

CLINICAL-DEMOGRAPHIC ASPECTS OF SCORPION STING IN AL SULAIMANEYAH PROVINCE: HOW FREQUENT IS HYPOCALCAEMIA IN THE VICTIMS?

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Abstract

Background: Injuries from scorpions and other insects usually causes local symptoms such as pain, redness, swelling and itching; most are non venomous or mildly venomous. The main effect of the sting comes from the venom, which is water soluble, antigenic, heterogeneous mixture of enzymes and substances. Systemic symptoms and signs of envenomation appear in 15 % of those who sustain scorpion stings, presented as diverse cardiovascular and neuromuscular features, while some patients may present with other features such as excessive salivation, dysphagia, and nausea and vomiting which may reflect hypocalcemia, causing autonomic storm and acetylcholine excess. There are a few papers in the literature about hypocalcaemia and it seems to have been underestimated and largely ignored as a presentation of scorpion sting; but it may be the cause of most neuromuscular features in scorpion victims`

Aim: This work aimed to find the frequency of hypocalcaemia in victims of scorpion stings in the Al Sulaimaniyah province and to raise awareness of the problem in our practice, in order to manage the patients in time with better outcomes.

Methods: All the victims of scorpion sting who arrived at the Casualty Hospital in Al Sulaimaniyah City during a 12-month period were considered; in addition, the retrospective period 1st March 2009 to 1st September 2009 and from 1st March 2010 to 1st September 2010 as the prospective periods of the work. Al Sulaimaniyah Teaching Hospital is a tertiary hospital in Al Sulaimaniyah City, Kurdistan, Iraq, which serves a population of 1.25 million people.

Demographic data were recorded, including the histories of the stings and the physical findings of the victims. When hypocalcaemia was suspected Chvostek-Weiss and Trousseau's signs were elicited and blood from the patient was sent for investigation including serum calcium.

Results: Most of the patients sustained the sting on an upper limb (170/318 = 53%) and most were stung once, although a small number had multiple sting marks. Although the sting of a scorpion is sharp and it is not easy, in the presence of local edema and sweating, to identify the number of stings, we noticed two sting marks (2/318 = 06%) and three sting marks (3/318 = 0.94%). More than half the stung patients came from a city (62%), most of them were stung between 6pm and 12 midnight (111/318 = 34.9%) or between 6am and 12 noon (79/318 = 24.8%). Most of them reached the Casualty Hospital within one hour of being stung (186/318 = 58.5%). All the victims were tested for serum calcium and serum electrolyte; while eighteen patients showed features of hypocalcaemia. In 13 of these (13/18 = 72.2%) this had turned to hypocalcaemia (less than 8.5 mg/dl), but none of them showed any other electrolyte abnormality. These 13 patients were sent for ECG, which in nine cases gave normal readings, but the rest (4) showed a shortened ST segment and two of them had ventricular ectopics.

Conclusion: Hypocalcaemia is evident in scorpion victims; in our practice in casualty wards, we should be more suspicious of this possibility. We suggest a routine estimation of serum calcium in victims of scorpion stings.

Keywords: Scorpion sting, hypocalcaemia, Chvostek-Weiss and Trousseau's signs

Introduction

Injury from scorpion and other insects causes usually local symptoms such as pain, redness, swelling and itching, but is for the most part non venomous or mildly venomous. (National Department of Health, Pretoria-2008)

Scorpion sting is, however, responsible in many countries for a number of deaths each year, of even greater importance is the loss of economic productivity and human potential resulting from serious, but non-fatal envenomation which occurs annually in otherwise healthy children or working adults, (Plorde J- 1985) in particular those living in poor rural communities where medical resources are often sparse. (WHO – 2007) Worldwide, moreover, nearly five million snake bites and scorpion stings are recorded annually, (WHO,BMJ-2007) (which may do different kinds of harm and significant mortality if left untreated.

The main effect of scorpion stings is derived from the venom, which is a water soluble, antigenic, heterogeneous mixture of enzymes and substances; it accounts for the varied reactions of patients who suffer it. Furthermore the various constituents of the venom may act directly or indirectly and individually or synergistically to manifest their effect. (WHO – 2007)

Infants and children are more severely affected by the toxicity of envenomation, attributable to their small body mass and the high proportion of stings to the head, neck, and body and also to the creature's poor withdrawal reflex from the sting, which gives it the chance of repeated stings, injecting more venom (Hisham M.A. Mahab – 2003).

Generally scorpions inoculate their venom into the interstitial space, (ISMAIL M - 1995, ISMAIL M – 1992) which acts very quickly. Most stings occur in rural areas, distant from health services, where no effective antivenin may be available. Although a study reported that antivenin does not change the clinical outcome of the scorpion victims (Bernard Foëx-2005) it does reduce the concentration of the venom in the blood. (Bernard Foëx-2005) The prognosis depends mainly on the length of time from the sting to arrival at the health center, when supportive management will be started. (ISMAIL M – 1992)

In 15 % of those who sustain scorpion stings, systemic symptoms and signs of envenomation appear, (Hisham- 1997) presented as diverse cardiovascular and neuromuscular features, while some patients may present with other features such as excessive salivation, dysphagia, nausea and vomiting, which may reflect hypocalcemia as causing autonomic storm and acetylcholine excess (Anthony F-2000). Few papers in the literature discuss hypocalcaemia, a forgotten presentation of scorpion sting (El Amin E -2003, El Amin E -1991, Ken Dittrich-2002, Ken Dittrich- 1995); it seems to be underestimated and may be the cause of most neuromuscular feature (Hisham- 1997, ISMAIL M – 1992). The present study aimed to find the frequency of hypocalcemia in victims of scorpion stings in the Al Sulaimaniyah province, so as to raise awareness of the problem in our practice and in turn to manage patients in time with better outcomes.

Patients & Methods

A double surveillance double study for two consecutive years was set up, to consider 318 cases of scorpion stings in 2009 and 2010. The physicians on duty at the Casualty Hospital in Al Sulaimaniyah City were asked to complete a questionnaire; it sought data about demographic aspects of the victims, the conditions of the sting, the clinical features of the victims, features of hyperkalemia and the options in management.

All the victims of scorpion sting who arrived at the Casualty Hospital in Al Sulaimaniyah City during a 12- month period were included and two further 6-month periods were added, 1st March 2009 to 1st September 2009 as a retrospective period and 1st March 2010 to 1st September 2010 as a prospective period. Al Sulaimaniyah Teaching Hospital is a tertiary hospital in Al Sulaimaniyah City, Kurdistan, Iraq, which serves a population of 1.25 million people.

Demographic data were recorded and histories of the stings were taken, including such physical features as carpopedal spasm (Ganesh Athappan- 2009), (*The wrist and metacarpophalangeal joints flex, the DIP and PIP joints extend, and the fingers adduct. The sign is also known as main d'accoucheur (French for "hand of the obstetrician") because is supposedly resembles the position of an obstetrician's hand in delivering a baby*), hyperreflexia and tetany in the victims were recorded. When hypocalcaemia was suspected two signs were elicited: Chvostek-Weiss (*An indication of tetany in which a unilateral spasm of the oris muscle is initiated by a slight tap over the facial nerve anterior to the external auditory canal*) (Helmut GRÖGER- 2001) and Trousseau (*a medical sign observed in patients with low calcium, a blood pressure cuff is placed around the arm and inflated to a pressure greater than the systolic blood pressure and held in place for 3 minutes. This will occlude the brachial artery. In the absence of blood flow, the patient's hypocalcemia and subsequent neuromuscular irritability will induce spasm of the muscles of the hand and forearm*) (Kumar, Abbas-2005) and blood from the patient was sent for investigation, including serum calcium. Drawing 4-mL samples from forearm veins and leaving the tourniquet in place for no longer than 1 minute, the sample was put in red topped or red/gray topped, tubes and were sent to the laboratory within 1 hour (Chernecky-2007), total serum calcium estimated by the *O-Cresol Phtalein Complexone* method. Serum calcium was repeated every hour for 4 hours, and for those with hypocalcemia every 6 hours for 48 hours or until the serum calcium level returned to normal.

Supportive treatment accordingly with observation of the patients was called for in most of the cases. Scorpion antivenom (*Scorpival vials IV, equine immunoglobulin F (ab) 2 fragments, Sanafi Pasteur Company*) were given on a clinical basis for those who had moderate (9 patients =2. 81 %) and severe envenomation (5 patients =1. 56 %) after performing a sensitivity test (by raising a wheal of antivenom in the ventral aspect of the left forearm “for right handed people and vice versa”). When the result was negative (in 14 victims) there was no obvious clinical reaction after 10 minutes. Antivenin was given intravenously as a core treatment and the patients were treated accordingly. None of those

who received antivenin (14 patients) developed anaphylaxis, but we could not say that the skin test precluded the risk of anaphylaxis developing. Auxiliary drugs were given the general treatment of symptoms and signs of envenomation, i.e., **Ampicillin-Cloxacillin** vials 500mg intravenously every 6 hours, intravenous fluid in the form of ringer lactate, diazepam 10mg administered slowly for sedation and a local injection of local anesthesia (2% plain Xylocaine). But those who had features of hypocalcemia were admitted to the Intensive Care Unit. There they received a calculated intravenous dose of calcium gluconate slowly over 10 minutes and repeated until the serum calcium level returned to normal and there was a clinical response in the disappearance of such features as difficulty in swallowing, dribbling and choking, agitation and difficulty in respiration.

All data were recorded by filling in the questionnaire and were analyzed using the SPSS (statistical package for social science) version 16.

A Qui -square analysis was made, P values less than 0.05 were considered positive and statistically important.

Results

Females outnumbered males (F / M ratio 6/4) (Table1), with ages ranging from 5 months to 80 years and mean age of (35±9.8) years and peak age of 27 years.

Most of the patients sustained the sting on an upper limb (170/318 = 53%) and most of the patients were stung once, although a small number had multiple sting marks i.e. Two stings (2/318 = 06%) and three sting marks (3/318 = 0.94%) were also found (see Table 2). Most (62%) of the victims came from a city, the accidents mainly occurring between 6pm and 12 midnight (111/318 = 34.9%) or between 6am and 12 noon (79/318 = 24.8%). Most had taken less than one hour to reach Casualty hospital (186/318 = 58.5%).

The scorpion sting victims arrived between March and August in both 2009 and 2010, with the peak incidence of stings in August in both years and the lowest incidence in March in both years (Table 3).

About one third (no= 121, 38.00%) of the scorpion victims were from outside Al Sulaimaniyah city, although a large number (no=83, 26.10%) came from other cities such as like Rania, Halabja, Sayed sadiq, Kalar, Penjween, etc. The total number of patients from cities was 204 (64.15%), and most of the stings (no=204, 64.15%) were inflicted indoors (Table4)

Patients were referred to Al Sulaimaniyah Teaching hospital for different reasons: more than half (146 patients in 2009 and 6 patients in 2010) were referred because of the

unavailability of medical services regarding the management of the scorpion stings in rural areas or other cities and the rest for different reasons (Table 5).

Comparing the results of year 2009 (retrospective) with those of 2010 (prospective), the main features in both years were pain in $262/274 = 95.6\%$ of the victims in 2009 and of $44/44 = 100\%$ of the victims in 2010.

Investigations of Hemoglobin, for example, were requested for 271 patients (98.9%) in 2009 and in 2010 for all the patients ($44 = 100\%$) and serum calcium was sent for investigation in only 24 cases (8.70%) in 2009 but in all 44 cases (100%) in 2010 (Table 6).

Thirteen patients in 2009 and 5 patients in 2010 were suspected to be suffering from hypoglycemia; the results from the laboratory confirmed that 13 (72.2%) of them (*11 in 2009 and 2 in 2010*) had hypocalcemia. These 13 patients were sent for ECGs; 9 of the ECGs were normal but of the remainder (4 ECGs), 2 had a shortened ST segment and ventricular ectopic (Table 7).

Most of the patients were managed supportively without antivenom administration. Only 12 (3.80%) patients received antivenom with supportive management and a minority (2 = 0.7%) patients received antivenom alone (Table 6).

Only a few patients ($5 = 1.80\%$) who were female developed local changes; other minority groups of both genders had developed neuromuscular signs (male: 5 patients = 1.80% and female: 7 patients = 2.20%), cardiovascular signs (males: 7 patients = 2.2% and females: 3 patients = 0.94 %) (Table 8).

Discussion

More than half the victims in this paper were females while in the literature “males were more affected than females”. More indoor incidents than others were recorded here; but the literature reports most of the sting as resulting from outdoor exposure to scorpions (Hisham-1997). This may be due to differences in the topography and structure of the cities in our locality compared to others.

The results show that local features developed in females alone; this may be explained by the vulnerability of female tissue and the presence of more subcutaneous fat, which delays absorption and helps to produce more peripheral fixation of the toxin, resulting in more local features (ISMAIL M-1992).

The incidence of scorpion stings, as noted, started in March, increasing gradually to a peak in August in both 2009 and 2010 – more than three-quarters of the stings occurred in the summer months, which is parallel to the literature (Hisham-1997). While a recent 5-year surveillance study in Saudi Arabia showed a higher incidence of stings in the months of May

through October, (Jahan S – 2007) another study also reported June as the highest month for stings, and February as the lowest. (Shahbazzadeh D-2009) This may be due to the difference in the length of hot seasons in the two areas. In our area, pre-summer high temperatures begin in the middle of April and the weather becomes cooler in the middle of August.

In 2009 there were two deaths, one of a male and one of a female, both adult patients (0.79%) among the scorpion sting victims. There are different reports of mortality in the literature, i.e., reports of high fatality and mortality rates (25%–30%) from western India (1961–83), (Simons FE -2006, Christopher Burton-2010, H S BAWASKAR-1999), seven deaths per 100,000 in the south of Libya, 84 deaths per 100,000 per year in Mexico, 24 deaths per year in Algeria (Anthony F-2000) and an average of 0.40% over five years of monitoring in Morocco, 0.25% in Tunisia and 0.35%, in Argentina. (H S BAWASKAR-1999) However, it was recently reported that in India, “There have not been any deaths over the past few years due to scorpion sting”. (EL OUFIR R -2008 The reason for the low mortality reported in this area and in this paper may be the small size of our sample and the types of scorpion native to our locality, which needs more exploration in the future by other studies, including a larger sample size, identifying the types of scorpion living in the area and the types of venom that they carry.

Results showed that the upper limbs are the most often stung areas of the body and this is consistent with Shahbazzadeh et al. -2009), who found that 39.3% stings occurred on the hands and 37.3% stings occurred on the feet (Shahbazzadeh et al. -2009) Yet a larger study showed that the most common site of stings (60, 0%) was the feet. (Hisham M – 1997)

Most of the stings occurred from 6pm to 12midnight and were indoors. The increased frequency of stings during the night may be due to the increased risk of accidental contact with a scorpion in the darkness. (Hisham M.A-1997)

The prospective study part of the present work was better than the retrospective part because the data documentation and investigation which were sent were documented clearly the prospective part but in the retrospective part many data were missing in the medical documentation (Table 3).

Most of the patients (94.6% in 2009 and 100% in 2010) were treated by supportive treatment, analgesia, antibiotics and the local injection of local anesthesia. This is consistent with results from Riyadh, Saudi Arabia, where it is reported that symptomatic treatment without the use of antivenom was successful in the management of 205 cases of scorpion sting and that no deaths ensued. (Hisham M.A-1997, David Cheng-1997)

ECGs were given to those who had features of hypocalcaemia and those in impending shock or with cardiovascular features. Nine of ECG s were normal but four patients had shortened ST segment and two of these ventricular ectopic also; however, a study by Bawaskar reported a higher incidence of changes on ECG, i.e., ventricular fibrillation (Christopher Burton – 2010, Warrell D-1987, Neale JR-1990, S B DESHPANDE-2000)

Experimentally, autonomic stimulation also causes significant biochemical disturbance, such as hypoglycemia, hypocalcemia, etc. (Ken Dittrich – 1995). In this work the hypocalcemia of eleven patients (3.98%) from 2009 and two (4, 50%) patients in 2010 from a total of 18 patients who were suspected of having hypercalcemia ($13/18 = 72.2\%$), turned to a level of less than 8.5 mg/dl, while no incidence was mentioned by other writers and only a few references were found in the literature to hypocalcemia in scorpion victims, i.e., “Mild hypocalcemia” (El Amin E- 2003), “In some patients hypocalcemia was encountered” (El-Amin – 1991) and “transient hypocalcemia” (Ken Dittrich 2002, Ken Dittrich-1995) .This may allow us to conclude that the incidence of hypercalcemia was 3.9%-4.5%, which is noteworthy; we need in our practice to be more aware of this risk in scorpion victims in casualty wards.

Conclusion

Hypocalcemia is evident in scorpion victims; we need in our practice to be more aware of this risk in scorpion victims in casualty wards. We suggest the routine estimation of serum calcium in victims of scorpion stings.

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Table I: frequency of gender distribution in 2009 and 2010

Year	Females	Males
2009	156	118
2010	26	18
Total	182	136
Frequency	57.2	43.8

Table II: Time and numbers for sites including time. From accident till reaching to the hospital

Variables related to sting	Frequency	Percent
Time from sting to hospital		
<i>1 Hour</i>	186	58.5
2 Hours	36	11.3
4 Hours	36	11.3
8 Hours	21	6.6
12 Hours	17	5.3
24 Hours	13	4.1
More than 24 Hours	9	2.8
Site of sting		
Head and neck	4	1.3
<i>Upper limb</i>	170	53.5
Lower limb	134	42.1
Trunk	5	1.6
Multiple	5	1.6
Number of sting		
<i>1</i>	313	98.4
2	2	0.6
3	3	0.9
Time of sting		
6-12 am	79	24.8
12-6 pm	61	19.2
<i>6-12pm</i>	111	34.9
12-6 am	67	21.1

Table III; The incidence of the scorpion stings over the spring and summer months in 2009 and 2010

Month	2009	2010	P value
March	2	2	0.043
April	35	3	
May	8	2	
June	49	6	
July	52	11	
August	130	20	
total	276	44	

Table IV; The geographic distribution for the accidents location

Residency	Location of the accident
Al Sulaimaniyah City 121 38.00%	Indoor 100 31.44%
	Outdoor 21 6.60%
Other cities 83 26.10%	Indoor 70 22.01%
	out door 13 4.09
Villages and urban 114 35.9%	Indoor 34 16.70%
	Outdoor 80 25.15%

Table V: reason to referras to Al Sulaimaniyah Teaching Hospital

Reference	2009	2010	Reasons	P value
Rural areas	146 (53.28%)	5 (11.36%)	Management not available	0.035
Other cities(Rania, Halabja, Ssayed sadiq, Kalar, Penjween...etc)	23 (8.39%)	0 (0.00%)	dysphagia	
	31 (11.31%)	0 (0.00%)	anemia	
	5 (1.82 %)	0 (0.00%)	Moderate dyspnea	
	14 (5.10 %)	1 (2.27%)	coma	
Total	219 (79.92%)	6 (13.63%)		

Table VI: Comparison of main clinical features and the investigations of the victims in two years

Variables	Years of research		P value
	2009 N (%)	2010 N (%)	
Main features			NS*
Pain	262 (95.60%)	44 (100.0)	
Local signs and changes	3 (1.11%)	2 (4.54%)	
Neuromuscular features	2 (0.73%)	10 (22.70%)	
Cardiovascular features	5 (1.80%)	5 (11.35%)	
ECG			NS
Not performed	265 (96.70%)	40 (90.01%)	
Normal	9 (3.30%)	4 (9.09%)	
hemoglobin (mg/dl)			NS
Less than 10 mg/dl	3 (1.11%)	0 (0.00%)	
10-15 mg/dl	271 (98.90%)	44 (100.0)	
Serum calcium (mg dl)			NS
Not send	252 (91.30)	00 (00.00.0)	
Less than 8.5	11 (3.98%)	2 (4.50%)	
8.5-10.5	13 (4.71%)	42 (95.50%)	
More than 10.5	0 (0.00%)	0 (0.00%)	
Managements			NS
Supportive	260 (94.90%)	34 (72.30%)	
Supportive, antivenom	2 (0.73%)	10 (22.70%)	
antivenom alone	2 (0.73%)	0 (0.00%)	

*NS; non significant statistically as P value is grater than 0.5.

Table VII: Main clinical features, and investigation of the victims

Variables	Frequency	Percent
Main features		
Pain		
Local signs and changes	318	100.00
Neuromuscular signs	5	1.80
Cardiovascular signs	12	3.80
	10	3.14
Hemoglobin (mg dl)		
Less than 10	3	0.90
10-15	315	99.10
Serum calcium (mg dl)		
No send	300	94.30
Less than 8.5	13	4.10
8.5-10.5	5	1.80
More than 10.5	0	0.00
ECG		
Not performed	305	95.91
Normal	9	2.83
Abnormal	4	1.25

Table VIII: comparison of time and numbers vs site and time from accident till reaching the hospital in 2009 -2010

Variables	Years of research		P value
	2009 N (%)	2010 N (%)	
Site of sting			
Head and neck	4(1.5)	0(0.0)	NS*
Upper limb	150(54.7)	20(45.5)	
Lower limb	110(40.1)	24(54.5)	
Trunk	5(1.8)	0(0.0)	
Multiple	5(1.8)	0(0.0)	
Time from sting to hospital			
1 Hour	162(59.1)	24(54.5)	0.007
2 Hours	27(9.9)	9(20.5)	
4 Hours	30(10.9)	6(13.6)	
8 Hours	21(7.7)	0(0.0)	
12 Hours	16(5.8)	1(2.3)	
24 Hours	13(4.7)	0(0.0)	
More than 24 Hours	5(1.8)	4(9.1)	
Number of sting			
1	269(98.2)	44(100.0)	NS
2	2(0.7)	0(0.0)	
3	3(1.1)	0(0.0)	
Time of sting			
6-12 am	69(25.2)	10(22.7)	NS
12-6 pm	53(19.3)	8(18.2)	
6-12pm	90(32.8)	21(47.7)	
12-6 am	62(22.6)	5(11.4)	

*NS; non significant statistically as P value is grater than 0.5.