

SCORPION ENVENOMING BY *Tityus discrepans* Pocock, 1897 IN THE NORTHERN COASTAL REGION OF VENEZUELA

Envenenamiento Escorpiónico por *Tityus discrepans* Pocock, 1897 en la Región Norte Costera de Venezuela

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ABSTRACT

One thousand and forty five scorpion-envenomed(SE) patients studied from 1990 to 1996 were analyzed. Depending on symptom intensity, these cases were distributed in categories: 1) Light Scorpion Envenoming (LSE) 72.06% expressed only a few symptoms like pain at the sting site; followed by 2) Moderate Scorpion Envenoming (MSE) with 16.55%; and Intense Scorpion Envenoming with 9.95%, and finally a group of patients classified as 4) Severe Scorpion Envenoming (SSE), with 1.44%. The proportion of envenomed subjects was analysed by age group and sex. In a comparison of the percentages SE by age groups classified by the Student T-test ($p < 0.05$), showed no significant differences for the distribution of cases in the ages over 10 years old, but the number of cases for ages under 10 years was significant. Towns located at altitudes of over 1,000 meters had the highest scorpion envenoming indexes: San Antonio de Los Altos- Los Teques (26.2%), Baruta-Hatillo-Hoyo de la Puerta (19.8%), El Junquito (15.4%). These localities accounted for 61.4% of scorpion envenoming, while 38.6% were distributed in ten towns down 800 meters. The envenoming could occur at any moment of the day, although the highest incidence (69.3%) was between 6:00 AM and 6:00 PM. A detailed analysis of the scorpion envenoming time distribution indicated that the highest percentage (42.8%) was concentrated from 6:00 AM to 12:00 M. In Caracas the incidence of SE constitutes a potentially significant epidemic situation, when we take into account that in Caracas we find a highly concentrated human population together with a highly dangerous scorpion. *Tityus discrepans*, Pocock, 1897.

Key words: *Tityus discrepans*, scorpionism, venom, scorpion envenoming.

RESUMEN

Se analizaron 1.045 pacientes envenenados por escorpión en una muestra desde 1990 a 1996. Dependiendo de la intensidad de los síntomas, estos casos fueron distribuidos en categorías: 1) envenenamiento escorpiónico ligero (LSE) 72.06% sólo pocos síntomas, como dolor en el lugar de la picadura; seguido por 2) envenenamiento escorpiónico moderado (MSE) con 16.55%; envenenamiento escorpiónico intenso (ISE) con 9.95% y finalmente un grupo de pacientes se clasificó como 4) envenenamiento escorpiónico grave (SSE) con 1.44% de los casos totales. La proporción de envenenados fue estratificada por grupo de edad y sexo. En una comparación de los porcentajes entre los grupos de edad usando de una prueba de T ($P < 0.05$), no se encontró ninguna diferencia significativa para la distribución de casos en las edades de más de 10 años, pero el número de casos para las edades bajo 10 años la diferencia fue significativa. Los pueblos localizados a más de 1.000 metros de altitud tienen el índice de envenenamiento escorpiónico más alto: San Antonio de Los Altos- Los Teques (26.2%), Baruta-Hatillo - Hoyo de la Puerta (19.8%), El Junquito (15.4%). Estas localidades comprendieron el 61.4% del envenenamiento escorpiónico, mientras 38.6% fue distribuido en diez pueblos bajo los 600 metros. Los envenenamientos podrían ocurrir en cualquier momento del día, aunque la incidencia más alta (69.3%) estaba entre las 6:00 am y 18:00 pm. Un análisis detallado del tiempo concentró el envenenamiento escorpiónico (42.8%) entre las 6:00 am a 12:00 del mediodía. En Caracas la incidencia de envenenamiento escorpiónico constituye una situación epidémica potencialmente importante, tomando en cuenta que en Caracas converge una elevada población humana con el altamente peligroso *Tityus discrepans*, Pocock, 1897.

Palabras clave: *Tityus discrepans*, escorpionismo, veneno, envenenamiento escorpiónico.

INTRODUCTION

The oldest fossil record of *Scorpionidae* arthropods dates from the Silurian Palaeozoic era and the first scorpions lived in aquatic media. Terrestrial scorpions appeared in the Devonian period. At the present time they are restricted to the subtropical and tropical regions, where they are abundant. More than 1,000 species of scorpions have been described in the world which 103 species, belonging to 18 genera distributed in four families representing nearly 10% of the well-known scorpion fauna are found in Venezuela [6].

In view of the high toxicity of the venom in humans, several species of scorpions are considered dangerous, such as those belonging to the *Androctonus*, *Buthus*, *Parabuthus*, *Hemiscorpion*, *Leiurus* and *Mesobothus* genera in the Old World and the *Centruroides* and *Tityus* genera in the Americas [6, 7].

Centruroides and *Tityus* genera are found in Venezuela, *Tityus discrepans*, Pocock, 1897 being considered the species responsible for the highest proportion of scorpion envenoming in the northern region of the country [3, 7]. In Caracas and surrounding cities an annual average of three severe scorpion envenoming (SSE) were detected by the Ministry of Health [1], but only one fatal case was observed between 1990 to 1996 according to our records.

In this paper, it will be described the clinical and epidemiological situation of scorpion envenoming in the most populated region of Venezuela.

MATERIALS AND METHODS

Caracas valley and surrounding cities ecological environment correspond to pre-montano dry forest and a transition cloudy forest or a humid montano wood [2]. This area, in an important extension has been deeply modified by continue and extensive urban process. In other words, essentially a mosaic of urban area inside of small patch of forest and different extensions of secondary savannahs were observed. The climate is bimodal, i.e. two periods with differential rain intensity: mean annual precipitation ranges from less than 100 mm in the dry season to over 1800 mm in the rainy season. The altitude range (0-1,250 m altitude) causes variations in mean temperatures between 22°C to 28°C. In this area, important proportions of population live close or inside to the natural habitat of several *Tityus* scorpion species. For instance, *Tityus discrepans* is frequently found in this area [3, 11]. A large number of scorpion envenomed patients (1,045) were examined at the Toxicology Service of "Leopoldo Manrique Terrero" Hospital (LMTH). They were clinically evaluated and in all cases the appropriate procedures of attention and treatment, including anti-scorpion serum administration were carried out.

The clinical information was accompanied by an epidemiological information collected in a clinical record including the patient's address and occupation, bioecological aspects, accident aspects, and treatment and evolution of the patient. This information was stored in a database elaborated with the Dbase II-III program and later the quantitative follow-up was carried out with the World Health Organization Epiinfo 5 (1990) and Excel 5.0 (1994) for Windows programmes.

The distribution of frequencies from different variables, the basic epidemic descriptive statistics and risk factors were obtained as well as a frequency analysis of the presence and intensity of certain combinations of symptoms in patients with scorpion envenoming. Four classificatory qualitative categories: a) light (LSE), b) moderate (MSE), c) intense (ISE) and d) severe (SSE) envenoming, were defined.

LSE was characterised by only minor local pain at the bitten place. MSE was distinguished by symptoms such as local pain at the bitten place, indisposition and nausea. ISE cases are typified by a more intense symptomatology, like nausea and vomiting, hypersalivation, abundant corporal perspiration, tachypnea, tachycardia and abdominal pain. SSE cases are characterised by an extreme symptomatology of pancreatitis, heart failure, acute lung oedema, deep gasping, convulsive spasms, and in some cases death [9, 14].

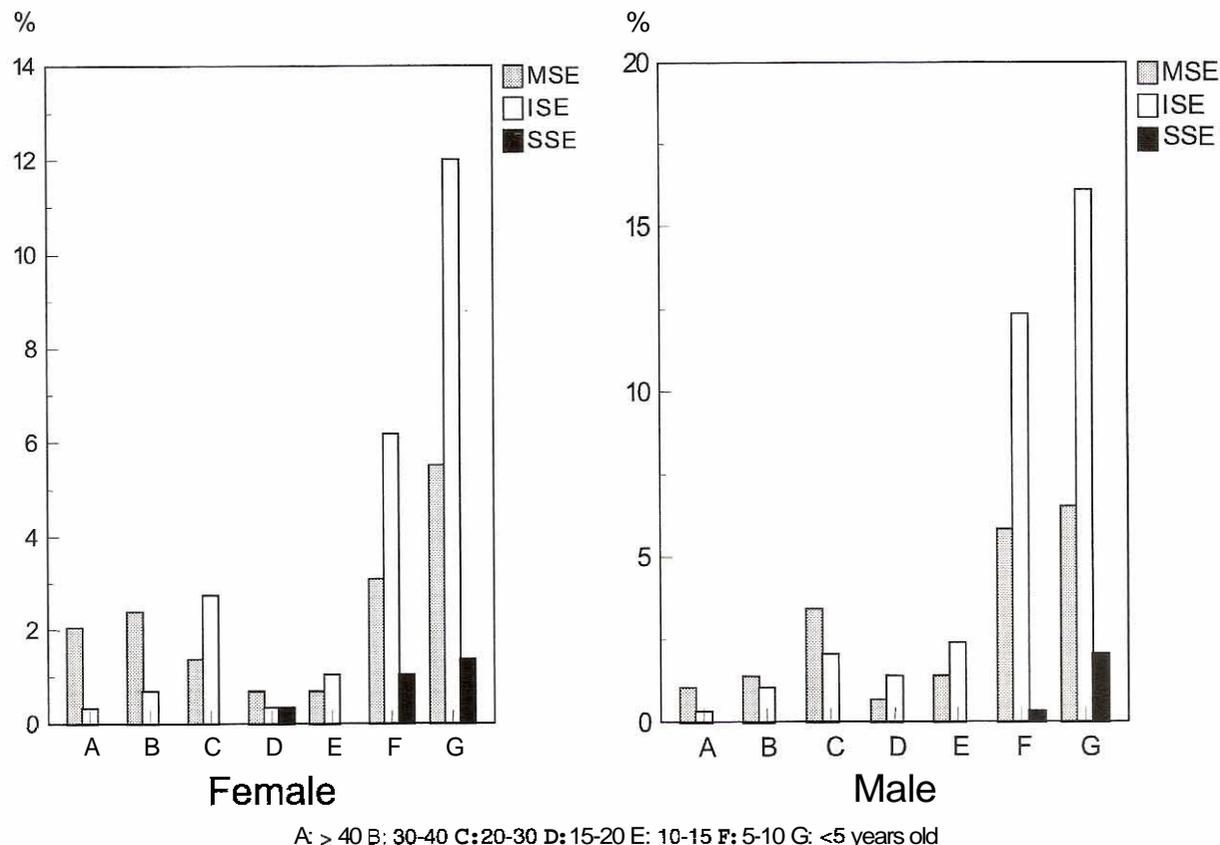
The patients rarely bring the scorpion specimen that has stung them to the hospital. In 56 cases that the animals were brought, 100% was *Tityus discrepans*.

RESULTS

A total of 1,045 scorpion envenomed patients (SE) studied from 1990 to 1996 was analysed in this work. The frequency distribution for ages was 18.4% (0-5), 13.6% (6-10), 9.6% (11-15), 11% (16-20), 11.4% (21-25), 8.3% (26-30), 7.8% (31-35), 6% (36-40) and 13.9% (>41) years old. 32% had less of 10 years old and 68% were distributed with similar values among the rest of age groups, confirmed with a T test ($P < 0.05$).

72% (753) (LSE) expressed only a few symptoms like pain in the place of the sting while 28% (292) belonged to the rest of considered categories (MSE, ISE AND SSE). These 292 patients had less than 11 years old and an important proportion of them presented moderate or severe symptoms (64.20%).

The FIG. 1 shows SE groups by age and sex. On comparing the percentages of SE among age groups by a T test ($P < 0.05$), significant differences for the distribution of cases in the ages up to 10 years old were not observed. Meanwhile, significant differences in patients less than 10 years old were detected.



Total number of patients: 292.

MSE: Moderate Scorpion Envenoming. ISE: intense Scorpion Envenoming. SSE: Grave Scorpion Envenoming (1 death, male < 5 years old)

FIGURE 1. SE CASES DISTRIBUTION ACCORDING TO SEX AND AGE GROUPS IN THE VALLEY OF CARACAS AND SURROUNDING CITIES BETWEEN 1990 to 1996.

TABLE I

SE PERCENTAGE DISTRIBUTION ACCORDING TO THE TIME OF ARRIVAL TO THE MEDICAL SERVICE (LMTH) AFTER THE SCORPION ENVENOMING ACCIDENT. CARACAS AND SURROUNDING CITIES, 1990 TO 1996 (n= 1.045)

Hours	LSE	MSE	ISE	SSE	Total
≤ 1	4.49	0.47	0.28	0.00	5.24
1-2	5.17	0.95	2.00	0.00	8.12
2-3	4.97	0.95	1.43	0.09	7.44
3-4	4.11	0.76	2.08	0.00	6.95
4-5	4.01	0.76	1.05	0.09	5.91
5-6	3.06	0.38	0.76	0.19	4.39
6	46.22	5.73	8.95	1.05 ^a	61.95
Total	72.03	10.0	16.55	1.42	100.00

LSE: Light Scorpion Envenoming. MSE: Moderate Scorpion Envenoming. ISE: Intense Scorpion Envenoming. SSE: Severe Scorpion Envenoming.

TABLE I shows SE percentage distribution for the Caracas valley and surrounding cities between 1990 and 1996 according to the time of arrival at the medical service after the accident. Six hours after the accident 61% of the patients arrived at the hospital.

TABLE II presents the monthly average percentage distribution of scorpion envenoming which occurred in the metro-

politan area of Caracas and surrounding cities between 1990 and 1996 in relation to the monthly precipitation in this region in those years.

In TABLE III, the SE percentage distribution for the different areas of the Caracas valley and surrounding cities between 1990 and 1996 is shown. It can be observed that towns located at over 1000 meters have the highest SE indexes: San Antonio

TABLE II

MEAN SCORPION ENVENOMED MONTHLY PERCENTAGE DISTRIBUTION AND RELATIONSHIP WITH THE DISTRIBUTION OF AVERAGE MONTHLY PRECIPITATION IN THE VALLEY OF CARACAS AND SURROUNDING CITIES BETWEEN 1990 AND 1996 [12]

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
SE%	3.7	5.0	9.7	13.8	18.5	12.3	8.3	8.5	5.6	7.2	4.1	3.3	100
Precipitation (mm ³)	9	8	13	31	86	126	118	162	125	143	103	32	956

de Los Altos- Los Teques (26.2%), Baruta-Hatillo-Hoyo de la Puerta (19.8%) and El Junquito (15.4%). These localities represent 61.4% of the SE, while 38.6% are distributed in ten towns down 800 meters.

DISCUSSION

Scorpions are predators that feed on diverse small prey, mainly insects and other arachnids. These arthropods have nocturnal habits. They hunt during the night, being more active in the twilight hours, while during the day they hide in dark places where they are not likely to be disturbed, under or in the cracks of rocks and in the bark and fissures in tree trunks. In dry atmospheres they become dehydrated and die relatively quickly. The scorpion principally lives in zones of high environmental humidity. Dispersion of the most mobile species as well as reproductive activity usually intensifies in the periods of the year when the environmental conditions are more favourable: for instance, in North African countries high rates of SE by the *Buthus* spp and *Androctonus* spp species are reported when Mediterranean climatic conditions prevail, with scorpion activity being concentrated mainly in summer [8]; while in the tropics it is reported that this level of activity occurs in the rainy season [10, 11]. In houses they usually take refuge in places equivalent to those of their natural habitat (dark, quiet and humid), being found relatively frequently inside shoes, in cardboard boxes with books, clothes or other stored objects, on shelves and in basements.

Scorpion envenoming is more frequent among agricultural workers [4, 8]. This results indicated that the probability of suffering a scorpion accident for both sexes was the same, but is more likely among children of pre-primary and primary school ages ($P = 0.72$). No significant differences for the distribution of the cases in the ages over 10 years old were obtained, but it was revealed that a significant proportion of patients were under 10 years old.

This situation is confirmed by several authors, who have also mentioned the high mortality observed in this age group when the victims are not treated within six to eight hours after SE occur [3, 4, 9]. Indeed, for Trinidad-Tobago 25% mortality in children under 5 years is reported [15]. In Mexico more than 300 annual deaths by scorpion envenoming are reported [4]. However, in the present research the mortality rate calculated

TABLE III
SE INCIDENCE STUDIED FROM LMTH PATIENTS IN DIFFERENT PARTS OF THE VALLEY OF CARACAS AND SURROUNDING CITIES, BETWEEN 1990 AND 1996 (n=1.045)

Place	SE%
San Antonio de Los Altos-Los Teques	26.2
Baruta-El Hatillo-Hoyo de la Puerta	19.8
El Junquito	15.4
El Valle-Coche	10.2
Antimano- La Vega	7.1
Caracas (Downtown)	5.2
Caracas (East)	1.5
Caracas (South)	1.4
Catia -Propatria	2.7
Filas de Mariche	2.7
Petare	4.6
Valles del Tuy	1.8
La Guaira	1.4
Total	100.0

for Caracas and surrounding cities between 1990 and 1996 was 0.78% (11128) for children less than 5 years old, TABLE IV, which was considerably lower than Trinidad-Tobago report. These children were treated within 6 hours of the scorpion envenoming, TABLE I. In all cases anti-scorpion serum (Pharmacy Faculty-UCV, Venezuela) was applied. This explains the short hospitalization period (between 0 and 3 days) and the lack of complications observed. It is worth mentioning that the only death recorded in the analysed data corresponded to a 5-year-old boy, who arrived to the medical service 6 hours after the SE.

This experience the clinical evidence (data not published) indicated that this period of time was considered critical and although four doses of anti-scorpion serum were administered, complications such as dehydration caused by vomits, tachycardia, bradycardia and acute lung oedema proved fatal.

TABLE IV
MODERATE, INTENSE AND SEVERE SCORPION ENVENOMING PERCENTAGE DISTRIBUTION FOR GROUPS OF AGE (n=292)

Groups of age	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	36 - 40	41	Total
MSE	11.98	8.9	2.05	1.3	3.08	1.7	2.39	1.7	2.7	35.8
ISE	28.28	18.49	3.42	1.7	3.63	1.3	1.3	0.34	0.68	59.14
SSE	3.42 ^a	1.3	0.0	0.34	0.0	0.0	0.0	0.0	0.0	5.06
Total	43.8	28.8	5.5	3.4	6.5	3.1	3.8	2.0	3.1	100

Total number of patients: 292. MSE: Moderate Scorpion Envenoming. ISE: Intense Scorpion Envenoming. SSE: Severe Scorpion Envenoming
^a 1 death, male < 5 years old.

SE starts to increase in January (3.7%) and peaks in May (18.5%), dropping thereafter until it reaches a low point of 3.3% in December. This corresponds directly to the pattern of rainfall in the Caracas valley, which have a bimodal rainfall regime [2,12]. A simple correlation analysis indicates that the pattern of monthly distribution of precipitation directly affects the number of cases of SE between January and June ($r = +0.66$, $P < 0.05$). Biologically this would correspond to the favourable effect of precipitation on the reproduction and dispersion of scorpions, which increase with the arrival of rains and diminish toward the end of rainy season [10], as occurs with other species of arthropods in this region [13]. The probability of suffering SE when rains begin is higher than in the rest of the year [7, 8].

With respect to the geographical location of the SE cases (61.4%) the towns of San Antonio de Los Altos, Los Teques, Baruta-Hatillo, Hoyo de la Puerta and El Junquito are located in the typical habitat of *Tityus discrepans*, Pocock, 1897 over 1,000 meters altitude, while the remaining SE cases were found in ten towns that were down 800 meters of altitude, where the respective scorpion species are less frequent.

A detailed analysis of the time-Table distribution of SE evidences that the highest percentage (42.8%) is concentrated between 6:00 am and 12:00 midday. An equivalent situation has been observed in Tunisia where the highest percentage of SE occurs in the early morning [8]. This data from this work indicated 86.8% of SE occurring inside the home, 8.6% at work, 3% in the field, and 1.6% in the peridomiciliar area. At home SE occurred almost exclusively inside bedrooms, when people were putting shoes on, dressing, lying in bed or cleaning. The most frequent SE is on the arms and fingers (49.8%) and the legs and toes (43.0%), with the rest of the body accounting for small percentages (neck 1.6%, abdomen 1.6%, face 1.7%, and 2.3% for other parts of the body).

Tityus discrepans is considered responsible for most of the scorpion envenoming in Caracas valley and surrounding cities [3,7]. In the studied area high proportion of population lives inside or very close to the *T. discrepans*, Pocock, 1897 natural habitat, therefore, there is a high probability of scorpion envenoming in the zone.

RECOMMENDATIONS

New epidemic studies, including other areas of Venezuela, it will be necessary to know with more certainty, the clinical behaviour of the patients envenomed by scorpions of different genera and the bioecological characteristic of these arachnids in the whole national territory. It will be important also, to deepen in the therapeutic considerations of these accidents.

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