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SCORPION STINGS AS A NEGLECTED HEALTH ISSUE IN LOWER DIR, PAKISTAN: A FIRST EPIDEMIOLOGICAL REPORT

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Abstract

Scorpionism is a major health issue in the tropics and subtropics of the world; this phenomenon accounts for around 1.2 million stings and 3250 deaths each year. Although Pakistan is a subtropical country heavily affected by scorpion stings, no previous study has examined scorpion stings in Lower Dir District. This study aimed to investigate, for the first time, the distribution and pattern of scorpion sting cases in District Dir Lower, Khyber Pakhtunkhwa, Pakistan. We conducted a cross-sectional analytical study across seven tehsils over 29 months. Data were collected retrospectively from health records and prospectively through structured online interviews and questionnaires, detailing demographic variables, circumstances of stinging, sting location, and clinical features. In total, 426 confirmed cases of scorpion stings were recorded. Women (57.3%) were affected more often than men (42.7%), and the most affected age group was 16-35 years. Most cases occurred at night or early morning (96.0%) and mostly in the summer months, when the number of cases was significantly related to temperature ($p < 0.00013$). The foot was the most affected body part, followed by the hand, and the victim's age was significantly associated with the sting site ($\chi^2 = 17.84$, $p = 0.007$). Most victims (93%) experienced only local signs of envenomation, and only 46 patients developed systemic symptoms, while only 9 patients experienced the most dangerous signs, including

tachycardia and respiratory problems. No fatalities were recorded. Munda tehsil had the highest number of sting cases (21.4%). Only 46% of the victims received medical treatment. Scorpion stings pose a significant health challenge in District Dir Lower, particularly for rural populations with poor access to healthcare. With limited access to medical facilities and antivenom in this rural region, public health initiatives must be improved.

Introduction

Scorpions are cosmopolitan organisms belonging to 22-23 families (Lourenco, 2018). About 2,937 scorpion species have been identified (Rein, 2012). Nevertheless, only about 30-50 medically important scorpion species exist because their potent venom can cause acute envenomation (Chowel et al., 2006).

Scorpion stings are a global health threat, particularly in tropical and subtropical areas. An estimated 1.2 million persons experience a scorpion sting yearly, leading to roughly 3250 fatalities (Ebrahimi et al., 2017). More than 2 billion people who live in high-risk regions may encounter scorpions, including northern Africa, the Sahel, Southern Africa, the Near and Middle East, Southern India, and the Eastern Andes, Mexico, and parts of South America (Chippaux and Goyffon, 2008). Climate change, rapid urbanisation, and poor waste management are other contributing factors in many endemic areas worldwide (Reckziegel et al., 2014).

The degree of toxicity and certain complications are determined by several factors, such as the type of scorpion, its age, size, feeding methods, number of stings delivered, quantity of venom, depth of the sting, type of venom, and the place of the sting (Bawaskar and Bawaskar, 1998). The victim's physiological response depends on the venom's characteristics, the victim's age and weight, and the effectiveness of treatment. Common symptoms of scorpion stings include nausea, vomiting, nystagmus, mydriasis, hypersalivation, dysphagia, and restlessness. Death is usually due to cardiac failure, respiratory failure, anaphylactic shock, bronchoconstriction, bronchorrhea, pharyngeal secretions, diaphragmatic paralysis, and multiple organ failure (Feola et al., 2020).

Only about one-third of all scorpion stings result in systemic envenomation, which is life-threatening without prompt medical intervention (Chippaux, 2012). Most cases of severe complications and human deaths can be avoided through public awareness and preventive measures. However, scorpion envenomation is largely ignored in many developing countries where these cases are frequently underreported (Kumar, 2012).

Since Pakistan is a subtropical country, it has a high rate of scorpion stings. However, little systematic research has addressed this issue nationwide. Specifically, no previous studies (no records in Cochrane Library, Google Scholar, LILACS, SCIELO, MEDLINE, PubMed, and PubMed Central) have examined cases of scorpion stings in Dir Lower. This study investigated scorpion sting incidents in Dir Lower for the first time.

Methodology

Study Area

Dir Lower is located in the northern region of Khyber Pakhtunkhwa province, Pakistan, covering an area of 1585 km^2 between the latitudes of 34°37' and 35°07' North and longitudes of 71°31' and 72°14' East (District Census Report, 1998). The present study was conducted in Lower Dir District, Khyber Pakhtunkhwa. All seven tehsils of the district, which include Balambat, Khal, Lal Qilla, Adenzai, Timergara, Samar Bagh, and Munda, were considered for the present study. Dir Lower has a hot, humid subtropical climate, specific mid-altitude topography, rich biodiversity, and a dense rural population.

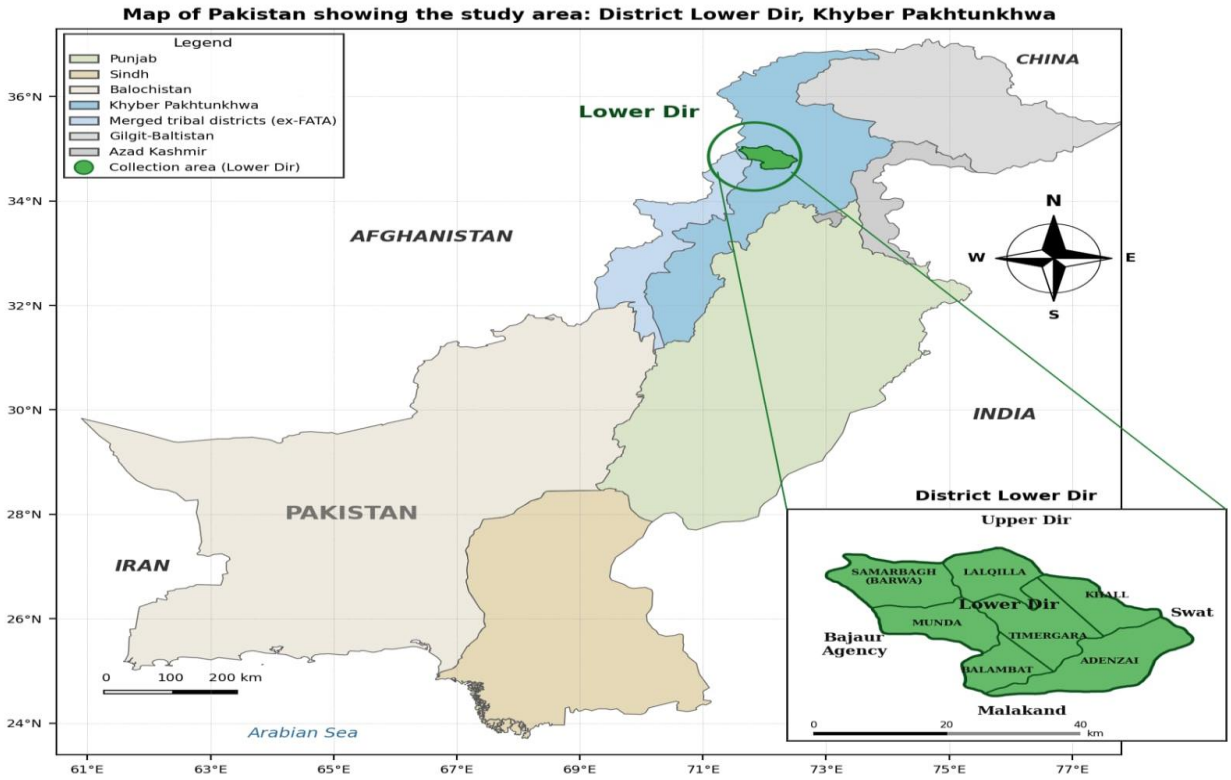


Figure 1: Map showing the study area

Study period

This study was conducted from March 2024 to July 2026.

Data collection

An analytical cross-sectional study design was utilized to evaluate the epidemiological characteristics of scorpion stings. Data were acquired retrospectively from healthcare facilities and prospectively through direct interviews with affected individuals (or their guardians for children), using a structured questionnaire. An online questionnaire through Google Sheets was also designed for the study population and Sampling. The questionnaire was designed to collect the following information: Full name, Gender, Age, Locality (tehsil), Date and time of the sting, Part of the body where the sting occurred, Symptoms experienced were divided into four groups as divided by, El-Aziz et al., 2019 and Al-Asmari and Al-Saif, 2004, i) No symptoms ii) localized symptoms like pain at the sting site, swelling, and redness, iii) systemic manifestations such as restlessness, nausea, sweating, and vomiting and iv) severe manifestations, including increased heart rate (tachycardia), salivation and difficulty breathing.

The target population included all individuals who experienced scorpion stings in the Dir Lower district. All Participants were grouped into three age groups: Group I: 1–15 years, Group II: 16–35 years, and Group III: >35 years. We focused on collecting valid data from parents of children under 15. We obtained consent from all participants before data collection began and ensured the confidentiality of private details.

Data Analysis

The collected data were initially processed in Microsoft Excel, where they were cleaned and organised. The statistical analysis was performed using appropriate software (SPSS version 26). Inferential statistics, such as chi-square tests for associations between variables, were used where appropriate. Data verification was performed by checking the original records and making follow-up calls to selected respondents to ensure accuracy.

Ethical Considerations

No human or animal model was used; however, the study followed ethical research principles. The study obtained approval from the relevant local health authorities. Participants were assured that their participation was voluntary and that they could withdraw at any time. All data were anonymised during analysis and reporting.

Results

During the study, 426 sting incidents (37 collected through a Google Sheets questionnaire) were recorded in Lower Dir District. The breakdown of sting cases shows that 182 (42.7%) were males and the remaining 244 (57.3%) were females. The chi-square test demonstrates that females are at greater risk than males in this region, as shown in Table 1. The data suggest that the majority of cases occur among people in the age group of 16-35 years (n = 183, 42.95%), followed by the age group of 36 years and above (n = 125, 29.34%), and lastly the age group of 1-15 years (n = 118, 27.7%).

Table 1. Distribution of sting cases by gender and age group.

Characteristic	Number of cases (n)	Percentage (%)
Gender		
Male	182	42.7
Female	244	57.3
Age group (years)		
1–15 (Group 1)	118	27.7
16–35 (Group 2)	183	43.0
Above 35 (Group 3)	125	29.3
Total	**426**	**100.0**

Chi-square test: $\chi^2 = 17.93$, df = 2, p = 0.00013 ($p < 0.001$)

Note: Percentages are calculated from the total of 426 stings. Chi-square is a goodness-of-fit test against equal distribution across the three age groups (expected count = 142 each).

More than half of the sting incidents showed seasonal trends, with most cases occurring during summer (May-July). Pearson correlation indicates that the number of sting cases is positively correlated with average temperature (Pearson's correlation coefficient = 0.77, $P < 0.00013$). Most incidents (n = 409, 96.0%) occur at night or early morning, and only 17 (4.0%) were recorded during the daytime.

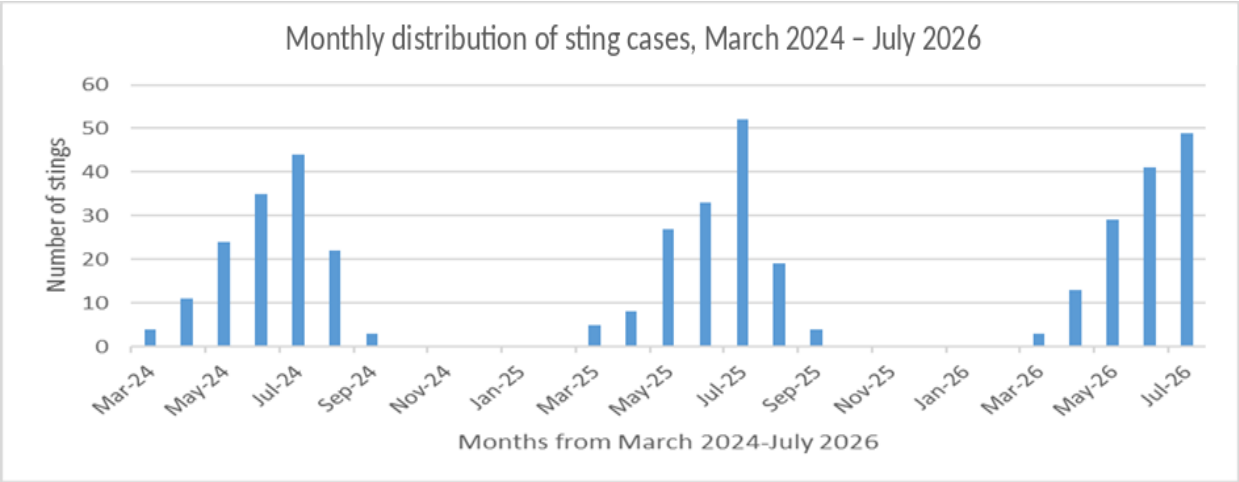


Figure 2: Number of stings in different months

In all age categories, the foot is the most common sting site, followed by the hand. The detailed age-group-wise distribution is shown in Table 2. Among the 1-15 years age group, 62 (52.5%) stings occurred on the foot and 55 (46.6%) on the hand, with just one case (0.8%) on other body sites, while no stings were reported on the head, back, or chest. In the 16-35 years old age group, 89 (48.6%) stings occurred in the foot, 58 (31.7%) occurred on the hand, 22 (12.0%) occurred on the back, and 14 (7.7%) on other sites; no stings were recorded on the head or chest. In the>35 years group, 54 (43.2%) occurrences were reported on the foot, 42 (33.6%) on the hand, 21 (16.8%) on the back, and 8 (6.4%) on other sites. The Pearson Chi-square test of independence found a significant association between age groups and sting site, Chi-square = 17.84, df = 6, p = 0.007.

Table 2. Distribution of sting sites by age group

Sting site	1–15 years n (%)	16–35 years n (%)	Above 35 years n (%)
Foot	62 (52.5)	89 (48.6)	54 (43.2)
Hand	55 (46.6)	58 (31.7)	42 (33.6)
Back	0 (0.0)	22 (12.0)	21 (16.8)
Head	0 (0.0)	0 (0.0)	0 (0.0)
Chest	0 (0.0)	0 (0.0)	0 (0.0)
Other sites	1 (0.8)	14 (7.7)	8 (6.4)
Total	**118 (100.0)**	**183 (100.0)**	**125 (100.0)**

Note: Values are the number of stings, n (%); percentages are calculated within each age group.

Among all the victims, around 28 (6.5%) exhibited no symptoms, while the others showed local symptoms such as soreness at the sting site, swelling, and redness. In addition, 46 people suffered from some systemic symptoms like uneasiness, nausea, sweating, and vomiting. In addition, 9 victims experienced acute symptoms, including increased pulse and difficulty breathing. No cases of full unconsciousness or death due to this matter were reported.

Table 3. Clinical presentation of sting victims

Clinical presentation	Number of patients (n)	Percentage (%)
No symptoms	28	6.6
Local symptoms (pain, swelling and redness at sting site)	398	93.4
Systemic symptoms (restlessness, nausea, sweating, vomiting)	46	10.8
Severe symptoms (tachycardia, salivation, difficulty breathing)	9	2.1
Unconsciousness or death	0	0.0

Note: Percentages are calculated from the total of 426 patients. Categories are not mutually exclusive, as patients with systemic or severe symptoms also had local symptoms, so percentages do not add up to 100%. Only 46% of those who experienced scorpion bites sought medical care, while others depended on spiritual healing methods. Even among those who sought hospital treatment, antivenom was unavailable, so treatments were limited to symptomatic medications.

Geographically, the highest number of cases was reported from Munda (n = 91, 21.4%), followed by Khal (n = 77, 18.1%), Balambat (n = 74, 17.4%), Timergara (n = 61, 14.3%), Adenzai (n = 48, 11.3%), Lal Qilla (n = 43, 10.1%), and Samar Bagh (n = 32, 7.5%).

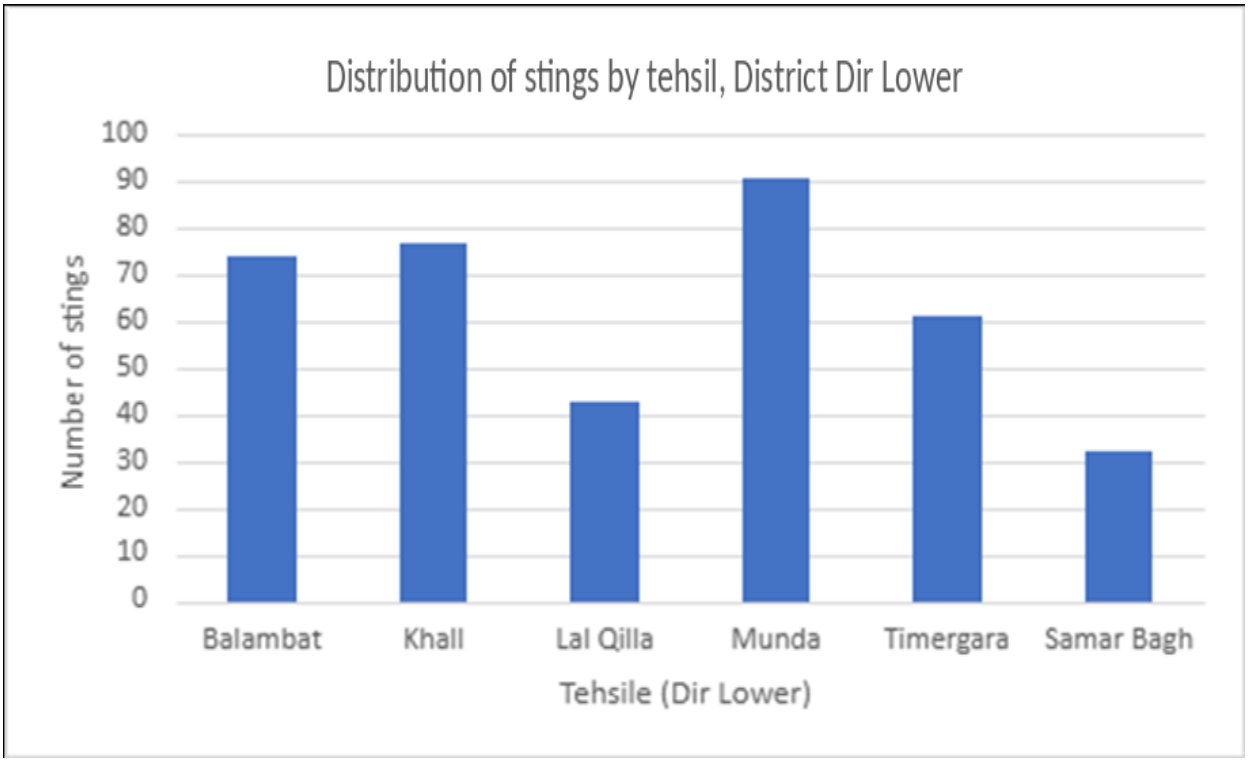


Figure 3: Number of stings in different tehsils of Dir Lower

Discussion

Scorpion envenomation occurs in different parts of the world, including the Middle East, Latin America, India, and Africa (Abroug et al., 1999). Reports indicate that in Northern Africa, the incidence of scorpion stings is around 350,000, with fatalities around 810. In Southern and Eastern Africa, the incidence of scorpion stings is around 79,000, and 245 fatalities are recorded (Chippaux, 2012). In Asia, the incidence of scorpion stings is recorded at 250,000, with fatalities being around 645. Mexico recorded 250,000 stings with 75 fatalities, while the Middle East recorded 146,500 stings and 796 fatalities (Muller, 2019). Most stings occur at night because scorpions are nocturnal. Hot, humid, and dry weather promotes scorpion stings (Chowell et al., 2005). However, related studies on scorpion stings globally are limited (Ismail, 1995).

This research presents a detailed analysis of 426 scorpion-sting cases identified in the Lower Dir District region over 29 months. This is the only systematic epidemiological study conducted so far on scorpion stings from the northern mountainous region of Khyber Pakhtunkhwa, Pakistan. Ahsan et al. from Sargodha, Punjab, documented 669 scorpion stings, but this region has different climatic and topographical conditions than Sargodha, Punjab.

In the present findings, the proportion of cases in females (57.3%) was higher than in males (42.7%), compared with Ahsan et al. (2015), who reported around 52%. The higher proportion of females in the study area may be due to its relatively rural nature compared with Sargodha. Moreover, women are usually responsible for carrying wood, grain, and other domestic products after sunset in Lower Dir District; they may be at greater risk of encountering scorpions.

The 16-35 age group had the highest burden of sting incidents (42.95%), suggesting that young adults experience the most stings. These results align with findings from many researchers, including Ghaderi et al. (2006), Emam et al. (2008), Dehghani et al. (2010), and Ahsan et al. (2015). These studies also suggested that most scorpion sting victims are adults.

The Pearson correlation analysis was conducted to determine whether the average monthly temperature is associated with the average number of cases recorded. The results show a significant, positive correlation between temperature and cases, $r(17) = 0.77$, $p < 0.00013$, indicating that average temperature is highly correlated with the number of cases. This finding is also consistent with other findings reported in the literature related to the epidemiology of scorpions and their stings; these are Ozkan and Kat (2005), Chowell et al. (2005), Ozkan et al. 2006), Kassiri et al. (2012), Kassiri et al. (2013), and Ahsan et al. (2015).

The remarkable domination of nocturnal stings (96.0%) agrees with the established behaviour of medical Buthidae scorpions as foragers, which hide during the daytime in cracks, under stones, and among stored materials and come out at night to search for food, and similar observations were recorded by Ahsan et al. (2015).

By age group, the foot was the most common site, followed by the hand, as indicated by Ahsan et al. (2015). This suggests that accidental scorpion stings occur when people go to different places and accidentally get stung while putting their hand inside something, such as a shoe, under the bed, or among stored items, or even while walking on the ground where a scorpion was hidden. A statistically meaningful link between age group and sting sites was established (Chi-square= 17.84, df=6, p=0.007).

Around 28 (6.5%) patients were asymptomatic after the sting, corroborating earlier findings, such as those of Al-Asmari and Al-Saif (2004), who reported asymptomatic cases and stated that 20.7% of cases in their study were asymptomatic. The remaining patients, 398 (93%), had localised symptoms such as pain, swelling, and redness around the sting site. However, apart from localised symptoms, 46 persons had systemic manifestations, including restlessness, nausea, sweating, and vomiting. Among the nine patients with localised and systemic manifestations, there were severe cases with significant increases in heart rate (tachycardia), salivation, and breathing difficulties, as previously reported by Khattabi et al. (2011), Ahsan et al. (2015), and El-Aziz et al. (2019). However, even in severe cases, no patient reported any results associated with coma, convulsions, or death (Ahsan et al., 2015; Vazirianmzadeh et al., 2008; Kassiri et al., 2012), and no deaths were reported. However, studies by Karami et al. (2013), Abroug et al. (1999), Bahloul et al. (2004), and R Dehghani et al. (2023) report deaths. These good outcomes may be due to the prevalence of low-lethality scorpion species in the area.

The study's results identified pronounced geographic clustering of scorpion sting events in the surveyed tehsils of Lower Dir district, among the surveyed tehsils of Lower Dir district, being Munda with the most scorpion sting cases (n = 91, 21.4%), Khal (n = 77, 18.1%), Balambat (n = 74, 17.4%), Timergara (n = 61, 14.3%), Adenzai (n = 48, 11.3%), Lal Qilla (n = 43, 10.1%), and Samar Bagh (n = 32, 7.5%) being the last one on this list. This skewed distribution suggests that scorpion envenomation risk is not uniform across the study area but is concentrated in specific territories, likely due to ecological conditions suitable for scorpions, housing structures, agricultural practices, and population density. Many papers provide evidence that scorpion sting occurrence varies spatially, such as Ahsan et al. (2015), Abbasi et al. (2025), and Fakhraei et al. (2025). In the neighbouring districts of Dir Lower, Jawad and Zahid (2022) show that the demographic situation, environmental conditions, and scorpion fauna differ across Charsadda, Mardan, Peshawar, and Kohat.

Most of the patients suffering from scorpion stings did not get any medical treatment; on the contrary, a significant number of them depended on spiritual or faith-based healing practices, with only 46% of patients seeking medical assistance at hospitals. This finding largely agrees with Ahsan et al. (2015), who reported that 56.05% of patients went to a hospital for treatment after being stung by a scorpion. The lower percentage in the present study is probably because Dir Lower is a largely rural area, with populations residing far from modern medical services; this pushes patients to heal themselves using traditional or spiritual healers first, and in many cases, only. Among those patients who reached a health care facility, definitive treatment with antivenom was not commonly available, and medical intervention mainly consisted of symptomatic treatment only — prescribing analgesics for pain and anti-inflammatory medicines for local swelling and inflammation, as described by Touloun et al. (2001), Ahsan et al. (2015) and Kadi et al. (2025).

Conclusion

This is the first large study to report on scorpion sting incidents in Lower Dir District. The study documented 426 cases over 29 months, mainly involving women and individuals aged 16-35 years. Cases appeared more severe during summer, and most occurred at night. The feet and hands were the most commonly affected body parts. Although most cases had mild features, some progressed to severe manifestations. No deaths were recorded. Less than half of the people sought medical help, and a lack of antivenom was also observed in the area.

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