ORIGINAL ARTICLE

Mortality risk factors for crush syndrome after an earthquake in Türkiye: Do systemic inflammatory parameters play any role?

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ABSTRACT

BACKGROUND: The aim of our study is to assess the prognostic impact of the neutrophil-to-lymphocyte ratio (NLR), lymphocyte-to-monocyte ratio (LMR), and platelet-to-lymphocyte ratio (PLR) on 28-day mortality in patients admitted to the intensive care unit with crush syndrome following the Kahramanmaraş earthquake in Türkiye.

METHODS: A total of 63 adult patients with crush syndrome admitted to the intensive care unit after the earthquake were enrolled in this study. The medical records of the patients were examined using follow-up forms and the hospital data system.

RESULTS: The mean age of the patients was 38.9±17.3 years, and the median time under debris was 31.5 hours. The 28-day mortality rate was 27%. In univariate generalized estimating equations (GEE) and other analyses, variables that are significant (or candidate variables) between 28-day mortality groups included age as a biological factor. These variables were included in the multivariate GEE model. The effects of continuous renal replacement therapy (CRRT), serum sodium concentration, Sequential Organ Failure Assessment (SOFA) score, and PLR on mortality were statistically significant.

CONCLUSION: Elevated SOFA scores, the necessity for CRRT, increased serum sodium levels, and decreased PLR values are associated with increased 28-day mortality in patients with crush syndrome after an earthquake.

Keywords: Crush syndrome; earthquake monocyte-to-lymphocyte ratio; neutrophil-to-lymphocyte ratio; platelet-to-lymphocyte ratio.

INTRODUCTION

On February 6, 2023, two earthquakes (7.8 Mw and 7.5 Mw) occurred in Türkiye, nine hours apart, with epicenters in the Pazarcık and Ekinözü districts of Kahramanmaraş, respectively. Fourteen days later, another earthquake (6.4 Mw) struck with the epicenter in Hatay. These earthquakes caused significant damage across 11 provinces in Türkiye. According to official figures, approximately 9.1 million people in Türkiye were affected, around 50,000 people died, and at least 115,000 were injured.[1] Following the earthquakes, many patients were treated for crush syndrome (CS) in various centers in the surrounding provinces.

Crush syndrome is a life-threatening medical condition that typically occurs when heavy objects or structures fall on or compress a persons' body, leading to continuous and prolonged muscle crushing. This syndrome is commonly seen in victims of earthquakes, wars, terrorist attacks, or other accidents. The main underlying pathologies are cellular hypo-

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perfusion, hypovolemia, traumatic rhabdomyolysis, and ischemia-reperfusion injury.[2] When pressure is rapidly relieved, substances such as myoglobin, potassium, uric acid, and phosphorus are released from the damaged tissue into the systemic circulation.[3] Major systemic problems can occur after reperfusion and CS, leading to potentially fatal complications such as rhabdomyolysis, acute renal failure (ARF), arrhythmias, sepsis, disseminated intravascular coagulation (DIC), and multi-organ dysfunction.[4,5] Treatment includes early fluid resuscitation, diuresis, renal replacement therapy, and surgical intervention.[4]

Systemic Inflammatory Response Syndrome (SIRS), mediated by neutrophils and cytokines, continues to be a serious issue in CS.[6] Although the effects of the lymphocyte-to-monocyte ratio (LMR), platelet-to-lymphocyte ratio (PLR), and neutrophil-to-lymphocyte ratio (NLR) on diagnosis and mortality in critically ill patients have been investigated, no study has evaluated the effect of these parameters on mortality in CS.[7-9] The aim of this study was to investigate the effects of these parameters on mortality in patients admitted to the intensive care unit (ICU) with CS. Our hypothesis was that they could help determine the prognosis of patients with CS after an earthquake. The primary outcome was 28-day mortality, and the secondary outcome was CS-related complications.

MATERIALS AND METHODS

Sixty-three ICU-admitted patients diagnosed with CS after the Kahramanmaraş earthquake were included in this retrospective cohort study. Following approval from the local ethics committee (Çukurova University Faculty of Medicine Ethics Committee, date: June 2, 2023; decision number: 134/3), the patients' medical records were reviewed using the ICU follow-up forms and the hospital data system. Inclusion criteria included patients with CS after the February 6 earthquake and aged over 18 years. Exclusion criteria were patients younger than 18 years of age and those with CS due to causes other than the earthquake.

ICU Treatment

Crush syndrome was diagnosed when the patient presented with painful and swollen extremities and a history of compression of any part of the body. Vital signs (heart rate, invasive systolic, diastolic, and mean arterial blood pressure), peripheral arterial oxygen saturation, and urine output were monitored. Intravenous fluid therapy was initiated, and arterial blood gas analysis, blood tests, and clinical, neurological, and radiological examinations were performed upon admission to the ICU. Necessary surgical procedures were performed. In the presence of pneumothorax, hemothorax, pneumomediastinum, or subcutaneous emphysema, a thorax tube was placed. Inotropic agents, vasopressors, vasodilators, blood and blood products, diuretics, anticoagulants, oxygen therapy, sedation, and analgesics were administered as needed. Glucose-insulin infusion and renal replacement therapy (either hemofiltration or hemodialysis) were used to treat hyperkalemia (serum potassium concentration > 6 mEq/L). The Glasgow Coma Scale (GCS), Acute Physiology and Chronic Health Evaluation II (APACHE II), Sequential Organ Failure Assessment (SOFA) scores, Revised Trauma Score (RTS), and Injury Severity Score (ISS) were used to assess patients' clinical status on a daily basis.

Data Collection

Demographic and clinical data of the patients, daily laboratory tests, time under debris, site of injury (lower limb, upper limb, thorax, pelvis, abdomen, head, and neck), and surgical procedures (amputation, fasciotomy, debridement, and others) were recorded. Duration of ICU stay, oxygen demand, and damage-related complications such as sepsis, DIC, and/or acute respiratory distress syndrome (ARDS), and mortality at 7 days were also noted. Oxygen demand was defined as low (room air, face mask, or nasal cannula) and high (high-flow nasal cannula, continuous positive airway pressure, or invasive mechanical ventilation). Mortality at 28 and 90 days was assessed by calling the patients and their relatives by phone. Only the first 14 days of patients' laboratory data were included in the study, as we had to evacuate our hospital due to damage caused by the Hatay earthquake on February 20, 2023.

Statistical Analysis

For data analysis, the Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM Corp.: Armonk, New York, USA) was used. While summarizing the data, descriptive statistics related to continuous variables were presented as median (minimum-maximum) values. Categorical variables were summarized as n (%). In the analysis of continuous variables, conformity to normal distribution was checked by the Shapiro-Wilk test. For variables that were not normally distributed, the Mann-Whitney U test was used for comparisons in two groups. Variables at each time point of the 14-day follow-up during the ICU stay were also compared in the 28-day mortality groups. Generalized estimation equations (GEE) were used to analyze the data due to non-normal data, changing data availability for each subject, and the ability to assess both time-varying and individual difference variables. The GEE model was performed to investigate the association between mortality and related risk factors. In univariate analyses, the variables that were found to be significant ($p<0.05$) between 28-day mortality groups (survivors and non-survivors) and that could be considered candidate variables ($p<0.25$) were included in the GEE model. Correlation between variables was assessed with Spearman correlation. Variables that were related ($r>0.4$) with each other were not added to the GEE model at the same time. With the NLR, PLR, and LMR, three different models were created and odds ratios (ORs) were reported with their 95% confidence intervals (CIs). A p-value of <0.05 was considered statistically significant in the evaluations.

RESULTS

After the February 6 earthquake, a total of 1,096 earthquake victims were admitted to our university hospital. Sixty-nine

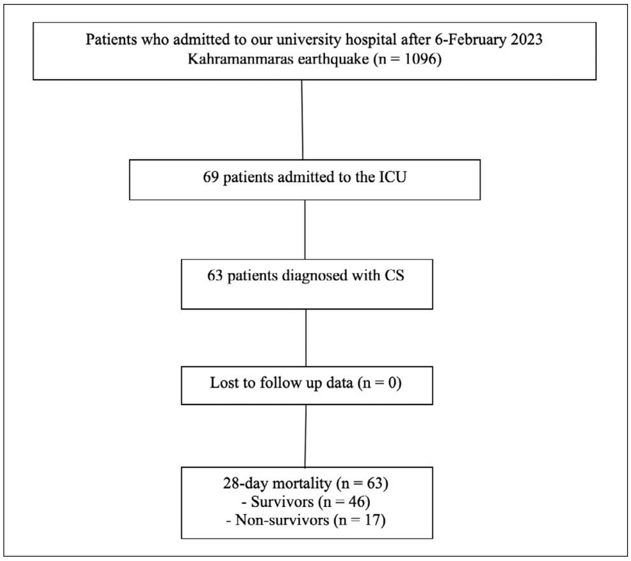

Figure 1. Study flow chart.

adult patients were admitted to the ICU after the earthquake, sixty-three of whom were diagnosed with CS and all were included in the study (Fig. 1).

Baseline Characteristics of the Patients

The mean age was 38.9±17.3 (18-90 years) and the median time under debris was 31.5 (1-220) hours. Of all the patients, 52.4% (n=33) were male and 47.6% (n=30) were female. Crush syndrome was diagnosed in 53 of 63 patients with at least one extremity trauma, and 10 patients had undamaged extremities. Amputation was the most common surgical procedure. The affected body parts and the surgical procedures are presented in Table 1.

Twenty-two patients had comorbidities: 6 with hypertension, 5 with cardiac disease, 4 with malignancy, 3 with diabetes mellitus, 3 with chronic obstructive pulmonary disease, and 1 with a neurological disease. Seven patients (11.1%) had a history of cardiac arrest due to hyperkalemia before admission to the ICU. Four of them (57.1%) died at the 28-day follow-up. The mean GCS score was 10.7±4.9 (3-15), the APACHE II score was 23.0±10.3 (8-49), the SOFA score was 6.1±3.1 (1-13), the RTS was 5.5±3.6 (1-12), and ISS was 25.1±24.5 (0-75). While 32 patients (50.8%) required intubation, 25 patients were treated with a nasal/face mask or high-flow nasal oxygen (HFNO). Only 6 patients (9.5%) did not require supplemental oxygen. The mean duration of mechanical ventilation was 125.5±105.3 (15–336) hours, duration of ICU stay was 6.5±4.4 (1–14) days, and length of hospital stay was 10.2±4.3 (1–16) days. After 14 days, 27 patients (42.9%) were transferred to the ward, 25 patients (39.7%) were transferred to another hospital, 10 patients (15.9%) died, and one patient (1.6%) was discharged.

It was found that the 7-day mortality rate was 12.7% (n=8), the 28-day mortality rate was 27% (n=17), and the 90-day mortality rate was 28.6% (n=18).

Table 1. Site of injuries and surgical procedures

	n	%
Site of Injury		
Lower limb	44	69.8
Thorax	35	55.6
Abdomen	24	38.1
Upper limb	20	31.7
Head and neck	15	23.8
Pelvis	14	22.2
Surgical Procedures		
Amputation	30	47.6
Fasciotomy	9	14.3
Debridement	7	11.1
Laparotomy	5	7.9
Internal fixation	4	6.3
Local flap	3	4.8
Thorax wall resection	1	1.6
Orchiectomy	1	1.6
Hemipelvectomy	1	1.6

Data are presented as the number of patients (n) and percent (%).

Damage-Related Complications

The most common complications during the ICU admission were sepsis (74.6%), renal failure (69.8%), wound infection (54%), pneumonia (38.1%), and hemo/pneumothorax (28.6%). Pulmonary embolism was observed in two patients, and pericardial effusion, acute respiratory distress syndrome (ARDS), gastrointestinal perforation, and bleeding were observed in one patient each. Hemodialysis was used in 10 patients (15.9%), continuous renal replacement therapy (CRRT) in 14 patients (22.2%), and a combination of both CRRT and hemodialysis in 18 patients (28.6%).

Risk Factors of Mortality

When risk factors for 28-day mortality were analyzed in univariate analyses, GCS, APACHE, and SOFA scores, RTS, pneumonia, diabetes mellitus, CRRT, oxygen demand, white blood cell (WBC) count, hemoglobin, hematocrit, C-reactive protein, sodium (Na+), potassium, albumin, lactate, procalcitonin, lactate dehydrogenase, creatine phosphokinase, glomerular filtration rate (GFR), blood urea nitrogen (BUN), creatinine, uric acid, NLR, PLR, and LMR were found to be statistically different between survivors and non-survivors, or could be candidate variables (Table 2).

Time-dependent changes in the primary variables of our study (NLR, PLR, and LMR) were also examined. These are shown in Figure 2.

The GEE model was performed to investigate the association between mortality and related risk factors. The variables

Table 2. Comparison of variables in "28-day mortality" groups

	Mortality (28 days)		p
	Survivors (n=46)	Non-survivors (n=17)	
Gender (male/female)	24 (52.2)/22 (47.8)	9 (52.9)/8 (47.1)	0.957
Age (years)	32 (18-68)	46 (19-90)	0.116
Site of Injury			
Lower extremity	32 (69.6)	12 (70.6)	0.937
Thorax	25 (54.3)	10 (58.8)	0.751
Abdomen	18 (39.1)	6 (35.3)	0.781
Upper extremity	14 (30.4)	6 (35.3)	0.713
Head and neck	12 (26.1)	3 (17.6)	0.485
Pelvis	9 (19.6)	5 (29.4)	0.404
Time under debris (hours)	30 (1-220)	36 (10-155)	0.114
GCS score	14 (3-15)	3 (3-15)	<0.001
APACHE II score	18 (8-49)	27 (8-47)	0.034
SOFA score	5 (1-11)	9 (4-13)	<0.001
Revised trauma score	4 (1-12)	3 (1-11)	0.011
Injury severity score	12 (0-75)	17 (0-75)	0.393
Complications			
ARDS	0 (0)	1 (5.9)	0.270
Sepsis	34 (73.9)	13 (76.5)	0.836
Pericardial effusion	1 (2.2)	0 (0)	0.540
Pulmonary embolism	2 (4.3)	0 (0)	0.382
Perforation	0 (0)	1 (5.9)	0.270
Cellulite	23 (50)	11 (64.7)	0.299
Kidney failure	31 (67.4)	13 (76.5)	0.486
Gastrointestinal bleeding	1 (2.2)	0 (0)	0.540
Pneumonia	13 (28.3)	11 (64.7)	0.008
Comorbidity			
HT	3 (6.5)	3 (17.6)	0.330
DM	0 (0)	3 (17.6)	0.017
COPD	2 (4.3)	1 (5.9)	0.800
Cardiac disease	4 (8.7)	1 (5.9)	0.714
Neurological disease	1 (2.2)	0 (0)	0.540
CRRT	19 (41.3)	13 (76.5)	0.013
Hemodialysis	23 (50)	5 (29.4)	0.144
Oxygen demand (low/high)	24 (52.2)/22 (47.8)	1 (5.9)/16 (94.1)	0.001
Duration of mechanical ventilation (hours)	84 (20-288)	73 (15-336)	0.985
Length of ICU stay (days)	5.5 (1-15)	5 (1-15)	0.762
White blood cells (103/µL)	11 (5.1-31.8)	21.1 (8.5-37)	0.018
Hemoglobin (g/dL)	8.6 (7.8-9.3)	7.7 (6.3-8.3)	0.038
Hematocrit (%)	27.3 (19.5-33.9)	24 (19.4-27.9)	0.197
Albumin (g/dL)	2.16 (1.67-3.33)	1.87 (1.49-2.38)	0.082
C-reactive protein (mg/L)	133 (15.4-421)	213 (83.8-464)	0.039
Procalcitonin (µg/L)	3 (0.1-68.2)	24.2 (0.4-97.7)	0.062
Potassium (mmol/L)	4.8 (3-7.3)	5.3 (3.2-7.5)	0.183
Sodium (mmol/L)	139 (116-168)	145 (131-167)	0.119
Lactate (mmol/L)	1.2 (0.8-2.9)	2.2 (1.5-3.4)	0.003
Blood urea nitrogen (mg/dL)	27.2 (5.2-108)	43.6 (12.3-121.3)	0.035
Creatinine (mg/dL)	3.8 (0.4-5.7)	2.1 (0.3-4.2)	0.093
Myoglobin (ng/mL)	1045 (22-3978)	2687.5 (351-4007)	0.257
Lactate dehydrogenase (U/L)	635.5 (53-5450)	874 (366-12850)	0.216
Creatine phosphokinase (U/L)	16203 (103-965000)	6990 (117-102898)	0.215
Alanine aminotransferase (U/L)	81 (27-739)	51 (17-289)	0.250
Aspartate aminotransferase (U/L)	259 (20-5343)	739 (38-2711)	0.341
Uric acid (mg/dL)	8.9 (0.9-19)	10.5 (3.9-17.4)	0.080
Glomerular filtration rate (mL/min/1.73 m2)	36.5 (8-145)	28 (9-138)	0.039
Neutrophil-to-lymphocyte ratio	10 (2.7-48.5)	12.7 (4.6-41.5)	0.186
Platelet-to-lymphocyte ratio	142 (58.1-301.8)	67.4 (32.5-290)	0.048
Lymphocyte-to-monocyte ratio	1.25 (0.55-2.11)	1.93 (0.17-4)	0.181

Data are presented as median (minimum-maximum), number of patients (n) and percent (%). APACHE: Acute Physiology and Chronic Health Evaluation; ARDS: Acute Respiratory Distress Syndrome; CRRT: Continuous Renal Replacement Therapy; COPD: Chronic Obstructive Pulmonary Disease; DM: Diabetes Mellitus; GCS: Glasgow Coma Scale; HT: Hypertension; ICU: Intensive Care Unit; SOFA: Sequential Organ Failure Assessment.

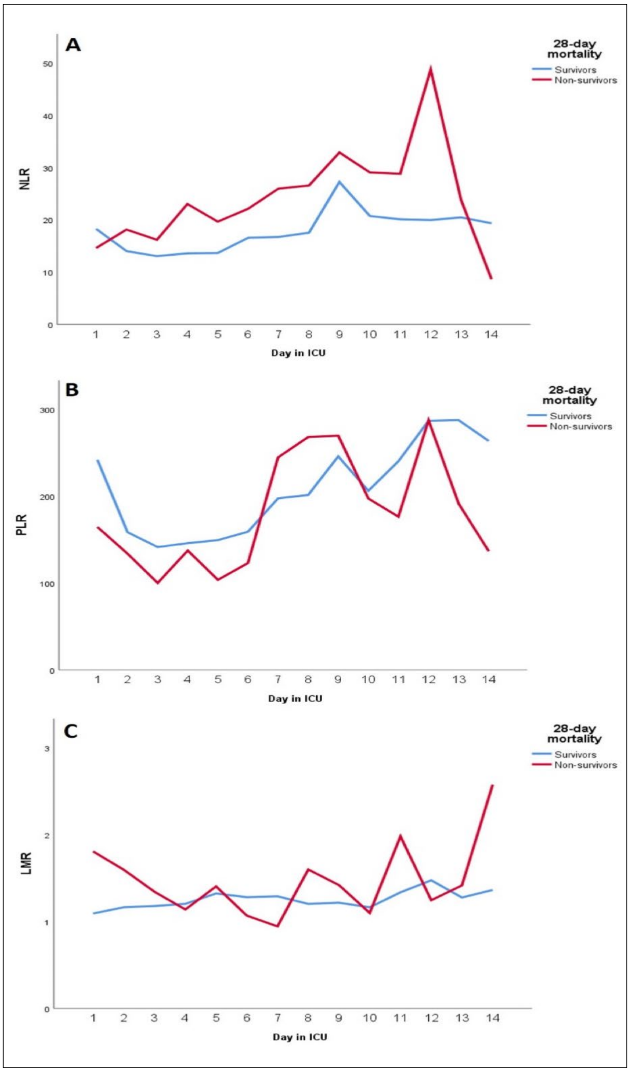

Figure 2. Trends in primary outcomes during intensive care unit stay.

found to be significant (or candidate variables) between 28-day mortality groups in univariate GEE or other analyses, and age as a biological factor, were included in the multivariate GEE model. The variables that were related to each other (r>0.4) were not included in the GEE model. Three different models were created with NLR, PLR, and LMR. All three models included CRRT, pneumonia, age, CRP, sodium (Na+), GFR, and SOFA scores on mortality were statistically significant. In Model 1 and Model 3, the effects of the NLR and LMR parameters on mortality were not statistically significant (p=0.138, p=0.204, respectively) (Table 3). In the second model, which included the PLR among the examined ratios, PLR was found to have a statistically significant effect on mortality (p=0.006) (Table 3). Receiving CRRT, high Na+ level, and high SOFA score increased mortality. Additionally, when Model 2 was evaluated, low PLR levels also increased mortality (Table 3).

DISCUSSION

In this retrospective cohort study, our findings suggest that higher SOFA scores, higher serum sodium concentrations, lower PLR values, and the need for CRRT are predictive factors for 28-day mortality in ICU patients with CS after the earthquake.

Previous reports have shown that CS and subsequent ARF are the main causes of hospital death after earthquakes.[10,11] The mortality rate for CS is approximately 20% (ranging from 13% to 25%), which may increase if treatment is not initiated promptly or in the presence of multi-organ failure.[5,12,13] Risk factors for mortality in earthquake trauma patients include age, time under debris, GCS, and comorbidities, particularly chronic renal disease.[5,14] The risk of mortality increases when time under debris exceeds 24 hours; however, the longest survival time reported in the literature is 14 days

Table 3. Generalized estimating equations analysis of the association between 28-day mortality and risk factors

	Model 1			Model 2			Model 3	
	OR (95% CI)	p		OR (95% CI)	p		OR (95% CI)	p
CRRT	6.29 (1.29-30.3)	0.017*	CRRT	6.91 (1.33-35.9)	0.022*	CRRT	7.30 (1.38-38.5)	0.025*
Pneumonia	1.10 (0.25-4.90)	0.900	Pneumonia	1.09 (0.24-4.97)	0.913	Pneumonia	0.99 (0.19-5.0)	0.990
Age	1.02 (0.97-1.07)	0.385	Age	1.02 (0.98-1.07)	0.388	Age	1.02 (0.98-1.07)	0.327
CRP	1.0 (0.99-1.00)	0.062	CRP	1.0 (0.99-1.00)	0.078	CRP	1.0 (0.99-1.01)	0.541
Sodium	1.01 (1.01-1.03)	0.016*	Sodium	1.01 (1.00-1.02)	0.014*	Sodium	1.01 (1.00-1.02)	0.029*
GFR	0.99 (0.99-1.01)	0.148	GFR	0.99 (0.99-1.0)	0.063	GFR	0.99 (0.99-1.00)	0.117
SOFA	1.75 (1.22-2.49)	0.002*	SOFA	1.75 (1.20-2.56)	0.004*	SOFA	1.77 (1.21-2.61)	0.004*
NLR	0.99 (0.99-1.0)	0.138	PLR	0.99 (0.99-0.99)	0.006*	LMR	1.02 (0.98-1.07)	0.204

Data are presented as odds ratio (OR) and 95% confidence interval (CI). CRP: C-Reactive Protein; CRRT: Continuous Renal Replacement Therapy; GFR: Glomerular Filtration Rate; LMR: Lymphocyte-to-Monocyte Ratio; NLR: Neutrophil-to-Lymphocyte Ratio; PLR: Platelet-to-Lymphocyte Ratio; SOFA: Sequential Organ Failure Assessment.

after an earthquake.[15] While severe thoracic and abdominal trauma leading to CS is another potential cause of death, the limbs are the most commonly injured body parts.[5,13,16] Another important problem in earthquake victims is ARDS and/or respiratory failure. Erek et al. found that ARDS and/or respiratory failure associated with sepsis was a risk factor for mortality in earthquake victims.[16] In our patients, we observed prolonged time under debris due to the impossibility of transport to the earthquake zone because of damaged roads. However, there was no difference in time under debris between survivors and non-survivors (1-220 hours vs. 10-155 hours, respectively). We observed a higher incidence of lower extremity trauma in both groups; however, the site of injury did not differ between survivors and non-survivors. Consistent with the literature, mortality was higher in our patients who required CRRT, had diabetes mellitus, had lower GFR, higher BUN, and higher GCS, APACHE II, SOFA and Revised Trauma Scores, had pneumonia, required higher oxygen demand, and had higher WBC counts.

Electrolyte imbalances are common in earthquake victims with CS, and hyperkalemia is one of the life-threatening conditions.[15] In our study, the mortality rate was 57.1% in patients with a history of cardiac arrest due to hyperkalemia before ICU admission. However, the potassium levels of survivors and non-survivors were not different at the time of ICU admission (3-7.3 mmol/L, 3.2-7.5 mmol/L, respectively) and during the 14-day follow-up. Studies investigating serum Na+ concentration in patients with CS are limited in the literature. Zhang et al. found hyponatremia (serum Na+ concentration <135 mmol/L) to be an independent risk factor after the Wenchuan earthquake; however, they excluded hypernatremic patients (serum Na+ concentration >145 mmol/L) and evaluated only normonatremic and hyponatremic patients in their study.[17] Another study found the incidence of hyponatremia to be 52.5% after the Bam earthquake.[18] In our study, 20 patients had hyponatremia (31.7%), 23 patients had normonatremia (36.6%), and 20 patients had hypernatremia (31.7%) at the time of ICU admission; however, serum Na+ concentration did not differ between survivors (139 mmol/L) and non-survivors (145 mmol/L) (p=0.119). Serum Na+ concentration was included in our GEE model because it was considered a candidate variable and was found to be associated with mortality. We observed hyponatremia less frequently than reported in the literature. This may be explained by the fluid therapy given to our patients prior to ICU admission (we could not obtain clear information on this issue) or the small sample size of our study.

The immune response to various factors plays a crucial role in critically ill patients, and many cell types, including neutrophils and lymphocytes, release cytokines into the circulation. Trauma, sepsis, and SIRS are associated with elevated plasma cytokine levels. Ischemia-reperfusion injury in crush syndrome triggers an inflammatory cascade, with neutrophils being the first to increase.[19-22] Conversely, there is a decrease in total lymphocytes.[23] Recently, the effects of the LMR, PLR, and NLR on mortality and clinical outcomes in critically ill patients have been explored, with higher NLR associated with poorer outcomes.[21-25] Heffernan et al. suggested that lymphopenia, developing after trauma, typically resolves within 72 to 96 hours, with delayed normalization potentially leading to worse outcomes.[22] Ke et al. found that a higher lymphocyte count, lower platelet count, and consequently, lower PLR play a crucial role in mortality among ICU-admitted trauma patients.[26] Van Helmond et al. posited that relative leukocytosis (especially neutrophil-based) in non-surviving patients may result from hypovolemia.[27] Dilektasli et al. demonstrated that elevated NLR on days 2 and 5 is an independent risk factor for mortality in trauma patients, mostly with blunt injuries.[8] Lee et al. reported that lower PLR and NLR at 6 hours after admission to the emergency department were associated with in-hospital mortality in trauma patients.[9] Riché et al. observed that septic shock patients with lower NLR at ICU admission had an increased risk of early death, while an increase in NLR from day 1 to day 5 was linked to late mortality.[28]

In our study, the victims could reach and be admitted to our hospital after the first 24 hours following the earthquake, so we compared the laboratory values at ICU admission and during the 14-day period. In accordance with the literature, we observed that NLR values were lower in non-survivors at ICU admission and gradually increased. However, in GEE Model 1, NLR was not a predictor of 28-day mortality (p=0.138). Similarly, PLR values were lower in non-survivors at ICU admission, and in GEE Model 2, emerged as a predictive factor for 28-day mortality (p=0.006). Although LMR values were higher in non-survivors, in GEE Model 3, they were not predictive of 28-day mortality (p=0.204).

To our knowledge, this is the first study to clearly investigate the effect of NLR, LMR, and PLR values on mortality in patients with CS. Furthermore, our study cohort represents a relatively homogeneous group, specifically comprising earthquake victims with CS who were admitted to the ICU. However, there are several limitations to our study. First, it was conducted as a single-center investigation, restricting our sample to patients admitted solely to our ICU and excluding those treated in nearby hospitals or on the ward. Second, the sample size was small; confirmation of our findings by other centers would have strengthened our results. Third, crucial data regarding the time elapsed from rubble removal to hospital arrival and from the emergency department to ICU admission were unavailable for all patients, thus limiting the comprehensiveness of our analysis. Fourth, the fluid therapy that all patients received until admission to the ICU was unclear, so this information was not included in the study data.

CONCLUSION

In conclusion, our study highlights several predictive factors for 28-day mortality in ICU patients with CS after an earthquake, including elevated SOFA scores, increased serum Na+ levels, decreased PLR values, and the necessity for CRRT. Notably, among these markers, the PLR emerges as a simple and cost-effective parameter that could serve as a valuable tool for assessing outcomes following an earthquake. Nevertheless, to validate these findings and ensure their generalizability, additional prospective studies conducted across multiple centers are warranted. Such endeavors will provide a more comprehensive understanding of the prognostic significance of these factors in earthquake-related CS cases.

Ethics Committee Approval: This study was approved by the Cukurova University Faculty of Medicine Ethics Committee (Date: 02.06.2023, Decision No: 134).

Peer-review: Externally peer-reviewed.

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Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Türkiye'de deprem sonrası ezilme sendromu için mortalite risk faktörleri: Sistemik inflamatuvar parametrelerin herhangi bir rolü var mı?

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AMAÇ: Çalışmamızın amacı, Türkiye'de Kahramanmaraş depremi sonrası yoğun bakımda takip edilen crush sendromu tanılı hastalarda nötrofil-lenfosit oranı (NLR), lenfosit-monosit oranı (LMR) ve trombosit-lenfosit oranının (PLR) 28 günlük mortalite üzerindeki prognostik etkisini değerlendirmektir.

GEREÇ VE YÖNTEM: Bu çalışmaya deprem sonrası crush sendromu tanısıyla yoğun bakım ünitesine yatırılan toplam 63 yetişkin hasta dahil edildi. Hastaların tıbbi kayıtları takip formları ve hastane veri sistemi kullanılarak incelendi.

BULGULAR: Hastaların ortalama yaşı 38.9±17.3 yıl ve enkaz altında geçen ortanca süre 31.5 saat idi. 28 günlük mortalite oranı %27 idi. Tek değişkenli genelleştirilmiş tahmin denklemleri (GEE) veya diğer analizlerde, 28 günlük mortalite grupları arasında anlamlı bulunan değişkenler (veya aday değişkenler) ve biyolojik bir faktör olarak yaş, çok değişkenli GEE modeline dahil edildi. Sürekli renal replasman tedavisi (CRRT), serum sodyum konsantrasyonu, sıralı organ yetmezliği değerlendirme (SOFA) skoru ve PLR'nin mortalite üzerindeki etkisi istatistiksel olarak anlamlıydı.

SONUÇ: Yüksek SOFA skorları, CRRT gerekliliği, artmış serum sodyum seviyeleri, ve azalmış PLR değerleri deprem sonrası crush sendromu tanılı hastalarda 28 günlük mortaliteyi artırmaktadır.

Anahtar sözcükler: Crush sendromu; deprem; nötrofil-lenfosit oranı; monosit-lenfosit oranı; trombosit-lenfosit oranı.

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