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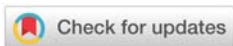
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Introduction

The skin is the largest organ of the body. While it protects the body against infections, at the same time acting as a barrier to the prevention of heat and fluid. Burns cause damaged in this barrier so the body become a clear target for infections. Burn is a type of injury to skin, or other body tissues, caused by heat, cold, chemicals, electricity, sunlight, or radiation. It is one of the most serious traumas affecting the human body. Though burn can be seen as a local disease, because of pathophysiological changes and immunological reactions in the body, it is a systemic trauma that affect the entire organism [1,2]. As a matter of fact, the vast majority of ex-patients are suffering from lung problems, sepsis, hypovolemic shock and multiorgan failure [3].

The R-Baux score has been used for many years for

Research Article

Could neutrophil-to-lymphocyte ratio be a new mortality predictor value in severe burns?

Abstract

Background: The aim of our study was to demonstrate if there is any relation between the neutrophil-to-lymphocyte ratio (NLR) and mortality in severe burns.

Methods: The records of 366 patients who were admitted to Intensive Care Unit of Burn Center of Derince Training and Research Hospital between January 2012 and December 2015 were evaluated retrospectively. The cases who were hospitalized in service or did not require intensive care were not included in the study. The cases were divided into two groups: ex-group (Group 1) and discharge group (Group 2). In both groups demographic information such as age, gender, burn scores, neutrophil counts and lymphocyte counts during admission to the hospital were recorded. NLR is the ratio of absolute neutrophil count to the absolute lymphocyte count.

Results: NLR was 10.94 ± 7.63 in the exitus group and 5.5 ± 5.56 in the discharged group. NLR was increased in mortality group and this value was statistically significant ($p=0.00$). Independent relationship between prognoses and NLR was shown with logistic regression analyses (Odds Ratio 0.895, 95% confidence interval 0.856-0.936, $p=0.00$)

Conclusion: NLR has increased in mortality group. Our study showed that NLR is correlated with probability of mortality after severe burn injuries. Therefore, it can be used as a cheap, easily obtained and new mortality predictor in severe burns.

estimating the risk of mortality in severely burned patients [4]. In a number of recent publications, it has been stated that the NLR which is cheap and easily calculated at every center, is a strong indicator of inflammation in many diseases such as cancer, cardiac, and autoimmune diseases, and can be used for estimating the prognosis of the patient [5-19]. So we also aimed to reveal the relationship between mortality and NLR in cases that treated in our center. We could not find any study linking mortality and NLR in burned patients in the literature. Therefore, we consider that our study is the first study about the link between NLR and mortality in burns in the literature.

Materials and Methods

The records of 366 patients who were admitted to the Intensive Care Unit of Derince Training and Research Hospital Burn Center between January 2012 and December 2015 were evaluated retrospectively. The cases who were not hospitalized in burn intensive care unit were not included in the study. The cases were divided into two groups: ex-group (Group 1) and discharge group (Group 2). In both groups demographic

information such as age, gender, burn scores, neutrophil counts and lymphocyte counts during admission to the hospital were recorded. NLR is the ratio of absolute neutrophil count to the absolute lymphocyte count.

Statistical analysis

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM, Chicago, IL, USA). The Mann Whitney-U test was used for numerical values which did not have normal distribution. Independent factors associated with exitus presence were investigated by multivariate logistic regression analysis. The results were evaluated in a 95% confidence interval and a significance level of $p < 0.05$.

Results

The demographic data of the patients studied are shown in table 1. We evaluated 366 cases who were hospitalized and treated in intensive care unit of our Burn Center. Of these cases, 268 (73.2%) were male and 98 (26.8%) were female. The mean age of the cases was 28.66 ± 21.12 years (range: 0–91 years). 52 (14.2%) of all were ex and 314 patients (85.8%) were discharged from the hospital. The mean age of the cases in Group 1 were as 42.85 ± 22.64 years (range 2–83 years) while the mean age of the cases in Group 2 was 26.31 ± 19.95 years (range 0–91 years). The degree of burn in the groups are shown in table 2. At the end of our study, we have found that NLR was significantly higher in exitus group. ($p = 0.00$). (Table 1) The multivariable logistic regression analysis was shown an independent relationship between prognosis and NLR (the odds ratio was 0.895, 95% and confidence interval 0.856–0.936, $p = 0.00$) (Table.3).

Table 1: Demographic characteristics and complete blood count of groups.

	Mortality Group (n=52)	Discharge Group (n=314)	Total (n=366)	P value
Age (years)	42.85±22.64	26.31±19.95	28, 66±21.12	0.00
Sex (Male/Female)	3 (39/13)	2.69 (229/85)	2.73 (268/98)	0.76
Neutrophil s ($10^3/mm^3$)	76, 42±18.52	67.42±16.17	68.70±16.80	0.00
Lymphocytes ($10^3/mm^3$)	11.06±9.79	21.35±13.42	19.89±13.44	0.00
Neutrophil/Lymphocyte Ratio	10.94±7.63	5.54±5.6 5	6.31±6.25	0.00
Mean Burn Percentage (%)	52±24.02	18.95±12.74	23.65±18.80	0.00

Table 2: Degree of burn in the groups.

	Mortality Group (n=52)	Discharge Group (n=314)	Total (n=366)
1. Degree burns	0	0	0
2. Degree burns	26	263	289
3. Degree burns	26	51	77

Table 3: Results of various variables on severe burns in logistic regression analyses.

	Odds Ratio	95% confidence interval	P value
Neutrophil/Lymphocyte Ratio	0.895	0.856-0.936	0,00

Discussion

Burn injuries are a significant problem with more than 450,000 people seeking medical treatment, 40,000 resultant hospitalizations, and 3000 deaths per year in the United States [20]. With the increasing number of treatment strategies, multidisciplinary approach and modern burn centers have reduced the rate of mortality in serious burn cases. However, the immunological response suppression and changes in burned patients may significantly influence the survey and patients can be lost from septic complications [3].

It is known that burn causes the activation of complex mediator systems which cause some pathophysiological changes in the body [21]. Local inflammatory response caused by burn injury is also caused systemic inflammation as the wound size increase. Neutrophils, which sequester in organs as a consequence of systemic inflammatory response to burn injury, are the main source of free oxygen radicals. Free oxygen radicals cause tissue damage by increasing the activity of xanthine oxidase. There is also a suppression in cellular immune response, that result a reduction in delayed type hypersensitivity reaction and lymphocyte count in the peripheral blood [22]. In severe burn cases, immune reactivity becomes even more complex with repeated surgical procedures, multiple blood transfusions and general anesthesia [23].

Recently, NLR, which is considered as a strong visual field of inflammation, has been shown in many studies that can be used to predict prognosis in many diseases such as cancer, cardiac, autoimmune [5–19]. NLR is the ratio of absolute neutrophil count to the absolute lymphocyte count. The normal NLR values in an adult, non-geriatric, population in good health are between 0.78 and 3.53 [24].

Duchesne j. et al hypothesized that the NLR would be a prognostic indicator of mortality in this population. At the end of their study, they found that NLR is strongly associated with early mortality in patients with severe hemorrhage managed with massive transfusion protocol [10].

Okashah A. S et al showed that NLR values were more strongly significant in patients with sepsis and severe sepsis than the values of classical parameters, such as CRP, WBCs, serum lactate, neutrophelia and lymphocytopenia [25].

Chen W. et al have revealed that increased NLR at admission of patients with severe traumatic brain injury was associated with unfavorable 1-year functional outcome and mortality [6].

Though the R-Baux score has been used for many years without estimating the risk of mortality in severe burn patients [4], recently published articles demonstrated that NLR is as a marker of the body's immune response in patients who has severe diseases. So that we tried to reveal the relationship between NLR and mortality in burned patients which is the most serious, perhaps the most important traumas that human beings are ever exposed.

As a conclusion, NLR has increased in mortality group. Our study showed that NLR is correlated with probability of

mortality after severe burn injuries. Therefore, it can be used as a cheap, easily obtained and new mortality predictor in severe burns.

Ethical committee approval

Ethical committee approval was not obtained because the study was done retrospectively by evaluation of patients' data's.

Multivariate Tests

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