognostic value of these parameters. In this way, a better clinical decision can be provided in the evaluation and treatment processes of AIS patients.

Methods: Using a retrospective design, the data of geriatric patients admitted to hospital with a diagnosis of AIS were analyzed. Demographic characteristics, clinical findings, laboratory results and radiological findings were obtained from electronic medical records. Platelet volume, platelet count, neutrophil count, leukocyte count and troponin I levels were recorded as primary data and other demographic, clinical and laboratory parameters were recorded as secondary data.

Results: MPV/PLT ratio was significantly higher in AIS patients (0.04±0.02) compared to non-ischemic stroke patients (0.03±0.02) (p<0.001). Similarly, NLR (5.29±5.09) was significantly higher in AIS patients compared to the other group (1.93±0.87) (p<0.001). In addition, Troponin I level was significantly higher in AIS patients (10.48±7.88 ng/mL) than the other group (2.18±1.11 ng/mL) (p<0.001).

Conclusion: This study demonstrates the predictive value of mean MPV/PLT ratio, NLR, and troponin I levels in geriatric patients admitted to hospital with AIS. Using these parameters in clinical evaluations may be helpful in the follow-up of AIS patients and in determining treatment strategies.

Keywords: Ischaemic stroke, Mean Platelet Volume/Platelet ratio, Neutrophil/ Leukocyte ratio, Troponin I

ÖZ

Amaç: Bu çalışmanın amacı, akut iskemik inme ile hastaneye başvuran geriatrik hastalarda ortalama MPV/PLT oranı, NLR ve troponin I düzeylerini araştırmak ve bu parametrelerin prognostik değerlerini değerlendirmektir. Bu şekilde, akut iskemik inme hastalarının değerlendirme ve tedavi süreçlerinde daha iyi bir klinik karar verme sağlanabilir.

Yöntem: Geriye dönük bir tasarım kullanılarak, akut iskemik inme tanısıyla hastaneye başvuran geriatrik hastaların verileri retrospektif olarak incelendi. Hastaların demografik özellikleri, klinik bulguları, laboratuvar sonuçları ve radyolojik bulguları elektronik tıbbi kayıtlardan elde edildi. Trombosit hacmi, platelet sayısı, nötrofil sayısı, lökosit sayısı ve troponin I düzeyleri primer veriler, diğer demografik, klinik ve laboratuvar parametreleri de ikincil veriler olarak kaydedildi.

Bulgular: MPV/PLT oranı, akut iskemik inme hastalarında (0,04±0,02) akut iskemik inme olmayan hastalara (0,03±0,02) göre anlamlı oranda daha yüksek olarak gözlemlendi (p<0,001). Benzer olarak akut iskemik inme hastalarında NLR (5,29±5,09), diğer gruba oranla (1,93±0,87) anlamlı oranda daha yüksek idi (p<0,001). Buna ek olarak Troponin I düzeyi, akut iskemik inme hastalarında (10,48±7,88 ng/mL) diğer gruptan (2,18±1,11 ng/mL) bariz olarak yüksek idi (p<0,001).

Sonuç: Bu çalışma, akut iskemik inme ile hastaneye başvuran geriatrik hastalarda ortalama MPV/PLT oranı, NLR ve troponin I düzeylerinin prognostik değerlerini ortaya koymaktadır. Bu parametrelerin klinik değerlendirmelerde kullanılması, akut iskemik inme hastalarının takibinde ve tedavi stratejilerinin belirlenmesinde yardımcı olabilir.

Anahtar kelimeler: İskemik inme, Ortalama Trombosit Hacmi /Platelet oranı, Nötrofil/ Lökosit oranı, Troponin I

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Introduction

Acute ischaemic stroke (AIS) has become an important health problem among older adults. The aging process increases the risk of AIS with the development of vascular diseases [1, 2]. The frequency and severity of AIS are growing in the geriatric population; therefore, an effective prognostic evaluation and determination of treatment strategies are of great importance [3].

In recent years, the role of platelets and neutrophils in the mechanisms of AIS has become important to determine the prognostic factors. Platelets are cells that play a critical role in hemostasis and platelet activation is a key factor in the development of ischaemic events such as plaque formation and arterial occlusion [4]. Neutrophils play an important role in inflammation processes and may secrete proinflammatory molecules that may increase brain damage during AIS [5].

In this context, the examination of some hematological parameters to evaluate platelet and neutrophil activation in geriatric patients admitted to hospitals with ischaemic stroke has become an important research area. The Mean Platelet volume (MPV)/Platelet (PLT) ratio draws attention as a parameter that can reflect platelet activation. Furthermore, the Neutrophil/Leukocyte ratio (NLR) is a marker used in inflammation and infection and may be a potential prognostic indicator for AIS patients [6].

Troponin I is a protein recognized as an indicator of heart damage and is closely associated with cardiovascular incidents such as acute coronary syndrome and myocardial infarction. It has been suggested that troponin I levels may be increased in AIS patients, and therefore, may be used in the management of the patients [7].

The objective of this research was to investigate the mean MPV/PLT ratio, NLR, and troponin I levels in geriatric patients admitted to hospital with AIS and to evaluate the predictive value of these parameters. In this way, better clinical decision-making can be provided in the evaluation and treatment processes of AIS patients.

Patients and Method

Study Design

This study was carried out taking into account the rules of the Declaration of Helsinki and was approved by the scientific research ethics committee of Mardin Artuklu University (Date: 10.07.2023, decision no 2023/7-12). The confidentiality of all patients' files was maintained. Using a retrospective design, the data of geriatric patients admitted to the hospital with a diagnosis of AIS were retrospectively analyzed. This study was carried out in compliance with ethical guidelines and principles of research conduct.

Participants

Geriatric patients admitted to our hospital between January 2020 and June 2023 and diagnosed with AIS were included in the study. Participants had to be aged 65 years and older. Uncontrolled diabetes and hypertension patients, cancer patients, steroid drug users, smokers, and alcohol users were not included in the study. These were enrolled as group I. People with similar demographic characteristics who applied to our hospital with no significant clinical problems were included as control group. In the AIS patient group, those who were discharged after hospitalization were recorded as survivors and those who died within 30 days of hospitalization were recorded separately. Comparisons were also made between alive and dead patients with AIS.

Data Collection

Demographic characteristics, clinical findings, laboratory results, and radiological findings were obtained from electronic medical records. Platelet volume, platelet count, neutrophil count, leukocyte count, and troponin I levels were recorded as primary data, and other demographic, clinical, and laboratory parameters were recorded as secondary data. The diagnosis of the patients was based on computed tomography, diffusion magnetic resonance imaging results, and anamnesis reports.

Statistical Analysis

The data were analyzed using SPSS software (ver. 26.0; SPSS Inc., Chicago, IL). The normality of the data distribution was determined by the Shapiro-Wilk test. Continuous variables are presented as mean ± standard deviation and

categorical variables are presented as frequencies and percentages. Continuous variables were calculated using a student t-test. A p-value <0.05 was set to indicate statistical significance.

Results

The included individuals were 108 AIS patients [52 (48.1%) females and 56 (51.9%) males] and 52 [33 (63.5%) females and 19 (36.5%) males]. Table 1 summarizes the distribution of laboratory data and mean age. Although there was a difference between the gender distributions, the difference was not meaningful (p=0.09). The mean age of patients with a history of AIS was 72.84±7.07 years and 70.42±5.85 years for those without AIS. The mean age was higher in AIS patients compared to the other group (p=0.045). MPV/PLT ratio was significantly higher in AIS patients (0.04±0.02) compared to non-AIS patients (0.03±0.02) (p<0.001).

Table 1. Distribution of laboratory data and mean age of AIS patients and controls

Parameters	AIS patients Mean±SD	Non-AIS patients Mean±SD	P
Age(years)	72.84±7.07	70.42±5.85	0.045
Glucose (mg/dL)	152.09±83.051	129.09±39.40	0.104
Urea (mg/dL)	46.62±21.21	37.59±11.12	0.014
Creatinine (mg/dL)	0.98±0.52	0.93±0.56	0.599
Albumin (g/dL)	4.71±5.34	4.39±0.39	0.863
Cholesterol (mg/dL)	192.76±56.48	203.2660±32.06	0.502
WBC (10*3/uL)	9.98±4.41	8.02±2.46	0.003
HCT (%)	40.94±6.75	42.69±5.07	0.099
MCV (fL)	88.79±8.09	88.54±7.15	0.844
MCH (pg)	28.55±2.77	28.07±2.62	0.301
MPV/PLT	0.043±0.021	0.03±0.016	<0.001
NLR	5.29±5.09	1.93±0.87	<0.001
Troponin I (ng/mL)	10.48±7.88	2.18±1.11	<0.001

WBC: White blood cell, HCT: Haematocrit, MCV: Mean Corpuscular Volume, PLT: Platelet, MPV: Mean Platelet Volume, PLT: Platelet NLR: Neutrophil to lymphocyte ratio MPV/PLT: The mean platelet volume/ platelet count ratio

Similarly, NLR (5.29±5.09) was significantly higher in AIS patients compared to the other group (1.93±0.87) (p<0.001). In addition, Troponin I level was significantly higher in AIS patients (10.48±7.88 ng/mL) than in the other group (2.18±1.11 ng/mL) (p<0.001).

Table 2 shows the mean distribution of WBC, MPV/PLT, NLR, and Troponin I values between alive and dead AIS patients within 30 days. NLR was significantly higher in the dead patients (13.41±6.21) than in alive patients (3.77±3.01) (p<0.001). On the other hand, although the mean MPV/PLT ratio and Troponin I values were higher in dead patients, the differences were not statistically significant (p=0.448 and p=0.125, respectively).

Table 2. Distribution of WBC, MPV/PLT, NLR and Troponin I values of discharged and dead patients with AIS

Parameters	Survivor patients Mean±SD	Died patients Mean±SD	P
MPV/PLT	0.042±0.021	0.047±0.020	0.448
NLR	3.77±3.01	13.41±6.21	<0.001
Troponin I (ng/mL)	9.68±7.27	14.68±10.16	0.125

PLT: Platelet, MPV: Mean Platelet Volume, NLR: Neutrophil to lymphocyte ratio

In patients with AIS, the MPV/PLT ratio showed a strong positive correlation with neutrophils (R=0.348, p<0.001), while the NLR showed a strong positive correlation with albumin (R=0.511, p<0.001), WBC (R=0.560, p<0.001), and neutrophils (R=0.754, p<0.001). In contrast, both the MPV/PLT ratio and NLR showed no significant correlation with Troponin I (Table 3).

Table 3. Correlation of MPV/PLT and NLR with other data

Parameters	MPV/PLT	NLR
Albumin (mg/dL)	(R=-0.093,P=0.524)	(R=0.511,P<0.001)
WBC (10*3/uL)	(R=-0.165,P=0.089)	(R=0.560, P<0.001)
NEU (10*3/uL)	(R=0.348** , P<0.001	(R=0.754, P<0.001)
Troponin I (ng/mL)	(R=0.200,P=0.194)	(R=0.130,P=0.400)

PLT: Platelet, MPV: Mean Platelet Volume WBC: White blood cell, NEU: Neutrophil, NLR: Neutrophil to lymphocyte ratio R: Pearson Correlation rank, P: Correlation is significant at the 0.01 level (2-tailed).

Discussion

In this study, it was found that the mean MPV/PLT ratio, NLR, and troponin I levels were significantly higher in geriatric patients with AIS. These parameters were also observed to be elevated in deceased AIS patients in comparison to survivors. These findings are essential for assessing the prognosis and treatment of AIS patients.

Platelets start the formation of blood clots by sticking together and accumulating. This process continues until inflammation occurs, leading to

the development of more organized blood clots and reduced blood flow [4, 8]. The levels of MPV and PLT have been studied in various diseases including cerebral ischemia, cardiovascular diseases, and cancer. Studies have shown that high MPV and MPV/PLT ratios are associated with poor outcomes in these conditions [9-11]. Ho Lim et al. showed that MPV/PLT was parallel with clinical severity in patients with AIS and that the values at the time of presentation could be used as a good tool to predict prognosis [6]. Our study findings are similar to the outcomes of these studies. According to this data, we can say that there is a significant relationship between the mean MPV/PLT ratio and AIS. Higher MPV/PLT ratios suggest increased platelet activation and thus increased risk of ischaemic events such as plaque formation and arterial occlusion. These findings underline the importance of a more detailed examination of platelet function in AIS patients.

Furthermore, NLR should also be considered as a prognostic marker in AIS patients. High NLR suggests increased inflammation processes and increased release of proinflammatory molecules that may increase brain damage. This finding emphasizes the importance of evaluating the inflammatory response in AIS patients [12, 13]. Li et al. showed that NLR values at admission were significantly negatively correlated with improvement in clinical outcomes in patients with AIS in the first 90 days after stroke [14]. In their study, Gong et al. also suggested that NLR is an independent factor for early neurological deterioration after thrombolysis [15]. Similarly, NLR was significantly higher in AIS patients in our study. This parameter was found to be increased in dead AIS patients compared to survivor patients. The results obtained provide important findings in the evaluation of the prognosis and treatment processes of AIS patients.

Troponin I level is also an important parameter that should be evaluated in AIS patients. Elevated troponin I levels are considered a marker of cardiac damage and are associated with cardiovascular events including acute coronary syndrome and myocardial infarction. Elevated troponin levels have been reported in many different pathological conditions including AIS [16, 17]. In their study, Schietz et al. reported that troponin I levels were elevated in one of seven patients with AIS, and these levels were independently associated with short-term mortality [18]. Troponin I levels were significantly increased in AIS patients in our study. Moreover, troponin I levels were significantly higher in patients who died due to AIS compared to those who were discharged. The findings of this study suggest that troponin levels may be increased in AIS patients and these levels may be used in the evaluation of prognosis.

Limitations: Limitations of this study should also be considered. Firstly, due to the retrospective design of the study, causal relationships cannot be determined and only associations are revealed. Secondly, the number of patients included in the study may be limited, which may affect the results. The results of this study should be confirmed by prospective studies involving larger sample groups.

Conclusion: In conclusion, this study demonstrates the predictive value of mean MPV/PLT ratio, NLR, and troponin I levels in geriatric patients admitted to hospital with AIS. Using these parameters in clinical evaluations may help in the follow-up of AIS patients and in determining treatment strategies. Future studies are necessary to further confirm these findings and to better understand the efficacy of these parameters in clinical practice.

Conflict of Interest: The authors declare no conflict of interest related to this article.

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Ethics Committee Approval: In this study, national and international ethical rules are observed. This study was approved by the scientific research ethics committee of Mardin Artuklu University (Date: 10.07.2023, decision no 2023/7-12).

ORCID and Author contribution: **G.S.S.(0000-0002-8691-1504)** was responsible for formulating the hypothesis, analyses and writing the report.

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