Saudi Journal of Biological Sciences (2017) **24**, 362–366

King Saud University

Saudi Journal of Biological Sciences

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

The prognostic value of the neutrophil/lymphocyte ratio in patients with snake bites for clinical outcomes and complications

Bilal Elbey [a,*], **Burhan Baykal** [b], **Ümit Can Yazgan** [c], **Yılmaz Zengin** [d]

[a] *Dicle University, Faculty of Medicine, Department of Immunology, Diyarbakır, Turkey*
[b] *Dicle University, Faculty of Medicine, Department of Medical Biology & Genetics, Diyarbakır, Turkey*
[c] *Zirve University, Faculty of Medicine, Department of Physiology, Gaziantep, Turkey*
[d] *Dicle University, Faculty of Medicine, Department of Emergency Medicine, Diyarbakır, Turkey*

Received 8 May 2015; revised 2 October 2015; accepted 7 October 2015
Available online 19 October 2015

KEYWORDS

Snake bite;
Neutrophil/lenfosit ratio;
Compartment syndrome

Abstract *Introduction:* Snake bites have cardiotoxicity, neurotoxic, myotoxic, nephrotoxic, and hemotoxic features. The neutrophil/lymphocyte ratio (NLR) provides valuable information for the determination of the diagnosis and prognosis of various diseases. In this study, we aimed to investigate the relationship between NLR with the development of complications and duration of hospital stay in snakebite cases.

Method: In this study, 107 patients with snakebite complaints that applied to a tertiary care university hospital between 2011 and 2014 were retrospectively reviewed. The control group compromised of 107 age-and gender-matched healthy subjects. These patients were examined using their previous laboratory results, bite areas pictures, geographic location, and analysis of complications that developed during the hospitalization.

Results: Patients in our snake bites group ($n = 107$), included males (64%) and females (36%). When NLR1–NLR2, NLR1–NLR3, and NLR2–NLR3 were compared, a statistically significant difference was found ($p < 0.001$). No mortality was observed in our patients. In cases of snakebites, 4.67% of the patients underwent finger amputation. Compartment syndrome occurred in 3.73% of patients. In one case that developed compartment syndrome, a finger amputation was made. When 8 patients with a complication were compared with patients having snakebite but no complication,

* Corresponding author at: Dicle University, Faculty of Medicine, Department of Immunology, Diyarbakır 21280, Turkey. Tel.: +90 412 2488001x4058, +90 5324824677 (Gsm); fax: +90 4122488660.
Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.sjbs.2015.10.002

the initial NLR was found to be higher and statistically significant ($p = 0.042$). The average length of stay of patients in the hospital was 9 days. In the analysis of the correlation between the duration of hospitalization and NLR, the patients with a high level of NLR were found to have a longer hospital stay compared to lower NLR levels ($p = 0.012$).

Conclusion: NLR was significantly increased in patients that developed complications and needed a longer stay in the hospital.

1. Introduction

Approximately one-third of the 2500 snake species in the world are poisonous. However, of the venomous snakes, only 200 are dangerous for people (Okur et al., 2001b). Snake bites are common especially in the south and southeastern region of Turkey, which is where the majority of the snakes are located due to the climate and geographical features. Snake species *Vipera lebetina obtusa* are often seen in Southeastern Turkey and have venom that causes serious systemic and tissue damage (Kuru, 1999). The snake poison has cardiotoxicity, neurotoxic, myotoxic, nephrotoxic, and hemotoxic effects. The chemical makeup of snake venom is complex and consists of a combination of many toxic proteins and enzymes (Demir et al., 2005). Local and systemic symptoms are observed according to the severity of toxin. Regional findings such as pain, temperature increase, hemorrhagic edema, ecchymosis, and tissue necrosis may occur in the bite area. Generally, most snake bite cases heal without sequelae. However, severe necrosis requiring amputation of the finger and compartment syndrome may be observed with some serious complications in some cases (Bentur and Cahana, 2003; Michelarakis and Varouhaki, 2009). Though the number of poisonous snake bite cases in Turkey is largely unknown, the annual death rate is estimated to be low.

Snake venom has widespread effects throughout the bite area as well as the whole body (Baran, 1976; Warrell, 1992). This is mostly due to the levels of toxic proteins and enzymes (such as neurotoxin, hemolysis, cardiotoxin, nucleotidase) within the venom, which can cause tissue damage (Basoglu and Baran, 1980). Neutrophils are the first inflammatory cells to respond to site of inflammation in this process. Even though they are short-lived, their production is increased in the bone marrow and they move into the region of the inflammation joining the circulation in about 1 h (Altenburg et al., 1995). In addition to this response, progressive anemia, leukocytosis, thrombocytopenia, hypofibrinogenemia, disturbances in coagulation tests, and proteinuria, azotemia occur in snake bites (Currie et al., 1991; Gökel et al., 1997; Okur et al., 2001a; Spiller and Bosse, 2003).

The neutrophil/lymphocyte ratio (NLR) measured in the blood has recently gained popularity since it is a practical method that is easy to measure. It provides valuable information for the determination of the diagnosis and prognosis of various diseases. NLR has been used in many cardiac and non-cardiac diseases as an indicator of inflammation (Azab et al., 2012). However, to the best of our literature search, no study has documented the NLR as a predictor of the complication and severity of patients with snake bites.

In this study, we aimed to investigate the relationship between NLR increase with the development of complications and duration of hospital stay in patients with snakebite.

2. Materials and methods

2.1. Methods

In this study, the medical records of the patients with snake bite complaints that applied to a tertiary care university hospital between 2011 and 2014 were retrospectively reviewed. The patients who were admitted for less than 6 h after bite were included in the study. The local ethics committee approved the study. The controls group compromised with age, and gender matched healthy subjects who were admitted to outpatient clinic. Patients who failed to fully conform to the information from the hospital records system; patients under 18 years of age; who had disease that may affect neutrophil and lymphocyte count such as diabetes mellitus, hypertension, had a history of chronic use of steroid or other medications, who develop an allergic reaction; with identified systemic infection; with active cancer, acute coronary syndrome, congestive heart failure, chronic obstructive pulmonary disease exacerbation period, and any chronic inflammatory disease were excluded. These patients were examined using their previous laboratory results, bite areas pictures, geographic location, and analysis of complications that developed during the hospitalization. The application of the patients; the third day and pre-discharge neutrophil, lymphocyte, and platelet counts, urea, creatinine, albumin, aspartate trans aminase (AST) ratio; the patient's NLR at admission (NLR1); NLR on the third day of the hospitalization (NLR2); and NLR on the day when the patient was discharged (NLR3) were recorded.

2.2. Statistical analysis

For statistical evaluations "Statistical Package for the Social Sciences 18" program (SPSS Inc., Chicago, IL, USA) was used. The Student's *t*-test and paired samples *t* test were used for the statistical analysis if the data were normally distributed, otherwise the non-parametric Mann Whitney *U*, and Wilcoxon's test were used. Chi-square test was performed for categorical comparisons. A *p* value less than 0.05 was accepted as statistically significant.

3. Results

Two hundred fourteen participants were included in the study. The demographics of the study population are given in Table 1.