

Clinical Manifestations and Treatment of Scorpion Sting Poisoning in Mexican Children (A 1565 Cases Report)

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Abstract

Our objective is to share the experience of a pediatric hospital, describing the clinical characteristics of scorpion sting poisoning of 1,565 children and the treatment used in the hospital according to the severity of the poisoning. 33% of the patients had severe intoxication, 34% moderate intoxication; and 31% severe intoxication, the main symptoms of intoxication are dysphagia (70.3%), sialorrhea (65.1%), irritability (58.1%), increased muscle tones (57.8%), odynophagia (55.2%) and nystagmus (43.35%). The most severe symptoms are found in children under 6 years; Treatment is based on the use of fabootherapeutic; too we found a correlation between the number of bottles of fabootherapeutic administered and the severity of intoxication; However, treatment with fabootherapeutic, in addition to reversing the symptoms, has made it possible to eliminate the use of antihistamines and steroids in these patients, and too has reduced the presence of complications and deaths from scorpion sting poisoning.

Keywords: Scorpion Sting; Poisoning; Treatment; Fabootherapeutic

Abbreviation

HNM: Hospital del Niño Morelense

Background

Among the poisonous animals, the scorpion occupies one of the main places because of its toxicity towards the man. In Mexico, approximately 130 species and subspecies of scorpions - all belonging to the genera *Centruroides*, *Buthidae* family - are described, however, they are only toxic to humans: *C. limpidus limpidus*, *C. limpidus tecomanus*, *C. infamatus*, *C. suffusus*, *C. noxius*, *C. elegans* y *C. sculpturatus*. These species and subspecies are located in the western and central regions of the country, being distributed predominantly in the provinces of Morelos, Guerrero, southeast of the State of Mexico, southeast, and central and north of Michoacan, southeast of Puebla, north and south of Aguascalientes [1,2].

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There are at least three groups of similar peptide toxins in the venom of *Centruroides*. One group includes toxins formed by a chain of peptides of 60 - 70 amino acids that affect sodium channels, and a second group includes toxins of 37 to 39 amino acids that acts at the level of potassium-blocking channels, while a third group consists of peptide chains (of 37 amino acids) specific for chlorine channels. The scorpion venom also contains low molecular weight proteins of unknown structure that affect the calcium channels and the endoplasmic reticulum [3].

The toxins of scorpion venom have an affinity for the sodium, potassium and calcium channels, causing a prolongation of the action potential of the cell membrane in a way that increases the secretion of acetylcholine and catecholamines, at sympathetic and parasympathetic levels, producing neurological and cardiac effects [4,5].

In the state of Morelos the most toxic species that exists is *Centruroides limpidus limpidus*. There are other species, but they are not toxic to man.

In 2019, in Mexico, a total of 289,760 cases of scorpion poisoning were reported; the state of Morelos is within the 5 states with more cases. A mortality rate of 12.4 per 100,000 inhabitants has been estimated [6,7].

Some physiological conditions have been described that favor the appearance of symptoms and signs of intoxication, such as the age, weight and state of health of the patient. Among the important characteristics of the scorpion, it is the species and the amount of venom inoculated [8].

Symptoms and signs of poisoning have been grouped as mild, moderate and severe:

- Mild: Asymptomatic patient, with little pain and local erythema, or with local paraesthesia's.
- Moderate: Patient with local symptoms, in addition to nasal pruritus, foreign body sensation in the throat, sialorrhoea, dysphagia, irritability, tachycardia, polypnea, respiratory distress, fever or hypothermia.
- Severe: In addition to moderate symptoms, there is nystagmus, respiratory distress and oxygen saturation below 92%, cyanosis, drowsiness, stupor, coma, focal or generalized seizures, increased muscle tone, hypotension, abdominal cramps, heart failure And acute pulmonary oedema [10,11].

In patients with severe scorpion sting poisoning, electrolyte alterations have also been reported, such as hyponatraemia and hypokalemia in 76%; At the Hospital del Niño de Morelos (HNM), hypernatraemia and hypokalemia have been reported, upon admission of the patient, these alterations remit without additional management, after management with the fabootherapeutic agent [12].

Regarding the cardiac alterations associated with scorpion sting, Margulis published the results of an experimental model of scorpion sting poisoning in dogs where there is damage to the left ventricle and suggests that this is due to coronary hypoperfusion as well as alterations of the ST segment. Other authors report within the complications cardiogenic shock and acute pulmonary oedema [13,14].

Complications such as myocarditis have also been described in 52% of cases, electrocardiographic abnormalities in 10.2%, interventricular conduction disorders in 12.8% and arrhythmias in 11% [15-17].

The treatment of scorpion sting poisoning is different in each region but in general antihistamines, steroids, benzodiazepines, prazosin and antivenom are used.

In Mexico, a fabootherapeutic is used that targets toxins of the *Centruroides* genus, with a composition of 85% of F (ab) 2, less than 2% of FAB, less than 13% of low molecular weight proteins and does not contain albumin, which you reduce the risk of anaphylactic reaction.

In reports of clinical trials where only fabotherapy has been used, no serious adverse events are reported after the application of the drug [5,8,18].

In some parts of the world, scorpion sting poisoning continues to be a health problem; and the state of Morelos in Mexico reported 25,6484 cases in 2019, so it is necessary for health personnel to know the clinical behavior of these patients as well as the treatment to be followed to avoid complications and deaths, so a cases review was made to describe the clinical behavior of these patients and the treatment [6].

Materials and Methods

To describe the symptoms in children, a retrospective, descriptive and observational study was carried out in which patients under 18 years of age were included, who came to the HNM emergency room in Cuernavaca Morelos, Mexico, with a history of having been stung by a scorpion. or have symptoms of scorpion sting poisoning, from October 2000 to October 2016.

The clinical records of these patients were reviewed and a database was made in SPSS 24, the data that were included were: gender, age, weight, accident occurrence site, time taken to go to an emergency room, symptoms presented to the time of admission to the emergency room, respiratory rate, heart rate, temperature, blood pressure. According to the symptoms, patients were classified as mild, moderate and severe. Regarding the treatment, the data collected were: number of doses of antihistamine and hydrocortisone, and dose of fabotherapeutic (this agent was produced by the National Institute of Hygiene and subsequently by the Bioclon Institute, which is the that produces and distributes it at present with name the Alacramyn®).

Ethical considerations

As it is a retrospective, descriptive study, it is considered of minimal risk for the patient, so informed consent is not required, it is authorized by the HNM research and ethic committee.

Statistical analysis

Descriptive statistics were used using mean and standard deviation and median, minimum and maximum values for variables that did not present a normal distribution. The frequencies were reported in percentages; the correlation between age, sex, weight and severity, was performed using the Pearson test (p ≤ 0.05 was considered statistically significant)

Results

A total of 1565 patients were admitted to the study. 55.3% males and 44.7% females. The median age was 66.6 months, with a minimum of 2 months and a maximum of 216 months; the median weight was 21.59 kg, with a minimum of 3.5 kg and a maximum of 84.5 kg (Table 1).

	Mild		Moderate		Severe	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age (months)						
2 - 36	163.0	31.3	178.0	32.6	206.0	41.2
37 - 72	158	30.3	141	25.9	145.0	29
73 - 108	97	18.7	110	20.2	82.0	16.4
> 109	103	19.7	115	21.3	67.0	13.4
	521	100	544	100	500.0	100
Peso (Kg)						
< 10	45	8.7	60	11	56.0	11.20
11 - 20	265	50.9	257	47.2	286.0	57.2
21 - 30	114	21.9	108	19.9	82.0	16.4
31 - 40	43.0	8.2	58.0	10.7	29.0	5.8
41 - 50	32	6.1	40	7.3	24.0	4.8
> 51	22.0	4.2	21	3.9	23.0	4.6
	521	521	544	100	500.0	100

Table 1: Age and weight distribution according to severity of scorpion sting poisoning.

52.07% of the patients belonged to the municipality of Cuernavaca, which is where the HNM is located, and the rest to nearby municipalities. Patients can go to health canterers that correspond to a first level of care, the staffs of these canterers is trained and has the treatment to provide timely management, so that patients do not have to travel long distances to be treated and they can receive attention before the first hour.

97.4% of the accidents occurred at the patient’s home and the rest of the accidents occurred on the public highway, school or other unspecified places.

58.9% of accidents occurred at night (9:00 pm to 7:00 am), 26.2% occurred in the afternoon (2:00 pm to 8:00 pm) and only 14.9% occurred in the morning (8:00 - 14:00hrs).

The months with the highest number of cases were March, April and May (spring season), with 38.8% (608 patients).

3.6% (56 patients) had previously suffered scorpion stings, and 3.1% (49 patients) had been treated with faboherapeutic and no adverse events were reported after its application.

According to the severity of the symptoms, 521 patients (33.3%) were classified as mild, 544 patients (34.8%) were classified as moderate and 500 patients (31.9%) as severe (Table 2).

Mild	Moderate	Severe
Pain, local hyperemia, paresthesias, and itching at the sting site	In addition to the mild symptoms, there is sialorrhoea, sensation of a foreign body in the pharynx, odyndophagia, lingual twitching, laryngeal stridor and nausea.	In addition to moderate symptoms, anxiety, dyspnea, shortness of breath, vomiting, abdominal cramps, bloating, priapism, elevated blood pressure, bundle branch block tachycardia, QT prolongation, arrhythmias, left ventricular failure and acute pulmonary edema

Table 2: Classification of the symptoms of scorpion sting poisoning according to the severity of the poisoning.

There was no significant correlation between severity of symptoms, weight, or gender. The severity of intoxication was correlated with the age of the patients (Pearson’s test, $r = -0.053$, $p < 0.05$), it is observed that the younger the age, the greater the severity of the intoxication symptoms, the majority of the patients with symptoms severe are found in the age group 2 to 36 months.

Regarding the symptoms that the patients presented, the most frequent were: dysphagia 70.3%, sialorrhoea 65.1%, irritability 58.1%, increased muscle tone 57.8%, odyndophagia 55.2% and nystagmus 43, 35%. In this period, only 2 patients who became complicated and died were reported, one from cerebral oedema and the other from heart failure (Table 3).

Symptom	Frequency	Percentage
Symptom	1100	70.3
Dysphagia	1019	65.1
Sialorrhoea	909	58.1
Irritability	905	57.8
Increased muscular tone	864	55.2
Odyndofagia	678	43.3
Nystagmus	610	39
Local pain	596	38.1
Local hyperaemia	415	26.5
Nasal pruritus	386	24.7
Paresthesia	371	23.7
Vomiting	134	8.6
Increased osteotendinous reflex	66	4.2

Table 3: Most frequent symptoms in patients with scorpion sting poisoning.

The time elapsed between the accident and the first medical attention had a median of 40 minutes (15 - 1140 minutes). When correlating the time with Pearson's test elapsed between the accident and the care, we find that the longer the patient has been in the course of evolution, the greater the risk of having symptoms of severe intoxication ($r = -0.116$ and $p = 0.00$). The time that the patient remained in the emergency room was 120 minutes (30-740 minutes).

The most common scorpion sting sites, it can be seen that the hand, arm and foot are the most frequent sting sites. There is no correlation between the severity of symptoms and the site of the bite.

The median vital signs in the patients were: respiratory rate 28 (16 - 68) breaths per minute; heart rate 120 (42 - 200) beats per minute; systolic blood pressure 98 mmHg (75 - 180 mmHg), diastolic blood pressure 60 mmHg (50 - 110 mmHg); only 1% presented hypertension and 0.19% fever.

In HNM, some patients were treated with hydrocortisone at a dose of 10 mg/kg, antihistamine at a dose of 0.03 mg/kg/day and fabo-therapeutic, the number of vials applied is according to the severity of the patient.

When correlating the severity of the symptoms with the number of vials of fabo-therapeutic administered we found a statistically significant correlation with Pearson's test ($r = 0.698$ and $p = 0.00$) the greater the intoxication severity, the greater the number of vials administered.

Discussion

The age group most affected is that of children under 10, with 81.9% (1263). 70.2% (351) of patients with severe poisoning were younger than 6 years; comments in his work that the population most affected are young people under 15 years of age, and when compared with other studies concludes that it is a health problem in which children are the most affected and therefore are an age group with risk for fatal complications [19].

According to the severity of the clinical picture, the distribution is similar in terms of percentages: mild 33%, moderate 34% and severe 31%. Other authors prefer to group them into only two groups, including mild and moderate in a single category; Thus, they have reported a percentage of 61.5% in the first group and 38.5% in the second group; which corresponds to our classification; in HNM, management is based on the degree of severity, so we prefer to use the classification of mild, moderate and severe.

The correlation between the severity of the clinical condition, the weight and the sex of the patients is not significant; however, age is a feature that showed the with Pearson's test significant correlation [20].

In general, scorpion stings are present at the time people take their clothes or shoes from the place where they are stored. This is why the site where the stings most frequently occur is in the hand, and less frequently in an arm or a foot.

The main clinical manifestations in this study were: dysphagia, sialorrhea, irritability, increased muscle tone and nystagmus, Boyer reports abnormal eye movements and lower limb increased tendon reflexes in 100% of his patients [21].

A statistically significant correlation was found in the time of transfer of the patient from the scene of the accident to a hospital, so we see in patients a longer time of evolution, a greater severity of the condition and a greater risk of complications that can put the life of the patient; In studies carried out in animal models, it has been observed that over time the scorpion venom is deposited in the lung and heart tissue, probably causing tissue damage in the lungs and the heart, favouring the presence of complications that can lead to the death of the patient [22].

The length of hospitalization varies according to the severity of the poisoning and the response of each patient, most of the patients remain hospitalized for less than 4 hours (87.2%), this has been achieved by the timely administration of fabo-therapeutic.

So far, it has not been possible to correlate the site of sting with the severity of the intoxication. The factors that seem to influence the most are the patient's age, and the time elapsed between the accident and the medical care.

The discrepancy between the time elapsed between the accident and medical care (15 - 1140 minutes) can be explained because, despite being an urban area, sometimes patients are administered folk remedies that only delay their care; favouring the presence of complications that can endanger the patient's life.

The clinical condition can be varied, due to the different species of scorpion; However, several authors agree on the presence of sialor-rhea, dysphagia, a sensation of a foreign body in the throat and vomiting, and nystagmus is observed only in patients with severe poison-ing [23,24].

Complications that have been documented in NMH are cerebral edema and heart failure, probably secondary to a decrease in the ventricular ejection fraction that are sometimes also associated with other electrolyte alterations such as hypokalemia; hyperglycemia are alterations that have also been documented in patients with severe scorpion sting poisoning in HNM; it is important to comment that the alterations in electrolytes and elevated glucose that are identified on admission of the patient, remit, after the application of the fabo-therapeutic, without other treatment [25,26].

Until now, the use of antivenom has reduced the presence of complications, length of hospital stay and mortality due to scorpion ven-om poisoning: some authors have carried out controlled clinical trials, with the use of antivenom, and others combining it with prazosin observing that patients recover without complications; compared to groups that are managed with placebo that present complications and increase the length of hospital stay [27]. In Mexico, hospital stay times were less than 4 hours in 87.2% (1,362) of the cases; This could be explained because patients receive medical attention in the first hour after the accident (median 40 minutes), and the administration of treatment with fabo-therapeutic prevents complications from occurring in these patients.

In our hospital, no alterations in serum calcium have been described, therefore the use of calcium gluconate has been ruled out in the treatment of patients; the use of antihistamines and hydrocortisone has decreased, due to the reports that have been made of the absence of adverse reactions from the use of the fabo-therapeutic [5,12]. Benzodiazepines have been used at some point to reduce psychomotor agita-tion in patients, however, sedating the patient does not allow us to see the improvement of symptoms, so we could increase hospital stay times, for this reason we do not suggest the use of benzodiazepines in the management of scorpion sting poisoning.

Patients in HNM who present symptoms of intoxication are classified according to the severity of the symptoms (Table 2) and treat-ment is started according to the severity of the intoxication, the dose of fabo-therapeutic that is proposed is based on clinical studies carried out in HNM in the that the concentration levels of the poison were measured in the patients at admission and after the application of the fabo-therapy, a decrease in the levels of toxins in the blood is observed, and secondarily the clinical data of intoxication disappear, these studies have allowed to reduces the number of vials administered to patients [12,18].

We recommend that patients with nasal itching and a sensation of a foreign body in the throat apply an intravenous (IV) vial and reas-sess one hour later the application of a second vial.

In patients with moderate intoxication, we suggest administering 2 IV vials and reassessing one hour later the application of 1 vial in case of persisting symptoms of intoxication.

In patients with severe symptoms, 3 IV vials of fabootherapeutic should be administered, and reassess one hour after the administration of a vial, every hour until the patient shows no signs of intoxication (Figure 1) [12,21,28].

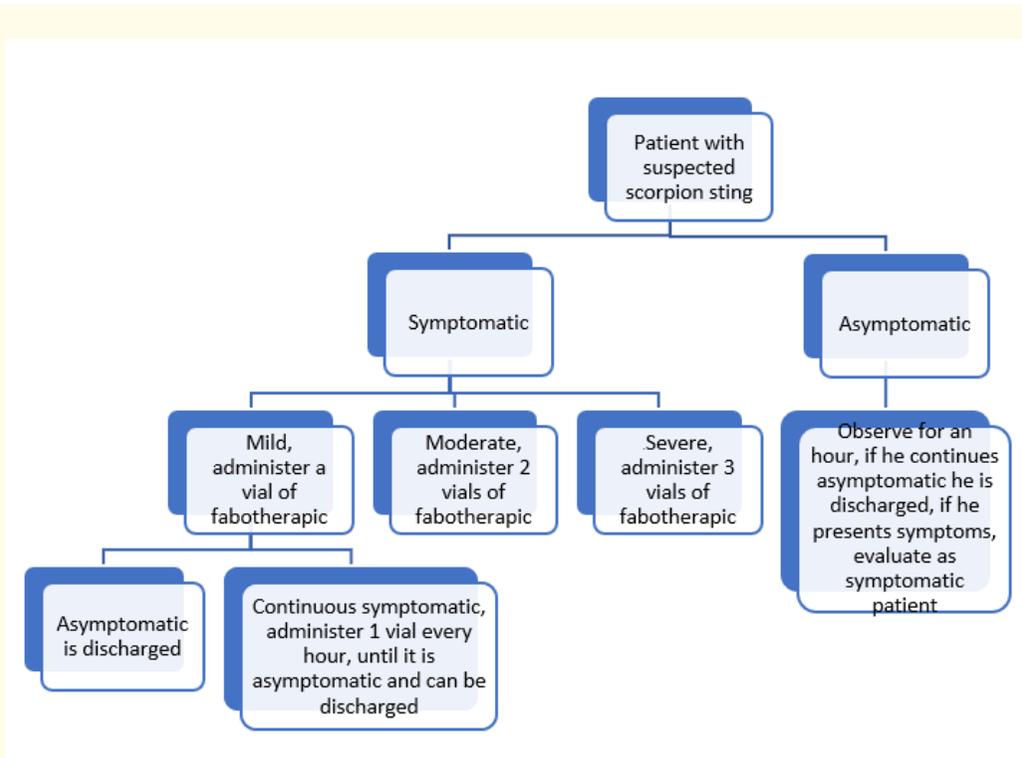


Figure 1: Suggested management for pediatric patients with scorpion sting poisoning.

In case the patient presents data of heart failure, they should be managed in an intensive care area.

In Mexico, the use fabootherapeutic has reduced mortality by up to 35.26% compared to other years [7].

Conclusion

Scorpion sting poisoning remains a health problem; It is necessary to make the medical and paramedical personnel aware of the wide variety of clinical manifestations of this nosological entity, mainly in endemic areas, it is important that medical and paramedical personnel know the management of these patients, but it is also important to establish preventive measures, avoiding the accumulation of garbage between the houses, fumigation programs, in endemic areas, and inspection of clothing and footwear before dressing to avoid suffering a scorpion sting and developing a intoxication scorpion’s venom.

Competing Interests

The authors declare no potential competing interests.

Ethics Approval

The present study is a retrospective, minimal risk study, it does not require informed consent, the study was approved by the HNM research committee.

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