Epidemiological and Clinical Investigation of Snake Bite Cases Admitted to the Emergency Department of a Tertiary Hospital in Izmir

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Abstract

Objectives: There are more than 3000 snake species in the world, about 30% of which are known to be venomous. Snake poisoning can cause serious mortality and morbidity. In this study, it was aimed to investigate epidemiologically and clinically the snake bite cases admitted to the emergency department of a tertiary hospital in Izmir.

Materials and Methods: Patients who applied to our emergency department with the complaint of snake bite between 2012 and 2022 were included in the retrospective observational study. The data of the patients were obtained by scanning the hospital electronic database. Vital signs, laboratory values, physical examination findings and outcomes of the patients were evaluated.

Results: Of the 52 patients, 42.3% were female and 57.7% were male, with a mean age of 48±16 years. It was seen that the most cases occurred in the summer season and only 1 patient died in total. Snake bite was seen on extremity in 41 (78.8%) patients while 11 (21.2%) had non-extremity bites. There was a statistically significant difference in creatine kinase (CK) value, K value, local edema and diffuse edema incidence between the two groups according to the bite site.

Conclusions: Higher CK, lower K level and more local and diffuse edema are seen in extremity bites compared to non-extremity bites.

Keywords: Snake bite, poisoning, environmental emergencies, emergency service.

Introduction

Poisoning due to snake bites is an important health problem all over the world. According to the World Health Organization (WHO), more than 5 million snake bites occur worldwide each year, with approximately 2.5 million poisonings and 81,000 to 138,000 deaths[1]. Approximately 30% of the 3000 snake species worldwide are venomous and considered dangerous to humans[2,3]. The most venomous species are grouped as Elapidae, Viperidae, Hydrophiida, Antractaspidida and Colubridae[4].

Of the snake species 41 are known in our country. 13 of these snakes are venomous. Of these venomous species, 10 are Viperidae (Vipers), 2 are Colubridae and one species is Elapidae. The Viperidae (viper) family is responsible for almost all of the snake bite cases in our country. The viper mostly causes hematotoxic effects, as well as local poisoning findings, necrosis in the skin and deep tissues[5]. Snake bites in Turkey are mostly seen in our Southern and Southeastern Anatolian region and especially in summer[6]. In addition, it is known that snake bites are mostly in the form of biting from the lower extremities[7]. It is known that correct and timely first aid and an effective treatment reduce the death rate, since snake venom can cause widespread effects on the bitten area and then on the whole body[8].

The first place of application for snake bites is emergency services and they cause serious poisoning that can result in mortality. For this reason, it is one of the diseases that must be managed well from the moment of admission to the emergency room. In this study, it was aimed to investigate the epidemiological and clinical features of snake bite cases admitted to the emergency department of a tertiary hospital in Izmir.

Methods

Study Design

This observational retrospective study was conducted between January 2012 and January 2022 in the emergency department of a tertiary university hospital. Vital signs and laboratory parameters of patients diagnosed with snake bite were analyzed. The patients were divided into 2 groups as with extremity and non-extremity bites. The 2 groups were compared in terms of vital signs, laboratory parameters, symptoms and outcome.

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Patients and Setting

Patients over the age of 18 who applied to the emergency department and were diagnosed with snake bite were included in the study. Patients whose results could not be reached, patients with missing data, pregnant women and those referred to an external center were excluded from the study.

Data Collection

The data of the patients included in the study were collected through the hospital information system and the vital parameters, demographic data and laboratory test results of the patients were recorded in the patient forms created to be used in the statistical analysis. The information about the exitus and discharge of the patients who were followed up for snake bites were noted. The obtained data were analyzed and compared between the 2 groups.

Statistical Analysis

SPPS 20 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) statistical package program was used to evaluate the data. Mean ± standard deviation and Median (25% and 75% quartiles) percentage and frequency values were calculated for the variables. In addition, the homogeneity of the variances, which is one of the prerequisites of the parametric tests, was checked with the Levene test. Normality assumption was checked with the "Shapiro-Wilk" test. When it is desired to evaluate the differences between the two groups, "Student's t Test" if the parametric test prerequisites are met; if not, the "Mann Whitney-U test" was used. The relationship between two continuous variables was evaluated with the Pearson Correlation Coefficient, and if the parametric test prerequisites were not met, the Spearman Correlation Coefficient. The performance of a test can be defined by the test's diagnostic adequacy or its capacity to correctly classify cases into subgroups (healthy/patient etc.). Statistical significance level was accepted as $p < 0.05$ and $p < 0.001$.

Results

Between January 2012 and January 2022, 107 patients who applied to our emergency department and were diagnosed with snake bite were identified and 52 patients who met the criteria were included in the study. Exclusion criteria for the study are shown in the consult diagram (Figure 1).

A total of 52 patients were included in the study. Of these patients 22 (42.3%) were female and 30 (57.7%) were male and their mean age was 48±16. When the patients were divided into 2 groups according to the site of the snake bite, 41 (78.8%) patients were bitten from the extremity area, while 11 (21.2%) patients were bitten from the non-extremity area. Exitus developed in 1 (1.9%) patient and 51 (98.1%) patients were discharged. Descriptive statistics of the patients are presented in Table 1.
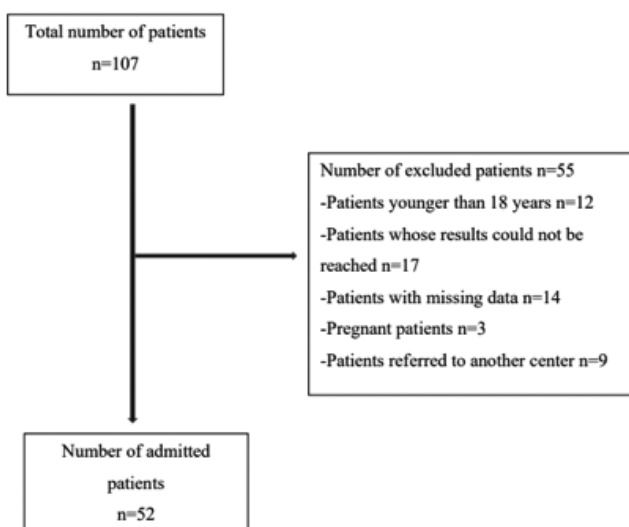

Figure 1: Consult diagram

Table 1: Descriptive statistics of patients

Location of the bite	Non-extremity	11(21.2)
	Extremity	41(78.8)
Tetanus vaccine	No	32(61.5)
	Yes	20(38.5)
Antivenom	No	27(51.9)
	Yes	25(48.1)
Analgesia	No	40(76.9)
	Yes	12(23.1)
Antibiotherapy	No	34(65.4)
	Yes	18(34.6)
Steroid	No	37(71.2)
	Yes	15(28.8)
Outcome	Ex	1(1.9)
	Discharge	51(98.1)

When the Creatine kinase (CK) and potassium (K) values of the patients were compared according to the bite sites, it was observed that the CK and K levels were statistically significantly higher in extremity bites (p<0.05). The comparison of the vital signs and laboratory results of the groups according to the snake bite site is presented in Table 2.

When the patients were compared in terms of the development of local edema, diffuse edema and systemic findings according to the bite sites, it was found that local edema and diffuse body edema were significantly more common in extremity bites (p=0.001, p=0.002 respectively). Considering the rate of development of systemic findings, it was seen that systemic findings developed only in 2 patients with non-extremity bites, and systemic findings did not develop in any of the extremity bites. These results show that there is no statistically significant difference between the groups (p=0.212) (Table 3).

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Table 2: Comparison of vital signs and laboratory results of both groups and total patients

	Non-extremity (n = 11)	Extremity (n = 41)	Total (n = 52)	P
SBP	117 ± 15	120 ± 16	120 ± 16	.655
DBP	83 ± 8	76 ± 12	77 ± 12	.083
Pulse rate	78 ± 8	81 ± 9	81 ± 9	.269
WBC	12 ± 4	12 ± 5	12 ± 5	.831
Neutrophil	9 ± 5	10 ± 5	10 ± 5	.663
Lymphocyte	1.3 ± 0.9	1.50 ± 1.08	1.50 ± 1.05	.519
Platelet	215000 ± 91000	196000 ± 82000	200000 ± 83000	.496
INR	1.04±0.11	1.10 ± 0.19	1.09 ± 0.18	.300
APTT	26 ± 4	30 ± 8	29 ± 8	.130
Creatine (mg/dl)	0.84 ± 0.13	0.81 ± 0.16	0.82 ± 0.15	.577
CK (U/L)	61 ± 28	374 ± 458	308 ± 425	.029
K (mmol/L)	4.50 ± 0.48	4.13 ± 0.52	4.21 ± 0.53	.038

SBP: Systolic blood pressure, SBP:diastolic blood pressure, WBC:White blood cell, INR :international normalized ratio, APTT :activated partial thromboplastin time, CK: creatine kinase, K: potassium

**Table 3:** Development of local edema, diffuse edema and systemic findings according to the bite site

		Bite location		P
		Non-extremity	Extremity	
Local edema	No	10 (90.9%)	12 (29.3%)	
	Yes	1 (9.1%)	29 (70.7%)	**.001**
	Total	11(100%)	41(100%)	
Comman edema	No	10 (90.9%)	16(39%)	
	Yes	1 (9.1%)	25(61%)	**.002**
	Total	11(100%)	41(100%)	
Systemic findings	No	9 (81.8%)	41(100%)	
	Yes	2 (18.2%)	0(0%)	**.212**
	Total	11(100%)	41(100%)	

Considering the months in which snake bites occur during the year, it is seen that there is an increase in the number of cases in the 7th, 8th and 9th months of the year. The distribution of the number of cases by months is presented in Figure 2.

Discussion

In this study, snake bites seen in the Izmir region were evaluated, and the majority of the cases were seen in the summer season. Extremity bites, on the other hand, were associated with the development of local and diffuse edema, and elevated CK and K levels.

It is known that snake venom can prolong thrombocytopenia, leukocytosis, prothrombin time and partial thromboplastin time with its procoagulant effect, and it has been reported that these laboratory changes are associated with poor prognosis and mortality[9]. In a study by
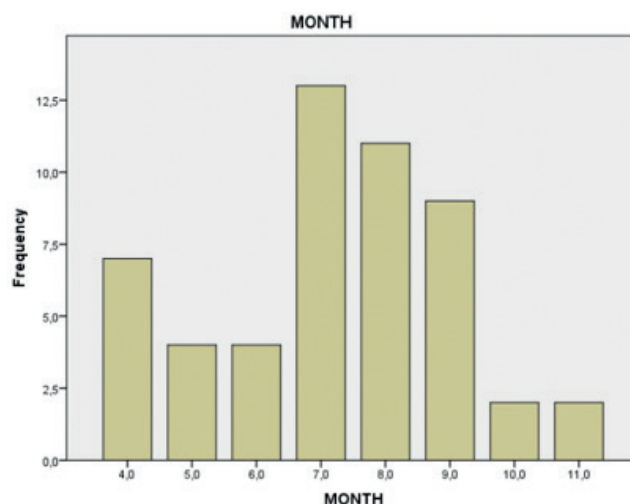
Figure 2: Distribution of the number of cases by months.

Gutiérrez et al., it was reported that there was an increase in White blood cell (WBC) count and neutrophil values, which indicate the inflammatory response, due to snake bite[10]. Oto et al. In their study, in which they aimed to present the clinical course, complications and treatment approaches of the patients, the platelet value was found within the reference values determined for normal population, and the results are compatible with our study[11]. Moon et al. In a study conducted by international normalized ratio (INR) and activated partial thromboplastin time (APTT), it was stated that there may be a prolongation in snake bite[12]. In this study, it was observed that there was an increase in WBC and neutrophil values due to snake bite, in accordance with the literature, and there was no significant change in PLT, INR and APTT values, contrary to the literature. The absence of coagulopathy findings in our study may be related to regional snake venom characteristics. However, there are not enough studies on this subject in the Izmir region. It is known that there may be an increase in serum CK, K, and myoglobin in snake bites due to rhabdomyolysis[13]. In this study, snake bite was found not to be associated with an increase in K, but was associated with an increase in CK. In addition, when we classify the patients according to the bite sites, it is seen that CK and K levels are significantly higher in extremity bites than in trunk bites. Considering that the reason for the increase in CK and K is rhabdomyolysis, the denser muscle tissue of the extremities and the thinner subcutaneous fat tissue in the extremities compared to the trunk may explain this difference. The clinical effects of snake bites can range from mild local reactions to life-threatening systemic reactions. Local tissue edema may occur as a result of the direct effect of the toxin on the tissues and the pressure during the bite[14]. In our study, when local edema and diffuse edema development were compared between bites with and without extremities, it was seen that both local edema and diffuse body edema were more common in bites in the extremities. In addition, it was observed that systemic

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findings developed in only two patients with trunk bite and no systemic findings developed in any extremity bite. Early treatment and antivenom applications are closely related to survival[15]. In addition to antivenom therapy, tetanus prophylaxis, antibiotic therapy, extremity elevation and rest splint are recommended for snake bites[16]. In recent studies, antibiotics are recommended instead of routine antibiotics in cases such as tissue necrosis, bullae, abscess development in the bitten area, and inappropriate first aid intervention (such as incision, suction)[17,18]. Antivenom was administered to 48.1% of our patients, and all of these patients survived. In the study, it is seen that antivenom treatment was not applied to the only patient who died. Antibiotherapy was administered to 34.6% of the patients in our study, which is consistent with the literature recommendations. It is known that snake bites occur mostly in the summer period[6]. In this study, snake bites occurred at a much higher rate in July, August and September compared to other months. This situation can be explained by the increase in the number of workers working in the rural areas during the summer months and the increase in the possibility of encountering snakes.

This study has certain limitations. The primary limitation of the study is that it was single-centered and carried out with a small number of patients. In addition, due to the retrospective nature of the study, some inaccessible data could not be evaluated. Prospective studies with a larger patient population are needed.

Conclusion

Our study is, to our knowledge, the first to compare snake bites with and without limbs. Local edema and diffuse edema are more common in bites from the extremity. Bites from the extremities have a higher CK value and a lower K value. There is a need for multicenter studies with more patients on this subject.

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