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CLINICAL STUDY

# Predictive value of prognostic factors at multiple trauma patients in intensive care admission

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**ABSTRACT**
PURPOSE: We aimed to evaluate the relationship between trauma patients' mortality and neutrophil/lymphocyte ratio (NLR) at intensive care units admission.
METHODS: We examined 107 ICU trauma patients. Patients were divided into two groups as those who survived (Grup I) and deceased (Grup II). Patients' age, NLR, mean platelet volume (MPV), lactate value, length of stay in the intensive care unit, acute physiology and chronic health evaluation 2 (APACHE II) scores were examined. The effects of these factors on mortality were examined.
RESULTS: 83 (77.58 %) patients were male, 24 (22.42 %) patients were female. The patients' mean age was 46.89 ± 19.06 years. The mean value of the lactate level was 3.25 ± 2.92, the mean value of MPV was 10.34 ± 1.02, the average value of NLR was 8.23 ± 8.11, the average score of APACHE II was 22.8 ± 8.75, and the average length of stay in the ICU was 11.33 ± 22.98 days. The relationship with mortality was evaluated between the groups, there was a statistically significant difference in APACHE II scores. There was no statistically significant difference between other variables.
CONCLUSIONS: NRL, MPV, lactate levels were not suitable for the evaluation of trauma patients as an early prognostic factor like APACHE II during admission to ICU *(Tab. 2, Fig. 1, Ref. 23)*. Text in PDF *www.elis.sk*
KEY WORDS: trauma, mortalite, prognostic factor.

## Introduction

Trauma is one of the most important causes of death in the World (1). Early death due to trauma usually occurs due to head trauma and bleeding related factors. Secondary injuries owing to head trauma in patients occur due to edema, ischemia, oxidative stress, and inflammation (2). NLR has been thought to be a simple, inexpensive and easily-reached predictor to evaluate systemic inflammation (3–6).

There is a critical balance between proinflammatory and anti-inflammatory systems in the immune response due to trauma. This balance plays an essential role in posttraumatic mortality (7). Neutrophils, lymphocytes, and other blood cells are the source of pro and anti-inflammatory cytokines in the immune response (8, 9). NRL is a predicting factor used in infectious and inflammatory conditions and postoperative complications (10). Zahorec has first reported the effects of neutrophils and lymphocytes on inflammatory response in patients with major abdominal surgery (11).

The relationship between trauma patients' mortality and neutrophil/lymphocyte ratio (NLR) at first hospitalization in intensive care units is still unknown.

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In our study, we aimed to investigate the relationship between NLR, acute physiology and chronic health evaluation II (APACHE II) score, mean platelet volume (MPV), blood lactate levels and neutrophil/lymphocyte ratio and mortality in trauma patients at the intensive care units (ICU) admission.

## Methods

After the approval of the local ethics committee, 107 patients who had been hospitalized in ICU due to multiple trauma were retrospectively reviewed from their files. Patients were divided into two groups based on 28-day mortality. Survivors (Group I) and deceased (Group II) identified. Trauma patient's age, gender, lactate levels, APACHE II scores and MPV data were collected from the electronic environment in their first hospitalization at intensive care units. The length of stay in ICU learning from patient' epicrisis from the electronic environment. NLR as an indicator of systemic inflammation was obtained by dividing the absolute neutrophil count by absolute lymphocyte count from blood analysis.

If the patients had heart failure, cerebrovascular disease, systemic inflammatory disease, inflammatory bowel disease, renal failure, tumor, and patients under 18 years of age they were excluded from the study.

All statistical analyses were performed using SPSS version 20.0 (SPSS. Inc., Chicago, IL). Categorical variables are expressed as percentages and frequencies. Categorical variables between the groups were analyzed by the Mann-Whitney-U test. The predictive

**Tab. 1. Distribution of patients.**

| Variables | Grup I | Grup II | % |
|---|---|---|---|
| Gender (M/F) | 68/21 | 15/3 | 77.57/22.42 |
| 28. Day mortality | – | 18 | |
| Age | 46.89±19.06 | | |
| Lactat | 3.25±2.92 | | |
| MPV | 10.34±1.02 | | |
| NLR | 8.23±8.11 | | |
| APACHE II | 22.8±8.57 | | |
| Hospitalization days in ICU | 11.33±22.98 | | |

MPV – Mean Platelet volume, NLR – neutrophil / lymphocyte ratio, Acute physiology and cronic health evalation II – APACHE II), ICU – Intensive care unit

**Tab. 2. Comparison of effects on mortality between groups.**

| Variables | Grup I | Grup II | p |
|---|---|---|---|
| Age | 45.49±18.7 | 53.83±19.83 | .103 |
| Lactat | 3.42±3.14 | 2.4±1.12 | .48 |
| MPV | 10.34±1.01 | 10.32±1.105 | .802 |
| NLR | 7.75±7.11 | 10.62±11.89 | .861 |
| APACHE II | 20.66±7.38 | 33.39±5.83 | .0001 |
| Hospitalization days in ICU | 13.84±22.76 | 16.72±24.58 | .808 |

$p < 0.05$ was considered statistically significant. MPV – Mean Platelet volume, NLR – neutrophil / lymphocyte ratio, Acute physiology and cronic health evalation II – APACHE II, ICU – Intensive care unit

capacity of the APACHE II on mortality was assessed using. The predictive value of APACHE II was evaluated using the Receiver Operating Characteristics (ROC) curve analysis. ROC curve optimum cutoff values were determined on the maximum Youden Index (sensitivity-(1-specificity)). The sensitivity and specificity of apache 2 for mortality was reported using the optimal ROC curve value according to the Youden index. Differences between groups were considered significant at $p < 0.05$.

## Results

In our study, we evaluated 107 patients. 83 (77.58 %) patients were male , and 24 (22.42 %) patients were female. The patients' mean age was 46.89±19.06 years. The patients' mean value of the lactate level was 3.25±2.92, the mean value of MPV was 10.34±1.02, the average value of NLR was 8.23±8.11, the average score of APACHE II was 22.8±8.75, and the average length of stay in the ICU was 11.33±22.98 days (Tab. 1).

In group I, the mean age was 45.49±18.7, and the mean lactate value was 3.42±3.14, the mean MPV was 10.34±1.01, the mean NRL was 7.75±7.11, the mean APACHE II score was 20.66±7.38. The mean value of legth of stay in ICU was 13.84±22.76 days in group 1 (Tab. 2).

In group II, the mean age was 53.83±19.83, mean lactate value was 2.4±1.12, mean MPV was 10.32±1.105, mean NRL value was 10.62±11.89, mean APACHE II score was 33.39±5.83. The mean value of the number of days in ICU was 16.72±24.58 days in group II (Tab. 2).

When evaluating continuous variables relationship with mortality between groups, while there was a statistically significant difference between APACHE II score and mortality, there was no significant difference between age, lactate, MPV, NRL, and length of stay in ICU (Tab. 2).

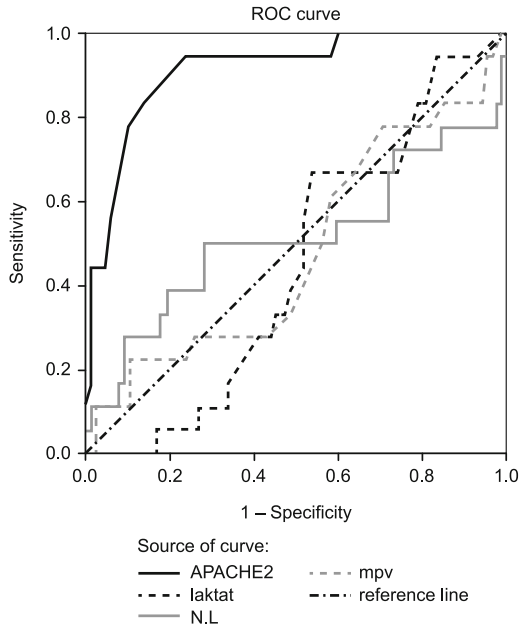


**Fig. 1. ROC curve analysis for group II continuous variables. MPV (Mean Platelet volume), N.L neutrophil / lymphocyte ratio), Acute physiology and chronic health evaluation II (APACHE II).**

In the ROC analysis, the area under the curve for the APACHE II score was 0.913, and the confidence interval was 0.843-0.984, $p < 0.001$. In the ROC analysis, the sensitivity for the APACHE II score in 26.5 cut off value was 0.944, the specificity was 0.764, and the mean value was 0.854 (youden index 0.708) (Fig. 1).

## Discussion

Many studies have shown that NRL is a valuable prognostic factor (12). In the inflammatory response number of neutrophils increase, and the lymphocyte count reduced. WBC subgroups play a critical role in inflammation and cytokine release. Tissue damage, stress, and inflammation result in neutrophilia and lymphopenia (11). Dilektaşli et al, found changes in NRL related to mortality on the 2nd and 4th days of trauma (13). In our study, we evaluated NRL when patients were first admitted to the intensive care unit, and it was statistically insignificant as a prognostic factor (Tab. 2). We think that this is due to the inflammatory response to trauma being insufficient. Rhind et al. showed that peripheral neutrophil counts increased after 48 hours (14).

Platelets secrete many substances in coagulation, thrombosis, and inflammation. Platelet count and volume are related to hematopoiesis in the systemic inflammatory response. MPV depends on platelet function and early risk factors for atherosclerotic patients, and MPV is a useful prognostic biomarker in cardiovascular patients (15). In our study, we evaluated MPV in ICU initial hospitalization of patients; however, the association of MPV value with mortality in the early period was not statistically significant (Tab. 2).

In the previous studies, the predictive capacities of scoring systems such as Glasgow coma score (GCS), injury severity score (ISS),

revised trauma and injury severity score (TRISS) and APACHE II are well understood (16,18). In our study, APACHE II scores were statistically significant like in the other studies (Tab. 2, Fig. 1).

Vandromme et al, examined 2413 trauma patients in a retrospective study. The normotensive patients' capillary and venous lactate levels of 2.5 mmol and above were found to be more effective than the systolic blood pressure. This study included trauma patients with the systolic blood pressure of 90–110 mm Hg (19). In another study, Callaway et al examined in 588 normotensive trauma patients the relationship between venous lactate levels and mortality retrospectively. In this study, the cutoff value of lactate was accepted as 2.5 mmol, and every increase in lactate level increased mortality (20). In another retrospective study, Kaplan et al, examined 78 patients and accepted lactate cutoff value was 2.2 mmol. Trauma patients' arterial lactate levels at admittance into the ICU were compared between those who deceased and survivors. There was no significant difference between the deceased and survivors patients (21). In our study, we compared the lactate levels at the first visit in ICU between trauma patients who deceased and survivors, and we could not find statistically significant results.

A study reported that theratio in ICU remained to be 37.8 % for 1–3 days and 22.6 % for more than 14 days (22). A trauma study reported that the mean duration of the length of stay in ICU was two days. Another trauma study reported 8.6 days (23). In our study, no statistically significant difference between deceased and survivor patients for the ICU hospitalization period was found.

## Conclusions

We conclude that NRL, MPV, and lactate levels can not be considered as a prognostic factor of trauma patients in the early period. However, it seems more appropriate to evaluate them after the first 48 hours depending on the systemic inflammatory response (13). We suggest that trauma scoring such as APACHE II during the ICU admission period are more suitable for mortality prediction.

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