Original Article

Patients with Arthropod Bites and Stings Presenting to the Emergency Department: Clinical Features and Burden on the Emergency Department

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Abstract

Background: There are few studies analyzing the epidemiological characteristics and clinical features of arthropod bites and stings, emergency department (ED) admission rate and cost burden. This study aimed to evaluate the clinical features and ED burden of such cases.

Methods: We retrospectively analyzed 954 patients who presented to ED after exposure to arthropods. The demographic and clinical characteristics, treatment rates, consultation and hospitalization requirements, and costs were evaluated.

Results: The rate of presentation to the ED after exposure to arthropods was 0.36%. Among the identifiable insects, 25%, 22%, 5%, 3% and 1% patients were exposed to bees, ticks, scorpions, spiders, and centipedes, respectively. Of the included patients, 51% were male and the mean age was 39.4±14.8 years. Exposure to arthropods was most commonly seen in the summers (45%). Local and systemic toxicities developed in 11% and 1% of patients, respectively. Further examinations were requested in 50% of cases and 83% of cases received treatment. 4% of cases were hospitalized, and 21% were prescribed medicines.. The average cost per patient of exposure to spiders, scorpions, centipedes, ticks and bees were 45.5, 28.3, 17.3, 12.6, and 10.1 US Dollars, respectively. The total cost of ED for all patients was calculated as $12,694.65.

Conclusion: We believe that a better understanding of the characteristics and prevalence of arthropod bites and stings will have a positive impact on primary prevention, health resource planning and reducing the burden on EDs by improving people's knowledge and practices to reduce the incidence of bites and stings.

Keywords: Bee; Cost; Emergency department; Tick; Toxicity

Introduction

Patients with injuries, disabilities, and deaths caused by contact with animals commonly present to the emergency department and are serious public health problems (1). Arthropods forms the largest part of the animal kingdom. The classes Insecta (including lice, fleas, bedbugs, flies, bees and mosquitoes), Arachnida (including spiders, scorpions, ticks and mites) and Chilopoda (centipedes) are responsible for high morbidity and mortality worldwide (2). The prevalence of venomous bites and stings from arthropods varies regionally. The rate of bites and stings among all poisoning cases has been reported to be 2.1% and 1.8% according to the American Poison Control Centers National Poison Data System Report 2015 and 2008 National Poison Advisory Center report, respectively (3, 4). Although most people fear snakebites, insect bites have a relatively high mortality rate. In the United States of America (USA), only 4–5 people succumb to snakebites, whereas more than 300 deaths are caused by bee stings (5). Bite and sting exposure may initially appear benign but may cause local and

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systemic clinical effects, anaphylaxis, tissue damage and even death (6). Some arthropods can cause vector-borne diseases by infecting humans (7).

In addition to increased morbidity and mortality, animal-related injuries cause financial loss. However, there is limited research on the cost incurred upon visiting the emergency department after experiencing arthropod bites and stings. In the US, an average of 1 million emergency department visits, approximately 50,000 hospitalizations and an estimated annual cost of 2 billion dollars are reported due to non-canine bite and sting injuries (1,8).

Only case reports and few regional studies are available on arthropod exposure. In Turkey, very little is known about the specific types of bites and stings, their epidemiological characteristics, the prevalence of emergency department visits, clinical features and the consequent cost burden to the emergency department and few studies have been conducted on this subject.

Therefore, this study aimed to evaluate the epidemiological and clinical characteristics [presence of local (itching, erythema-redness, swelling and pain) and systemic toxicity findings (abnormal vital signs and systemic complaints accompanying local findings and abnormal laboratory findings), need for symptomatic treatment including adrenaline and hospitalization of patients after exposure] of the commonly seen arthropod bites and stings, the affected population and the burden on the emergency department of a tertiary education and research hospital.

Materials and Methods

Study Design

This was a descriptive and retrospective study that analyzed the clinical and epidemiological characteristics of arthropod bites and stings. Patients aged 18 years and older who were exposed to bites and stings of specific arthropod species (spiders, scorpions, bees, ticks, centipedes, and other insects) and admitted to the Adult Emergency Department of Mersin University Medical Faculty Hospital in Mersin province (87% of the province's surface area is mountainous and 54% is forested). It is located between 36–37° north latitude and 33–35° east longitude. The land border of the province is 608 km, the sea border is 321 km and its surface area is 15.853 km^2 in the Mediterranean region of Turkey during 11.1.2017–11.30.2020 were included in the study. Patients with missing data and those who were suffering from snake bites, cat/dog bites, bites and stings of sea creatures and exposed to unknown creatures were excluded from the study (Fig. 1).

To analyze the specific arthropod species (scorpion, spider, bee, tick and centipede), these were categorized as “arthropods.” Flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects were classified as “other insects.” The information regarding the admission to the ED and examination results of patients with the International Classification of Diseases (ICD)-10 diagnosis codes “W57 (bite and sting by nonvenomous insects and arthropods),” “W59 (bite or crush by reptiles),” “T63 and subgroup (contact with snakes, reptiles, scorpions, spiders, arthropods, fish, marine animals, venomous animals)” were retrospectively reviewed from their hospital records and observation forms. The data regarding the cost incurred upon visiting the emergency department and during their examination, treatment, hospitalization and discharge were obtained from the finance section of the hospital information system. The classification of the insects to which the patients were exposed was based on the clinical signs and symptoms of the cases and the insect identified by the patients and their relatives.

The data regarding the type of insect to which the patient was exposed, demographic characteristics (age and gender), presence of comorbid diseases, clinical findings (local and systemic symptoms), request for further ex-

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aminations from the patients and the consequent test results (complete blood count, biochemistry, coagulation parameters, cardiac markers and imaging results), treatments administered in the emergency department (hydration, antihistamines, steroids, analgesics, antiemetics and adrenaline), need for consultation, patient outcome from the emergency department (hospitalization and discharge), prescription of medication, follow-up outpatient visit by the patient after discharge and the cost of each patient to the emergency department (4-year average US dollar exchange rate; 1 US dollar = 4.87 TL) were collected and analyzed. The presence of systemic findings, administration of adrenaline or antivenom, need for hospitalization and need for further tests (complete blood count, biochemistry, cardiac markers, coagulation parameters, and ECG tests ordered together) were defined as major adverse events.

The time of presentation was categorized as per the four different seasons.

The local findings described by the patients after exposure or as seen on examination were defined by the presence of itching, erythema-redness, swelling and pain; whereas, systemic findings were defined by the presence of abnormal vital signs and systemic complaints accompanying local findings and abnormal laboratory findings.

The burden of patients on the emergency department was determined according to the blood and imaging tests requested, presence of major adverse events, consultation, hospitalization rate and cost.

Statistical analysis

The Shapiro–Wilk test was used to check the conformity of the data to normal distribution. The Chi-square test was used to check the relationship between the categorical variables. The Z test was used to compare the differences between the two groups. The analysis of variance test was used to compare the averages according to insect types and Tukey test was used as a post-hoc test for pairwise comparison. $P< 0.05$ was considered statistically significant.

Results

A total of 954 patients who met the inclusion criteria were included in the study. The percentages of patients exposed to various arthropods are as follows: 1% centipede, 3% spider, 5% scorpion, 22% tick, 25% bee, and 44% other insects (flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects). Of the included patients, 51% were male and 49% were female. The patients were aged 18–86 years and their mean age was 39.4±14.8 years. It was observed that men (62%) were more affected by bee exposure than women, whereas women (54%) were more affected by exposure to other insects than men ($p= 0.005$, Table 1).

A statistically significant difference was found in the distribution of insect types according to the seasons ($p< 0.0001$). The highest and lowest numbers of admissions occurred in the summer (45%) and winter (6%) seasons, respectively. Scorpion exposure was highest in summer and lowest in winter (49%, 7%), spider exposure was highest in summer and lowest in winter (52%, 4%), bee exposure was highest in fall and lowest in spring (41%, 11%), tick exposure was highest in summer and lowest in winter (54%, 4%), centipede exposure was highest in fall (57%), and exposure to other insects was highest in summer and lowest in winter (46%, 5%), (Fig. 2).

Most patients did not develop any signs of toxicity after the exposure to arthropods (89%). Among patients who developed toxicity, the number of patients with local toxicity findings was significantly higher than those with systemic toxicity findings ($p< 0.0001$ and $p= 0.007$, respectively). The proportion of patients exhibiting systemic toxicity was 1%, which developed after the exposure to spiders, bees and other insects (Table 1, Fig. 3).

Although the presence of comorbidity (diabetes mellitus, hypertension, atherosclerotic cardiovascular disease, chronic pulmonary disease, and hyperlipidemia) was found to have no significant effect on the development of local and

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systemic toxicities (p= 0.276, p= 0.971, respectively), it was associated with more local toxicity development only in patients with tick exposure when the cases were differentiated according to the type of insects (p= 0.01).

Further examinations were requested in 50 % cases; it was observed that complete blood count and biochemistry tests were the most frequently ordered tests, followed by coagulation parameters and cardiac markers tests. Patients presenting after exposure to scorpion, spider and tick had high chances of undergoing further examination (Table 1). Electrocardiogramwas performed for 29% patients (n= 74).

A majority of the patients (83%) were treated in the emergency department. Corticosteroids and antihistamines were the most commonly used treatment modalities in 796 patients treated in the emergency department, followed by intravenous (IV) hydration and analgesics. Adrenaline and antiemetic administration were not significant (p= 0.068 and 0.556, respectively). IntravenousIV hydration was administered more commonly in cases of scorpion, bee and centipede exposure than in the other cases, while antihistamines and steroids were administered at a high rate in cases of exposure to bees and other insects. Both narcotic and non-narcotic analgesics were commonly administered in cases of scorpion exposure, whereas adrenaline was administered only in cases of exposure to bees and other insects (Table 2).

Regarding the need for consultation in the follow-up of the cases, it was observed that no consultation was requested in the cases of scorpion and centipede exposure. The rate of hospitalization for follow-up was higher in cases of scorpion and spider exposure. The highest rate of outpatient visits for post-discharge follow-up was observed in cases of spider and tick exposure. Prescriptions were issued more frequently in cases of bee exposure compared to other cases (Table 2).

The cost incurred for the patients who presented to the emergency department ranged from 3.3 to 414.8 US dollars. The mean cost per case was 13.3±23 US dollars (Table 2, Fig. 4), whereas the total cost for all patients included in the study was 12,694.65 US dollars.

There was a statistically significant relationship between the type of exposure and development of major adverse events (p< 0.0001). Major adverse events were most commonly seen in cases of tick, scorpion, spider and centipede exposure, respectively (Table 2).

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Table 1. Arthropod types and clinical features of patients admitted to the adult emergency department of Mersin University Hospital between November 2017–2020

	All arthropods	Scorpion	Spider	Hymenoptera*	Tick	Centipede	Other Insects[t]	P value
Age[a]	39.5±14.8	46.8±15.2	35.2±13.4	37.5±13.7	42.7±15.3	48.3±17	38±14.4	< 0.0001
Gender (Male)	490 (51%)	27 (60%)	12 (48%)	146 (62%)	103 (48%)	7 (50%)	195 (46%)	0.005
Toxicity Findings								
• **None**	850 (89%)	23 (51%)	14 (56%)	210 (89%)	209 (98%)	13 (93%)	381 (91%)	< 0.0001
• **Local**	102 (11%)	22 (49%)	11 (44%)	25 (11%)	5 (2%)	1 (7%)	38 (9%)	< 0.0001
• **Systemic**	10 (1%)	None	2 (8%)	6 (3%)	None	None	2 (0.5%)	0.007
Comorbidity	92 (10%)	6 (13%)	1 (4%)	15 (6%)	28 (13%)	4 (29%)	38 (9%)	0.038
Blood Tests	474 (50%)	43 (96%)	18 (72%)	45 (19%)	193 (90%)	10 (71%)	165 (39%)	< 0.0001
Complete Blood Count	468 (49%)	43 (96%)	18 (72%)	44 (19%)	190 (89%)	10 (71%)	163 (39%)	< 0.0001
Biochemical Profile	460 (48%)	43 (96%)	18 (72%)	43 (18%)	186 (86%)	10 (71%)	160 (38%)	< 0.0001
Cardiac Biomarkers	222 (23%)	37 (82%)	16 (64%)	13 (5%)	74 (34%)	9 (64%)	73 (17%)	< 0.0001
Coagulation Parameters	422 (44%)	42 (93%)	18 (72%)	19 (8%)	183 (85%)	10 (71%)	150 (36%)	< 0.0001
Imaging Studies	14 (1%)	1 (2%)	4 (16%)	1 (0.4%)	1 (0.5%)	1 (7%)	6 (1%)	0.002

*(Hymenoptera) refers to all bee species, as patients were often unable to distinguish between bee species, [t]: other insects refers to flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects, [a:] Mean ± Standard Deviation.

Table 2. Arthropod types and management of patients admitted to the adult emergency department of Mersin University Hospital between November 2017–2020

	All arthro-pods	Scorpion	Spider	Hymenoptera*	Tick	Centipede	Other Insects[t]	P Value
Treatment in ED	796 (83%)	43 (96%)	23 (92%)	224 (95%)	150 (70%)	14 (100%)	342 (82%)	**< 0.0001**
Iv hydration	386 (40%)	31 (69%)	13 (52%)	133 (57%)	30 (14%)	11 (79%)	168 (40%)	**< 0.0001**
Antihistamine	486 (51%)	20 (44%)	10 (40%)	193 (82%)	21 (10%)	11 (79%)	231 (55%)	**< 0.0001**
Corticosteroids	494 (52%)	22 (49%)	9 (36%)	186 (79%)	28 (13%)	9 (64%)	240 (57%)	**< 0.0001**
Analgesics	112 (12%)	21 (47%)	5 (20%)	27 (11%)	10 (5%)	2 (14%)	47 (11%)	**< 0.0001**
Narcotic Analgesics	4 (0.4%)	3 (7%)	None	None	None	None	1 (0.2%)	**0.008**
Antiemetic	15 (2%)	2 (4%)	None	3 (1%)	2 (0.9%)	None	8 (2%)	0.556
Adrenalin	6 (0.6%)	None	None	5 (2%)	None	None	1 (0.2%)	0.068
Consultation	16 (2%)	None	4 (16%)	6 (2%)	1 (0.5%)	None	5 (1%)	**0.003**
Hospitalization	39 (4%)	13 (29%)	10 (40%)	6 (2%)	2 (0.9%)	1 (7%)	7 (2%)	**< 0.0001**
MAE	219 (23%)	37 (17%)	16 (7%)	19 (9%)	64 (29%)	9 (4%)	74 (34%)	**< 0.0001**
Prescriptions	203 (21%)	11 (24%)	9 (36%)	62 (26%)	45 (21%)	5 (36%)	71 (17%)	**0.023**
Outpatient Clinic Application After Discharge	55 (6%)	None	5 (20%)	3 (1%)	35 (16%)	1 (7%)	11 (3%)	**< 0.0001**
Average Cost[a] (in US Dollar)	13.3±23	28.3±29.3	45.5±64.9	10.1±13.3	12.6±13.1	17.3±12.5	12±24.4	**< 0.0001**

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*(Hymenoptera) refers to all bee species, as patients were often unable to distinguish between bee species, [t]: other insects refer to flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects, MAE: the presence of systemic findings, administration of adrenaline or antivenom, need for hospitalization and need for further tests (complete blood count, biochemistry, cardiac markers, coagulation parameters, and ECG tests ordered together), [a:] Mean ± Standard Deviation

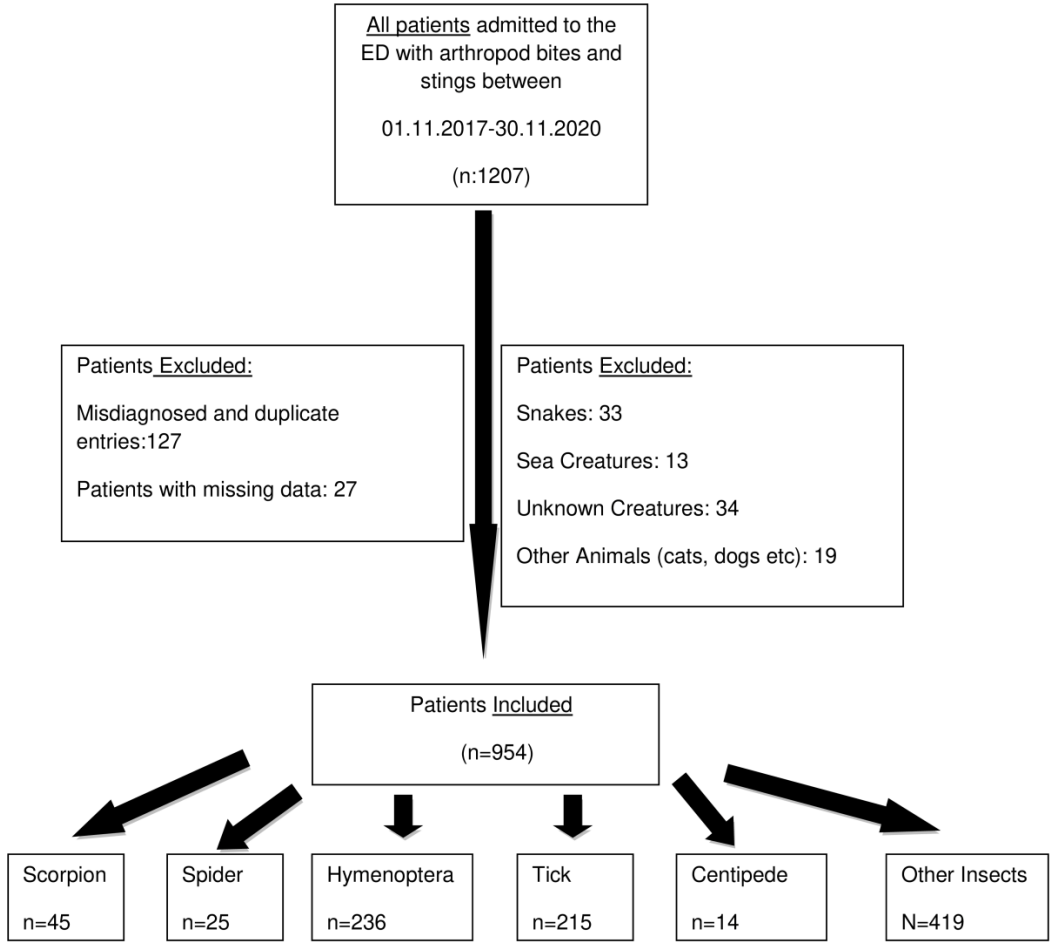

Fig. 1. Flow chart of patients admitted to the adult emergency department of Mersin University Hospital between November 2017–2020 (Other insects: Flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects)

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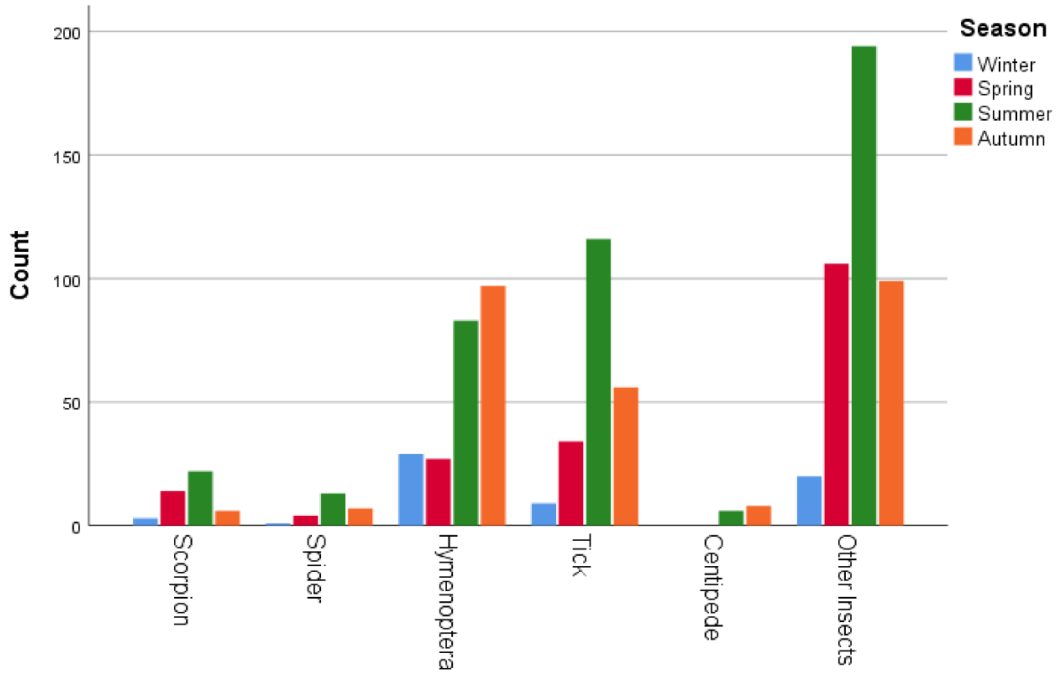

Fig. 2. Seasonal arthropod exposure of patients admitted to the adult emergency department of Mersin University Hospital between November 2017 and 2020 (Other insects: Flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects)

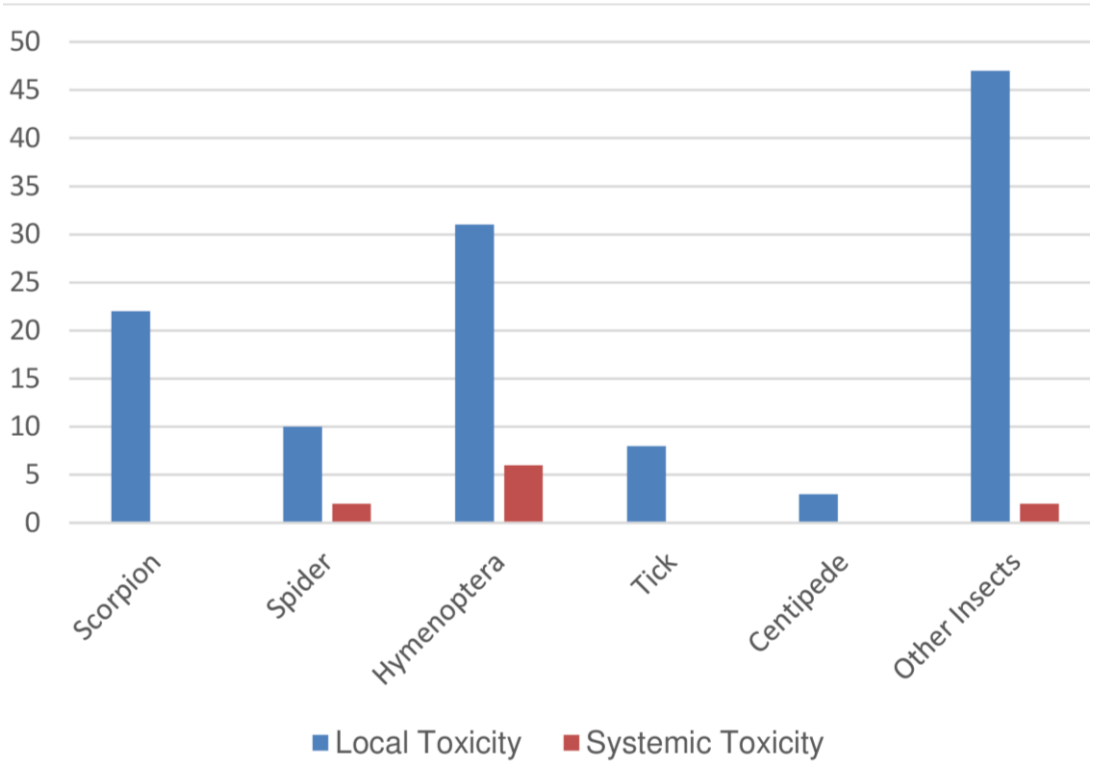

Fig. 3. Number of patients admitted to the adult emergency department of Mersin University Hospital with local/systemic toxicity by arthropod species between November 2017 and 2020 (Other insects: Flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects)

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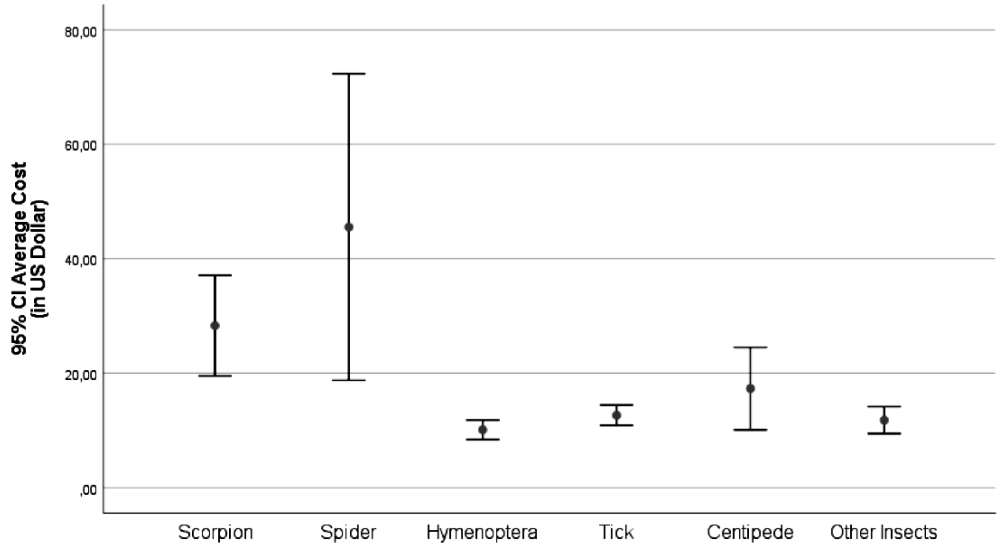

Fig. 4. Average cost per patient by arthropod species in Mersin University Hospital adult emergency department between November 2017 and 2020 (in US dollars) (Other insects: Flies, moths, ants, grasshoppers, fleas, bedbugs and unidentified insects

Discussion

Although arthropod bites and stings are common worldwide, their prevalence and clinical determinants have not been fully studied. We believe that several important findings of this study are worth emphasizing. In accord with the previous studies, our findings showed that bee stings were more common than spider bites and scorpion stings; however, unlike previous studies, tick bites were commonly seen in our study (2, 9). Second, in line with the previous studies, we found that the incidence rate of arthropod bites and stings were relatively high in the summers and in young people (1). Third, we found that most bite and sting cases (50%) required further investigations, most cases (83%) were treated in the emergency department and there were no mortal cases. Fourth, the total cost of treatment for all patients included in the study to the emergency department as USD 12,694.65. We observed that these cases were a considerable cost burden to the hospital and country. High cost of treatment was observed because important cost parameters such as examination, tests, treatment in the emergency department, hospitalization requirements, post-discharge prescription needs and outpatient clinic visits for control purposes were included in our analysis. Finally, we found the highest incidence rate of major adverse events in cases of exposure to tick, scorpion, spider and centipede.

The cases of arthropod bites and stings are underestimated in the health system, but they are a burden for the emergency departments. The national US data show that millions of people are treated annually in the emergency departments who present with injuries related to noncanine bites and stings (1). During this study, we found that bite and sting cases constituted 0.36% of all patients admitted to the emergency department and 0.28% patients included in the study. In a different study, these patients constituted 0.24% of all cases admitted to the emergency department (10). This rate differs among studies. It is not possible to calculate the exact incidence rate, as a considerable proportion of bites and stings, which are more common in rural areas, are treated at home using the traditional methods and these patients may not present to the emergency department. The variation in the types of arthropods due to

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regional differences may also have affected the rate of presentation of symptomatic cases.

Similar to our study, the cases of bee stings were more commonly encountered than the cases of spider bites and scorpion stings by the emergency department in the USA between 2010 and 2014 (9). In another study, the exposure to hymenoptera (bees and wasps) was found to be the most common among identifiable insects (2). We excluded 33 cases of snakebite in our study, but these cases were less common than cases of bee stings. Scorpion stings accounted for 5% cases that presented to the emergency department. The difference in the rates of exposure to arthropods may be due to the regional climatic characteristics and vegetation and socioeconomic and cultural variations in the population that affect the rate of emergency department visits. We think that the rate of bee and tick exposure in our study is higher because Turkey is one of the leading countries in the world in beekeeping, agriculture and animal husbandry are intensive especially in the Mediterranean region, and people socialize more in forested areas and picnic areas due to the geographical location of our province. Our results also supported the results of previous literature and showed that the risk of exposure to arthropods was the highest in the summer months (1).

The reason behind the low mean age group of patients included in our study (39.5±14.8) than a similar study conducted in the UK may be explained by the high proportion of young population in Turkey (10).

In an arthropod-based study conducted in northwest Sri Lanka, localized pain was observed in 56% cases, including 70% centipede cases, 60% scorpion cases, 59% spider cases, 52% hymenoptera cases and 45% patients with exposure to unidentified arthropods. In this study, local symptoms developed in 11% cases (2).

A history of comorbid disease was present in 92 patients. In two different studies (11, 12), it was observed that the severity of intoxication and clinical symptoms due to bites and stings varied depending on comorbid diseases such as diabetes and cardiovascular disease; however, no statistically significant difference was found in the occurrence of local or systemic toxicity in patients with and without comorbid diseases, which is in accord with the findings of this study. When the cases were categorized based on the type of insects, local toxicity was statistically more likely to occur in patients who were exposed to ticks than patients who were exposed to any other insects.

In a study conducted in the USA between 2008 and 2015, bee and wasp (Hymenoptera) stings were responsible for 478 deaths (13). In this study, adrenaline was administered to six patients (0.6%) with systemic toxicity, including five cases of bee sting and one case of exposure to other insects; hospitalization and follow-up were recommended to these patients. However, none of these patients died. We think that the early use of adrenaline as first-line treatment may be due to the development of abnormal vital signs such as hypotension, systemic symptoms and anaphylaxis. Similar to our study, a Sri Lanka-based study showed that the main factor responsible for anaphylaxis was hymenoptera bites and it did not report any fatal cases after arthropod exposure (2).

Abnormal laboratory test results in cases of arthropod bites and stings are crucial in patient management (14). Consistent with a previous study (15), blood tests were requested for 50% patients included in our study, which were mainly complete blood count, biochemistry profile and cardiac markers.

Providing supportive symptomatic treatment using analgesics, antiemetics and fluid resuscitation is a crucial general approach for treating bite and sting cases (11). Although corticosteroids and antihistamines are commonly prescribed in cases of bites and stings, there is very little scientific evidence supporting their efficacy (5). In this study, antihistamines and corticosteroids were the most commonly prescribed treatment modalities and their use was

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statistically significant. In a study investigating the cases of anaphylaxis related to insect stings encountered in the emergency departments, it was observed that antihistamines were the most commonly administered drugs (69%), followed by steroids (50%) (6). In our study, although local toxicity symptoms were more common in scorpion and spider exposures and systemic toxicity findings were more common in spider exposures than in bees, antihistamine and corticosteroid administration was highest in bee exposures. This may be related to the fact that physicians believe that symptoms of anaphylaxis are more likely to occur after a bee sting and should therefore provide symptomatic treatment. The use of paracetamol, nonsteroidal anti-inflammatory drugs and narcotic analgesics for pain relief was most common in scorpion exposures. This may be because local symptoms such as pain, swelling and redness are most common in scorpion exposures.

In a study examining noncanine bites and stings in the US emergency departments, it was observed that 1.8% patients were hospitalized (1). The high rate of hospitalization (4%) in our study may be explained by the fact that in addition to hospitalization, a group of patients who were kept under observation by the emergency physicians in the emergency department was included in the analysis.

Only few reports have estimated the cost of managing arthropod bites and stings, but the available estimates suggest that these cases are a significant economic burden. In a study on the treatment of arthropod bites and stings in the emergency department, the average cost per person during the entire study period was 850 US dollars (9), whereas the average cost in our study was 13.3±23 US dollars (based on a 4-year average US dollar exchange rate). In a study (16) examining animal injury-related admissions and hospitalizations in US emergency departments, it was found that the cost incurred in such cases was an average of 7,000 US dollars during their hospital stay. This study included equestrian accidents and animal exposures (such as poisonous reptiles, poisonous marine animals, dog bites, rat bites), which were excluded in this study and found that treating equestrian accidents and poisonous reptile exposures were one the costliest treatments that led to hospitalization. The lower average cost in our study compared to these studies may be explained by the high exchange rate of the US dollar in our country, injury types studied and the number of cases of arthropod exposure in other studies; additionally, it must be considered that most patients who presented to our emergency department had social health insurance. Our study excluded the cost incurred during hospitalization and the cost of prescriptions/medication prescribed after discharge, labor loss and repeated admissions and outpatient visits. In addition, the cost mentioned in the study excluded the loss of quality of life because of pain, cases kept in the emergency department for observation and patients leaving the emergency department untreated. The health costs associated with arthropod bites and stings are therefore likely to be underestimated.

Our study has several limitations. Since the study was a descriptive, retrospective, cross-sectional, and single-center study and included patients admitted in a specific period, the results are not fully representative of the general population. We could analyze only a limited amount of data as we screened only the patient records. The variation in the quality of the recorded data and differences in the individual coding, which depends on the health personnel recording the admission of cases, may have affected the results. Additionally, since ICD-10 coding makes it difficult to classify bite and sting exposures based on insect type, the identification of arthropod type, especially for non-hymenopteran exposures, was based on patient statements and clinical suspicion. This may be attributed to the high proportion of cases where the insect was unidentified (other insects) due to cases with missing data.

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Conclusion

We observed a considerable number of patients who were exposed to bees and ticks and admitted to our emergency department, which serves as a single center in a tertiary education and research hospital. The high rate of examination and treatment of patients with arthropod exposure was found to significantly increase the burden due to the emergency department admission, examination and treatment process, consultation and hospitalization, prescription, repeated emergency department visits and outpatient clinic controls. Better management of cases by taking a detailed anamnesis may help in reducing the burden on the emergency department. We believe that the data obtained in this study will be useful in defining the characteristics and prevalence of arthropod bites and stings in Turkey and will have positive effects on addressing the gaps in the epidemiological information, primary prevention, health resource planning and reducing the incidence of bites and stings by improving the knowledge and practices of people on this issue.

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None

Ethical considerations

The present study was performed upon the approval of the Clinical Research Ethics Committee, Mersin University Rectorate (dated 01/04/2023, No. 2023/15).

Conflict of interest statement

The authors declare that there is no conflict of interest.

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