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Evaluation of snake bites at an emergency department

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Abstract

This study aimed to explore the epidemiology, clinical stage, treatment modality, complications and prognosis of cases presenting to the emergency department with a complaint of snakebite. Snakebite patients admitted to the emergency department between January 2012 and January 2021 were analyzed retrospectively. We retrieved epidemiological-demographic data of patients, procedures carried out in the emergency room, biochemical tests, final outcomes of inpatients, treatments administered during hospitalization, and complications. A total of 123 snakebite cases were detected in the emergency department medical records from this period. 16 cases were excluded from the study, and the remaining 107 cases were examined retrospectively. 15.9% (n=17) of snakebite cases were categorized as stage 0. Local symptoms were observed in all stages, except for five patients; systemic complications were observed only in advanced stages. The most common local complication was pain (n=99, 91.6%), while the systemic complication rate was 8.4% (n=9)Antivenom therapy was not administered to 14 (13.1%) patients, but it was applied to a total of 93 (86.9%) patients, with 74 (69.9%) receiving it in our center and 19 (17.8%) in external health centers. Antibiotherapy was administered to 93 (96.6%) of the patients, immobilization to 42 (39.3%), erythrocyte suspension to 1 (0.9%), fresh frozen plasma to 2 (1.8%), and 1 (0.9%) fasciotomy. No adverse outcomes were observed at 6-month or 1-year follow-up. Complications should be evaluated based on the type of toxin and clinical stage, and then appropriate treatment should be commenced without any delay. This approach should reduce or prevent the development of complications.

Keywords: Complications, snakebite, treatment

Introduction

Snakebite is a very serious and widespread public health problem in tropical and subtropical regions. Of the 41 snake species currently found in Turkey, 28 are non-venomous and 13 are venomous snakes, with 10 of them belonging to the Viperidae family. The venom of such snakes is mostly hematotoxic, and rarely neurotoxic. This family can deliver large amounts of venom with hematotoxic effects. Snakebite cases can exhibit a broad clinical spectrum, ranging from mild and minor symptoms to systemic complications and death [1,2] The patient's clinical course depends on various factors; including the level, type, amount of toxin, location of the bite, and sensitivity of the individual. In order to facilitate the treatment and monitoring of snakebite cases, a grading system has been developed based on clinical evidence [2]. When treatment and care are arranged according to this grading system, complications occur very rarely or not at all. Our study, therefore, aimed to examine the epidemiology, clinical grading, treatment modeling, complications and prognosis of cases presenting to the emergency department with a complaint of snakebite.

Material and Methods

In this retrospective and single-center study, patients who were admitted to our emergency department and hospitalized due to snakebites were identified from the electronic patient database and patient charts between January 2012 and January 2021 were included. A total of 123 snakebite cases were found in the emergency department medical records and 16 patients were excluded from the study sample because 6 patients lacked data, 4 patients refused admission and 6 patients were referred to another hospital. The medical records of the remaining 107 patients were reviewed retrospectively (Figure 1). This study was approved by the Muğla Sıtkı Koçman University ethics committee (210051). All patients included in the study were evaluated in terms of gender, age, bite site, local and systemic complications, clinical stages (Table 1), as well as treatment choices and care outcomes [2].

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Table 1. Clinical grading, use of antivenom, and patient monitoring [2]

Level of poisoning	Clinical findings	Antivenom use	Monitoring
No poisoning **Stage 0**	Puncture wounds No local or systemic symptoms	None	**Discharged after 8 hours of monitoring**
Mild poisoning **Stage 1**	Minimal swelling around bite area or systemic symptoms. Normal lab findings (Normal platelet count) Systolic blood pressure >90 mmHg	None	Discharged after 12 hours of monitoring
Moderate poisoning **Stage 2**	Advanced local symptoms Pain, ecchymosis, prolonged PTT, Platelet Count<80000/µL, Systolic blood pressure >90mmHg	2 vials of antivenom are recommended depending on the severity of the poisoning.	Must be closely monitored in the proper unit.
Severe poisoning **Stage 3**	Advanced swelling, pain, necrosis, and bullouse lesions Prolonged PTT, Platelet Count <80.000/µL, Systolic blood pressure <80mmHg, Severe systemic symptoms and coagulopathies Bleeding (nose, gastrointestinal bleeding etc.)	4 or more vials of antivenom are recommended depending on the severity of the poisoning.	Must be closely monitored in ICU.

Laboratory findings are presented in Table 2. All cases were categorized by the clinical grading system and evaluated according to their clinical status, after which antivenom therapy was administered accordingly. Eligible patients were treated with European viper snake venom antiserum, provided by the Turkish Ministry of Health, either through intramuscular injection of 10 mL vial or slow intravenous infusion of 100mg/mL equine immunoglobulin, prepared in 100cc saline, for 60minutes. The research data were analyzed on the SPSS software package (version 21.0; SPSS Inc., Chicago, IL, USA).

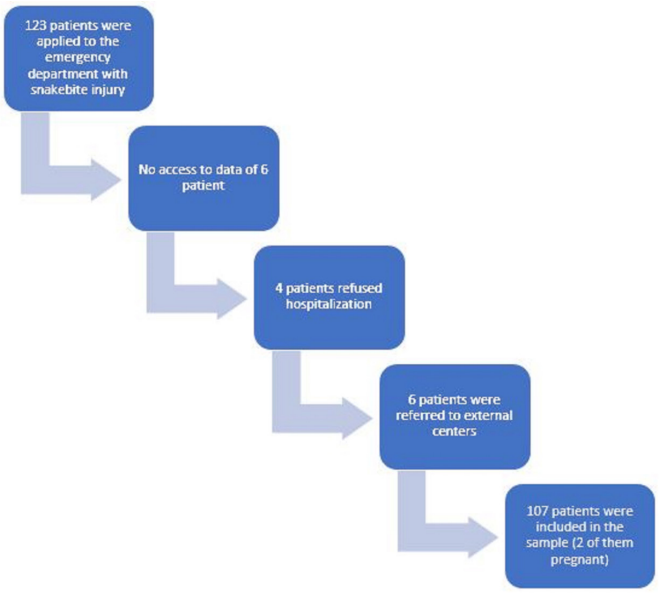

Figure 1. Must be 'Flow diagram patient exam section'

Results

The age of patients in the study sample ranged between 3 and 89 years, with 53 (49.5%) female and 54 (50.5%) male. The mean age of the patients was 44.87+2.11. The bite sites were as follows: 43 (40.2%) upper extremities, 63 (58.09%) lower extremities, and 1 torso. As our hospital is a regional training and research hospital, 69.2% of the patients presented directly to our emergency department, and only 30.8% were referred from health centers and clinics in the peripheral areas.

The clinical grading of the cases was as follows: 17 (15.9%) Stage 0; 66 (61.7%) Stage I; 22 (20.6%) Stage II, and 2 (1.8%) cases Stage III. Routine parameters were analyzed in laboratory tests. Serum glucose levels, alanine aminotransferase and aminotransferase activities, and sodium and potassium levels were normal. While increased white blood cell count (WBC >10.2x103/µL) was detected in 28 patients at hospital admission, leukocytosis was detected in 16 patients by tests conducted during patient monitoring. However, there was no significant relationship between WBC counts and clinical stages.

Except in five patients, local symptoms were observed in all stages, while systemic complications were observed only in advanced stages (Table 3,4). The most common local symptom was pain (n=99. 91.6%).

The erythrocyte suspension was administered to patients with hemoglobin values below 7.0g/dL and 20.8 hematocrit levels. Clinical stages of patients and respective treatments are listed in Table 5.

Antivenom therapy was not administered to 14 (13.1%) patients, although a total of 93 (86.9%) cases were given antivenom therapy, with the majority (n=74.69.9%) receiving it at our center and the rest (n=19.17.8%) in another center.

Antibiotherapy was administered to 93 (96.6%) of the patients, immobilization to 42 (39.3%) erythrocyte suspension to 1 (0.9%), fresh frozen plasma to 2 (1.8%) and fasciotomy to 1 (0.9%) of the patients.

Only two of the 107 cases were categorized as Stage III and transferred to the intensive care unit. Fifteen patients were monitored in the emergency room, and since no complications were observed and the bites were categorized as Stage 0, they were discharged after 6 hours of monitoring; 15 patients were discharged after 24 hours of monitoring, and 76 patients were discharged after 2-11 days of monitoring at various clinics because no permanent complication developed. Only one patient, who was referred from an external health center and didn't receive antivenom treatment in the early period died. Except for the death of this one patient (0.9%), no other death was observed during the one-year follow-up.

Table 2. Laboratory Findings of Patients

Laboratory tests	Mean±SD
White blood cell (x103/µL)	9.60±4.15
Hemoglobin (g/dL)	13.30±1.90
Hematocrit (%)	41.70±5.70
Platelet (x103/µL)	213.76±89.3
Glucose (mg/dl)	125.70±46
Blood urea nitrogen (mg/dL)	15.19±12
Creatinine (mg/dL)	0.77±0.46
Aspartate aminotransferase (U/L)	22.70±7.30
Alanine aminotransferase (U/L)	17.90±8.80
Sodium (Na) (mEq/L)	139.60±3.18
Potassium (K) (mEq/L)	4.18±0.50
Prothrombin time (PT) (s)	13.57±4.40
Partial thromboplastin time (PTT) (s)	25.80±5.10
International normalized ratio	1.12±0.50

Table 3. Local findings and clinical stages of patients

Complication	Number	%	Clinical stage
Pain	98	91.6	0-3
Erythema	60	56.1	1-3
Edema	84	78.5	1-3
Necrosis	2	1.2	1-3
Cellulitis	11	10.3	1-2

Table 4. Systemic complications and clinical stages of patients

Complication	Number	%	Clinical stage
Systemic findings	9	8.4	3
Abnormal PT, PTT, and INR	7	5.3	3
Anemia	6	4.5	3
Elevated BUN and Creatinine	5	3.7	2
Vomiting	3	2.2	2
Confusion	2	1.5	3
Compartment syndrome	2	1.5	3
Abnormal vital signs	2	1.5	3
Thrombocytopenia	1	0.7	3
Dyspnea	1	0.7	3

PT: Prothrombin time; PTT: Partial thromboplastin time; INR: International normalizedratio; BUN: Blood urea nitrogen

Table 5. Treatment options and clinical stages of patients

Treatment	Number	%	Clinical stage
Antibiotherapy	103	96.3	0-3
Tetanus prophylaxis	103	96.3	0-3
Snake antivenom	93	86.9	2-3
Immobilization	42	39.3	2-3
Fresh frozen plasma (FFP)	2	1.8	3
Erythrocytes suspension	1	0.9	3
Fasciotomy	1	0.9	3

Discussion

lthough the ratio of male and female patients in our study was close to 1:1, previous work in the relevant literature shows that this ratio is heavily biased towards the male gender, with the majority of snakebite cases consisting of men [1,2]. The balanced ratio in our study could be attributed to the fact that women constitute a large portion of the agricultural labor force in our region.

The effect of snake venoms varies depending on certain factors such as the bite site (the area of the body bitten), toxin sensitivity, severity, amount, physiological and pathological indicators. The most important of such factors appears to be the toxicity of the venom. Although the majority of previous research reports that 90-92% of snake bites occur in extremities, as in our study, snakebites in the head, neck and torso can prove to be the most dangerous ones [2,3].

Snake venom can cause various toxic effects in and around the bite site, local complications such as pain, redness, increased sensitivity, edema, and systemic complications such as fever and nausea. It can also result in vomiting, conjunctival hemorrhages, cerebral hematoma, compartment syndrome, heart failure, arrhythmias, acute renal failure, toxic shock, coma, and ultimately death [4]. While the rate of systemic complications was 8.4% in our study, Cesaretli Y, Ozkan O. [4] reported a much higher incidence at 24.76% in their review of the clinical and epidemiological features of snakebites in Turkey between 1995 and 2004. This difference could be explained by the widespread and timely use of antivenom therapy both in our hospital and other health centers in the peripheral areas, as well as increased awareness about the importance of presenting to emergency departments as soon as the snakebite occurs.

Patients are treated according to predetermined protocols; dry bites without toxic effects are categorized as Stage 0, and no antivenom is suggested, instead the patient is monitored in the emergency room. Antivenom therapy should be administered to patients with progressive local or systemic complications. Bites with predominant local symptoms without systemic signs and symptoms are called Stage I. Such patients can be discharged after antibiotherapy, tetanus vaccination, symptomatic treatment and monitoring.

Antivenom therapy is the main choice of treatment for patients with progressive local or systemic complications. A review of studies in the literature reveals that the incidence of antivenom therapy varies between 16-80% [1,5,6]. In our study, however, the rate of antivenom therapy administration was 86.9%. Besides the Stage 2 and Stage 3 cases, it was given to Stage 1 cases and patients with advanced local complications. No anaphylactic reaction was observed in our study after antivenom therapy. However, the study conducted by Şahan M. et al. in 2015 reported that 2 anaphylactic reactions occurred in their patients [3]. The rate of antivenom use was higher in our study than in other studies, probably because patients were often referred to our hospital after they had been given antivenom therapy at external health centers

and patients directly presented to our hospital once they developed advanced local complications due to more prevalent forest village life-style in our region with subtropical climate, at a much higher rate than the average of Turkey. In our study, we found the rate of all local and systemic complications at around 22.5%, which is in agreement with previous research, where this rate varies between 20% and 75% [1,5,7-9].

Snake venom is a toxic substance consisting of 70% water and leukotrienes, 30% protein substances, phospholipases, acetylcholinesterase, hyaluronidase, collagenase, antibacterials, neurotoxins, hemotoxins, anticoagulants, cardiotoxins, hemolytic factors, fibrinolytic enzymes, quinine, and histamine [10,11]. Toxins can cause a variety of systemic effects, including leukocytosis, thrombocytopenia, hypofibrinogenemia, bleeding disorders, proteinuria, and azotemia [5,12,13]. However, leukocytosis has been reported as a primary laboratory finding [5,14]. Although the number of patients with WBC >10.2x103/μL was 28, the clinical classification of these patients was determined as Stage 0 or Stage 1. However, there was no significant relationship between WBC counts and clinical severity.

A substantial portion of the neurotoxic and haemotoxic effects caused by the most common venomous snakes in Turkey [4] is associated with the Viperidae family. In this study, erythrocyte suspension was applied to only one patient due to anemia and fresh frozen plasma was applied to two patients due to bleeding diathesis. Daily checks of hemogram, PT, PTT and international normalized ratio (INR) in intensive care and follow-up visits at the ward can help prevent complications.

Patients should be evaluated according to their stage and treated based on clinical evidence. Those graded as Stage 0 or Stage I can be discharged if no systemic complications develop after 12 hours of monitoring [2,15-17]. In our sample, 17 cases were Stage 0, but 2 of them were hospitalized given that they were pregnant, and 15 (14%) cases were discharged after 6-12 hours of monitoring. A total of 4 cases (2 cases graded as Stage 0 and 2 cases graded as Stage 1) were hospitalized because they were pregnant. There is no previous research to explore snakebites in pregnant women in the literature.

Reasons for death after snakebites often include inadequate first aid, insufficient monitoring, and hesitation to accept antivenom treatment. According to the World Health Organization, approximately 35.000-50.000 people die from snakebites in the world each year [2] .

In this study, 76.7% of the cases were hospitalized in the appropriate clinic and 7.5% in the intensive care unit. One of our cases (0.9%) died in the emergency department, but all of the remaining patients were discharged after full recovery.

Limitations of the Study

This study has some limitations. İt is a retrospective study with a relatively small sample size.The time it takes the patients to reach this hospital was not measured. However, our study was not designed specifically to address this issue.

Conclusion

In cases of snakebite, interventions by those lacking necessary training and experience should be avoided, and emergency department presentation should not be delayed. Even if the patient is graded as Stage 0, they should be kept under observation for at least 8 hours. Antivenom therapy should be started without delay in patients with indications. Complications caused by the toxins of snake venom should be evaluated and appropriate treatment should be applied effectively according to the stage of the snakebite. Patients should also be followed up through daily hemogram and bleeding diathesis tests. We believe that this approach can prevent or reduce the development of complications.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
This study was approved by the Muğla Sıtkı Koçman University ethics committee (210051).

References

1. Karakus A, Zeren C, Celik MM, et al. A 5-year retrospective evaluation of snakebite cases in Hatay, Turkey. Toxicol Ind Health. 2015;31:188–92.
2. Kara ME, Ay MO, Seğmen S, et al. Management of Snake Bites. Archives Med Rev J. 2014;23:272–92.
3. Şahan M, Duru M, Çalışkan K, et al. Snake Envenomation to the Face of A Child-Rare Case. Prague Med Report. 2015;116:314-20
4. Cesaretli Y, Ozkan O. Snakebites in Turkey: epidemiological and clinical aspects between the years 1995 and 2004. Rev Inst Med Trop Sao Paulo. 2010;52:215-20.
5. Sönmez BM, Yılmaz F, Yılmaz MS, et al. Clinical aspects and emergent management of snake bites presented to Emergency department. J Clin Anal Med. 2015;6:558–61.
6. Moreno E, Queiroz-Andrade M, Lira-da-Silva RM, et al. Clinical and epidemiological characteristics of snakebites in Rio Branco, Acre. [Article in Portuguese] Rev Soc Bras Med Trop. 2005;38:15–21.
7. Açıkalın A, Gökel Y, Kuvandik G, et al. The efficacy of low-dose antivenom therapy on morbidity and mortality in snakebite cases. Am J Emerg Med. 2008;26:402–7.
8. Jenkins JL, Break GR. Manual of emergency medicine. Philadelphia, PA: Lippincott Williams Wilkins; 2000:467-69.
9. Satar S, Karcıoglu O, Sebe A. An Unusual Localization of Snakebite Treated without Antivenin: Case Report. Mount Sinai J Medi. 2005;72:116–9.
10. Koh DC, Armugam A, Jeyaseelan K. Snake venom components and their applications in biomedicine. Cell Mol Life Sci. 2006;63:3030–41.
11. Ouyang C, Teng CM, Huang TF. Characterization of snake venom components acting on blood coagulation and platelet function. Toxicon. 1992;30:945–66.
12. Gökel Y, Başlamışlı F, Koçak R. Bites in Çukurova region. Journal of Çukurova University Faculty of Medicine. 1997;22:184–8.
13. Gundappa RK, Sud K, Kohli HS, et al. Snakebite induced acute interstitial nephritis: report of a rare entity. Ren Fail. 2002;24:369–72.
14. Santoro ML, Sano-Martins IS, Fan HW, et al. Haematological evaluation of patients bitten by the jararaca, Bothrops jararaca, in Brazil. Toxicon. 2008;51:1440–8.
15. Johnston MA, Tullett WM. Adder (Vipera berus) bites: a case report and review of the management for emergency medical personnel. Arch Emerg Med. 1993;10:375–9.
16. Chang KP, Lai CS, Lin SD. Management of poisonous snake bites in southern Taiwan. Kaohsiung J Med Sci. 2007;23:511–8.
17. Köse R. The management of snake envenomation: evaluation of twenty one snake bite cases. [Article in Turkish] Ulus Travma Acil Cerrahi Derg. 2007;13:307–12.