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## Clinical and epidemiological aspects of scorpion stings in the northeast region of Brazil

Aspectos clínicos e epidemiológicos dos acidentes escorpiônicos na região do nordeste do Brasil

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**Abstract** *Scorpion stings are a serious public health issue in tropical and subtropical countries. This is a descriptive and retrospective study of the clinical-epidemiological characteristics of scorpion sting cases registered in the Health System in the city of Campina Grande, Paraíba state, from 2007 to 2012. Data was collected from the Injury Notification Information System data banks of the Ministry of Health. A total of 2,283 records, provided by the Third Health Sector of Campina Grande, were analyzed. Data revealed that the majority of the victims are female aged between 20 and 29 years, and the highest incidence of stings was in the urban area. Victims were mostly stung on the feet and hand. Serotherapy was not administered in most cases. The majority of the victims received medical assistance within 1 to 3 hours after the sting. The most prevalent clinical manifestations were pain, edema and paresthesias. Most cases were classified as mild, though seven deaths were reported. The high incidence rate suggests that this town may be an endemic area of scorpion stings, supporting the need to develop strategies to control and prevent scorpion stings.*

**Key words** *Paraíba State, Scorpion stings, Human poisoning, Scorpions, Epidemiology, Public health*

**Resumo** *Os acidentes escorpiônicos constituem um grave problema de saúde pública em países tropicais e subtropicais. Este estudo retrospectivo analisou as notificações dos acidentes escorpiônicos registrados no Sistema de Saúde do município de Campina Grande, no estado da Paraíba, de 2007 a 2012. As informações foram coletadas do banco de dados do Sistema de Informação de Agravos de Notificação do Ministério da Saúde. Foram analisadas 2283 fichas de notificação. Os dados revelaram que a maioria dos acidentados é do sexo feminino, com idade entre 20 e 29 anos. Os acidentes foram mais frequentes em área urbana, sendo os pés e as mãos os locais anatômicos do corpo mais atingidos pelas picadas. A soroterapia não foi administrada na maioria dos acidentados e as vítimas prevalentemente recorreram aos sistemas de saúde dentro do período de 1 a 3 horas após o acidente. As manifestações clínicas mais frequentes foram dor, edema e parestesias. A maioria dos acidentes foi classificada como leve, porém foram registrados 7 casos de óbito. A elevada taxa de incidência de acidentes escorpiônicos sugere que esse município pode ser uma área endêmica de escorpiões, justificando a necessidade da elaboração de estratégias de controle e prevenção de acidentes por estes animais.*

**Palavras-chave** *Paraíba, Picada de escorpiões, Envenenamento humano, Escorpiões, Epidemiologia, Saúde Pública*

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## Introduction

Scorpion envenomations have been considered a public health problem in tropical and subtropical countries due to their high incidence and potentiality of venom of some species to induce severe clinical registers, sometimes fatal ones<sup>1</sup>. In Brazil, three species of scorpions of *Tityus* type have been responsible for stings of medical importance: *T. stigmurus*, *T. bahiensis* and *T. serrulatus*, the last one being the main species responsible for severe stings, with death register mainly in children<sup>2</sup>. Epidemiological studies on scorpion stings have revealed that their incidence is most frequent in male individuals, aged between 20 and 40 years, and that they are predominantly stung on the feet and legs<sup>3</sup>. Most of the cases take place in urban area, inside or nearby home, with seasonal distribution in the South and Southeast states during the warm and rainy months, being however practically invariable all year long in the north, northeast and center-west<sup>3</sup>. The seriousness of the case depends on factors such as the species and size of the scorpion, the amount of venom inoculated, the victim's body mass and the patient's sensitivity to poison. Early diagnosis, time elapsed between the sting and serotherapy, and the maintenance of the victim's vital functions also interfere in the case evolution<sup>2</sup>.

In Brazil, the registering system of scorpion stings was established in 1988 and, since then, the number of cases has increased significantly. In 2011, it was estimated that about 58,000 scorpion sting cases, with incidence of 52 cases/100,000 inhabitants<sup>4</sup>. In spite of the significant increase of data originated from states of northeast such as Bahia, Rio Grande do Norte, Pernambuco, Alagoas and Ceará, the highest number of registers is from the state of Minas Gerais<sup>5</sup>. In the northeast, the epidemiological profile of scorpion sting cases is not yet clarified, and the *Tityus stigmurus* has been pointed out as the main offending species<sup>6,7</sup>. Despite the medical importance regarding scorpion stings and the increasing number of registers in the northeast, the epidemiology of these stings in the state of Paraíba is still poorly understood. In this sense, this research aims to evaluate clinical-epidemiological data of scorpion sting cases in the period from 2007 to 2012, in the town of Campina Grande, Paraíba.

## Materials and Methods

### Study area

The study was accomplished in the city of Campina Grande, located in the countryside of Paraíba state, in the northeast of Brazil. The mentioned town is placed in the Paraíba *agreste*, eastern part of the *Planalto da Borborema*, at an average altitude of 555 meters above sea level and it has tropical climate of altitude, with average annual temperature of 25°C. Its population was estimated around 385,276 inhabitants, covering a geographical area of 599.6 Km<sup>2</sup>, with demographic density of 597.9 inhabitants/Km<sup>2</sup><sup>8</sup>.

### Data Acquisition

A descriptive and retrospective study of the clinical-epidemiological characteristics of scorpion sting cases was performed. The epidemiological data was obtained from information present in the registers of scorpion sting cases which occurred in the city of Campina Grande, in the period from 2007 to 2012. Data collection was carried out in the Third Health Sector of Campina Grande, using the SINAN (Injury Notification Information System) databases of the Health Ministry. Epidemiological data was analyzed according to sex, age, year and month of the scorpion sting, zone of occurrence (urban or rural), part of the body stung, and time elapsed between sting and medical assistance. The variables investigated in clinical evaluations were: local and systemic clinical manifestations, seriousness and evolution of the case, and serotherapy. Demographic and population data furnished by the Brazilian Institute of Geography and Statistics (IBGE) were used to calculate incidence rates. Statistical analyses were performed using the Analysis of Variance (one-way ANOVA) and Tukey tests. The level of significance was set at  $p < 0.05$ . All statistical analyses were performed using the software R version 2.15.1 for Windows.

## Results

Between January/2007 and December/2012, a total of 2,283 scorpion stings were notified and given care in the town of Campina Grande, with average incidence rate of 132 cases/100,000 inhabitants in 2007, 127 cases/100,000 inhabitants in 2008, 109 cases/100,000 inhabitants in 2009, 47 cases/100,000 inhabitants in 2010, 68 cases/

100,000 inhabitants in 2011, 108 cases/ 100,000 inhabitants in 2012. Table 1 shows the month distribution of scorpion sting cases. Such scorpion stings occurred during the whole studied period, with irregular monthly distribution of the cases. No statistical difference was observed when comparing months ( $p = 0.6620$ ). Table 2 shows the individual characterization and circumstances of the reported scorpion stings. Victims were predominantly female ( $n = 1,371$ ; 60.05%) and were not at work at the time of the sting ( $n = 2,095$ ; 39.94%). Most cases occurred in urban area ( $n = 2,062$ ; 90.3%). In terms of age range, the highest frequency of stings was found in individuals between 20 and 29 years old ( $n = 493$ ; 21.59%), followed by age range between 10 and 19 years old ( $n = 395$ ; 17.30%), no statistical difference was observed between the age ranges ( $p = 0.7775$ ). The lowest frequency was observed in individuals above 70 years old ( $n = 110$ ; 4.81%), for both genders. The part of the body mostly stung was the feet ( $n = 743$ ; 32.54%) when compared with the others anatomic regions ( $p < 0.05$ ). The most frequent time interval, elapsed between the sting and medical assistance, was of 0 to 1 hours after the sting ( $n = 627$ ; 27.46%), followed by time interval of 1 to 3 hour ( $n = 545$ ; 23.87%). No statistical difference between these time intervals ( $p = 0.05$ ). Serotherapy was fulfilled in only 19 patients (0.83%), and in 2,226 patients (97.50%) antivenom was not administered. Table 3 shows the clinical classification and the evo-

lution of the cases. The majority of the cases ( $n = 2,209$ ; 96.75%) was classified as mild; just a few cases as moderate ( $n = 52$ ; 2.27%) and four as severe ( $n = 4$ ; 0.17%). Evolution for cure was predominant ( $n = 2,211$ ; 96.84%). A total of seven deaths (0.30%) were registered. Table 4 shows local and systemic clinical manifestations observed as a result of scorpion stings. The most frequent local manifestations were pain ( $n = 2,195$ ; 96.14%), edema ( $n = 693$ ; 30.35%), paresthesia ( $n = 455$ ; 19.92%) and ecchymosis ( $n = 33$ ; 1.44%). The most frequent systemic clinical manifestations were generalized pains ( $n = 38$ ; 1.66%), vagal manifestations ( $n = 24$ ; 1.05%) and arterial hypotension ( $n = 6$ ; 0.26%).

## Discussion

In the city of Campina Grande, between 2007 and 2012, a number of 2,283 scorpion stings were registered. Such cases presented average annual incidence of 98 cases/100,000 inhabitants. Table 1 show the case distribution in relation to the months. The scorpion stings occurred mostly from July to September. However, no statistical difference was observed between the months ( $p = 0.6620$ ). The distribution of cases during the year with little variation between the months may be attributed to region climatic conditions, characterized by defined climatic seasons and average annual temperature of 25°C. These conditions

**Table 1.** Distribution by month of scorpion sting cases registered in the municipality of Campina Grande, State of Paraíba, Brazil, from 2007 to 2012 ( $n = 2283$ ).

Variables	Year						Total
	2007	2008	2009	2010	2011	2012	
Months							
January	41	41	58	48	17	34	239
February	52	35	62	14	48	38	249
March	44	46	39	23	9	43	204
April	25	26	0	5	0	35	91
May	50	49	51	13	1	41	205
June	34	26	37	0	0	0	97
July	62	60	25	11	46	61	265
August	56	60	30	3	39	71	259
September	44	57	31	12	46	49	239
October	38	37	18	0	27	0	120
November	25	31	32	4	29	0	121
December	39	21	40	49	0	45	194
Total	510	489	423	182	262	417	2.283

No statistical significant difference was observed between the months.

**Table 2.** Descriptive analyses of scorpion sting cases registered in the municipality of Campina Grande, State of Paraíba, Brazil, from 2007 to 2012, according to quantitative demographic variables (n = 2283).

Variables	Year						Total
	2007	2008	2009	2010	2011	2012	
Age group (years)							
1  —  9	43	50	46	23	29	65	256*
10  —  19	85	92	72	36	40	70	395*
20  —  29	131	92	102	39	49	80	493
30  —  39	77	81	68	24	44	65	359
40  —  49	59	72	46	31	37	55	300
50  —  59	66	49	55	13	19	38	240
60  —  69	28	28	14	9	23	28	130
≥ 70	21	25	20	7	21	16	110
Unknown	0	0	0	0	0	0	0
Total per age group	510	489	423	182	262	417	2.283
Gender							
Male	184	202	174	72	114	166	912
Female	326	287	249	110	148	251	1.371*
Total	510	489	423	182	262	417	2.283
Localities of Occurrence							
Urban	465	431	388	164	241	373	2.062*
Rural	34	44	26	10	17	39	170
Periurban	1	1	0	1	0	0	3
Unknown	10	13	9	7	4	5	48
Total	510	489	423	182	262	417	2.283
Work-related accident							
Yes	9	11	17	10	17	18	82
No	455	435	398	170	240	397	2.095*
Unknown	46	43	8	3	5	2	106
Total	510	489	423	183	262	417	2.283
Part of the body stung							
Forearm	3	2	7	2	2	11	27
Hand	85	72	58	15	24	45	299
Leg	16	13	16	6	10	13	74
Foot	173	157	125	61	85	133	734*
Arm	10	11	15	6	8	10	60
Unknown	178	175	54	1	3	1	412
Total	465	430	275	91	132	213	1.606
Antivenom							
Yes	3	1	6	3	1	5	19
No	502	471	410	176	255	412	2.226
Unknown	5	17	7	3	6	0	38
Total	510	489	423	182	262	417	2.283
Time from sting until assistance (hours)							
0  —  1	53	39	149	87	121	178	627*
1  —  3	89	137	84	44	62	129	545*
3  —  6	8	13	20	11	29	45	126
6  —  12	7	0	16	7	15	22	67
≥ 12	11	6	23	13	10	19	82
Unknown	342	294	131	20	25	24	836
Total	510	489	423	182	262	417	2.283

\* p < 0.05 significant when compared to the other variables (Tukey Test).

**Table 3.** Classification and evolution of scorpion sting cases registered in the municipality of Campina Grande, State of Paraíba, Brazil, from 2007 to 2012 (n = 2283).

	Clinical Classification				Evolution		
	Mild	Moderate	Severe	Unknown	Cured	Unknown	Death
<b>Total</b>	2.209	52	4	18	2.211	61	7

**Table 4.** Clinical manifestations of scorpion sting victims registered in the municipality of Campina Grande, State of Paraíba, Brazil, from 2007 to 2012 (n = 2283).

Clinical Manifestations			
Local	N	Systemic	N
Pain	2.195	Pains	38
Edema	693	Vagal Manifestations	24
Paresthesia	455	Arterial Hypotension	6
Ecchymosis	33	Myolytic	6
Headache	5	Manifestations	
Necrosis	4	Neurological	5
Itching	2	Manifestations	
Erythema	0	Chills	1
Local Bleeding	0		
Abscess	0		
Local Dormancy	0		
Teeth Marks	0		
Dizziness	0		

can favor the reproductive activities of scorpions, with consequent maintenance of stings throughout the year. On the other hand, in the south and southeast regions of Brazil, the stings follow a noteworthy seasonality, being more frequent from October to December<sup>9,10</sup>. Santos et al.<sup>11</sup>, investigating the epidemiology of scorpion stings in the state of Minas Gerais, it observed a higher frequency of cases in the urban area. In present study, the most of scorpion sting cases occurred in urban area (n = 2,062; 90.31%) (Table 2). Scorpions became adapted to urban home life, possibly due to the presence of man in regions originally occupied by these animals. Therefore, they had to adapt themselves to the conditions offered by human housing, getting shelter in places containing garbage, piles of bricks and roof tiles, and being generally fed with insects<sup>12</sup>. Furthermore, the lack of predators and natural

competitors, such as monkeys, chickens, toads and frogs can contribute to the fast proliferation of scorpions, since this is an important factor for the population control of these animals<sup>13</sup>. According to Albuquerque et al.<sup>14</sup> the increase of the scorpion stings in urban areas of Campina Grande is resultant of ideal conditions for shelter and proliferation of these animals, such as the presence of debris, garbage and plenty of food, besides the high demographic density and the lack of basic sanitation. These observations were also reported by the studies by Sales et al.<sup>15</sup>.

Results of the current study show that scorpion stings were more frequent in female individuals (n = 1,371; 60.05%). Albuquerque et al.<sup>14</sup>, in a study carried out in Campina Grande, reported that the risk of scorpion sting among women is higher than that among men. This is due to the fact that women do housework involving cleaning activities in locals frequently housed by scorpions. On the other hand, these results differ from data registered for other municipalities in the north and northeast regions of Brazil, where there is predominance of attacks in male individuals<sup>5,16</sup>. Such difference in results may be due to a higher exposure of the female gender to situations favorable to stings; this is probably related to occupational and behavioral differences in home environment<sup>13</sup>. In this study, there was a higher incidence of scorpion stings in individuals aged between 20 and 29 years (n = 493; 21.59%), followed by those aged between 10 and 19 years (n = 395; 17.30%), thus indicating that the highest number of stings occurs in the economically active population. This is in accordance with the studies carried out by Albuquerque et al.<sup>14</sup>, in Campina Grande and by other authors for different regions<sup>17</sup>. However, no significant difference between the cases of scorpion sting when compared to age. This result suggests that individuals of all ages are vulnerable to scorpion stings. This reinforces the need for the development of preventative education campaigns for this type of accident.

The high incidence of data ignored and not filled up referring to the part of the body stung ( $n = 412$ ; 18.04%) is pointed out. Even though, the lower limbs was the main part of the body stung, especially the feet ( $n = 734$ ; 32.15%). On the other hand, most of the epidemiological studies show that the upper limbs, especially the hands, are the part of the body frequently attacked by the stings<sup>5,7,11</sup>. In the current study, most victims received medical assistance up to 3 hours following the sting ( $n = 1172$ ; 51.33%), similar to what was observed in some municipalities of the state of São Paulo<sup>17</sup> and Uberlândia, in the state of Minas Gerais<sup>18</sup>, where the majority of the victims received care in the first two or three hours after the sting. However, it is important to highlight that out of the 2,283 victims who sought medical care, 275 (12.04%) did it only after 3 hours following sting, and in 836 cases (36.61%) the time elapsed between sting and medical assistance was ignored or not registered. The majority of cases were classified as mild ( $n = 2,209$ ; 96.75%). The case classification was similar to data reported for Campina Grande<sup>14</sup>, as well as for other regions of the country<sup>7,16</sup>. Most cases evolved for healing ( $n = 2,211$ ; 96.84%) and seven for death (0.30%). The cause of the deaths was not registered. The cases that resulted in death were classified as mild and antivenom was not administered. It is possible that deaths may have occurred due to failure in classifying the severity of the cases. Serotherapy was accomplished in 19 cases (0.83%), however, the type of antivenom was not registered. Local pain was notified in almost 100% of the cases and the registered clinical manifestations, either local or systemic, were similar to those described in other studies carried out both in Paraíba and other states<sup>7,14,16</sup>. The low number of severe cases may be the most

probable cause of the reduced number of deaths observed in this study.

Various deficiencies were identified on the notification files, such as the lack of accounts of the time of day when the sting occurred and the genus of the offending scorpion, and the high proportions when the clinical evolution of the patient and the time elapsed between sting and medical care was not reported. These deficiencies on the clinic charts may be related to the unusual high demands at the health centers, the lack of available time of members of the health team, or little number of workers at the health center<sup>18</sup>. These situations should be emphasized once they are all common in health care centers in the northeastern Brazil, and will all contribute to the incomplete patient records. The improvement of data collection, fulfilled by local health agencies, is of remarkable importance in order to make up reliable information sources. Register files evaluated in this study were not suitably filled up, thus indicating deprivation of health services. Flaw in register services makes the scorpion envenomation difficult to be fully understood in certain regions of the country. To aggravate this situation, the curricula of university courses in medicine, pharmacy and nursing are almost always deficient in terms of instruction about attacks by poisonous animals<sup>19</sup>. Finally, the results of the current study may contribute to improve understanding of the epidemiology of scorpion stings in the state of Paraíba. Such knowledge may in turn provide relevant information for enhancing policies of antivenom production and distribution in the northeast region, as well as boost care given to scorpion envenomation victims. Furthermore, this research may supply important data for the development of educational campaigns aiming at preventive control of scorpion stings.



## Collaborations

JA Pasquino, LR Peixoto, ITG Targino, and RM Barros worked in the survey of the literature, in the research and methodology. JA Sousa worked on statistical analysis of data and RS Leite worked on the conception and design the study, analysis and interpretation data, wrote the first version of the article.

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