

*3-year-old male child with hypertension
uncontrollable vomiting, sympathetic manifestations (pallor,
piloerection, prolonged time of capillary filling and priapism*

Marcelo Garcia Leal M.D. Ribeirão Preto- São Paulo – Brazil

English

Dear Andrés,

I find that this case is very interesting for the network; a 3-year-old child, admitted in the ER of the Hospital das Clinicas USP from Ribeiro Preto, with uncontrollable vomiting, with information from the mother that when putting the child in bed, he started crying and yelling touching his head. In the physical examination at admittance, he was in a poor general state, pale, piloerection, no fever, acyanotic, anicteric, regular heart rhythm in 2 times, BP: 142x102, HR: 60 (?), respiratory auscultation with diffuse rattles, dyspneic; respiratory rate: 40, O2 saturation: 98%, time of capillary filling greater than 5 sec, presence of priapism, Glasgow 7 (AO: 1, RV: 2, RM: 4).

In the attachment you will find the ECG of the child.

I will send the evolution and the final diagnosis after hearing your opinions,

Warm regards,

Portuguese

Caro Andrés,

Acho esse caso interessante para ir para a rede, criança de 3 anos deu entrada na unidade de emergência do Hospital das Clínicas USP de Ribeirão Preto com vômitos incontroláveis, com informação da mãe que ao colocar criança na cama esta começou a chorar e a gritar levando a mão a cabeça. Ao exame físico da entrada estava em mal estado geral, descorada, piloereção, afebril, acianótico, anictérico, ritmo cardíaco regular a 2 tempos PA: 142X102 FC:60 (?), ausculta respiratória com estertores difusos, dispneico FR: 40, saturação de O2: 98%, tempo de enchimento capilar maior que 5 segundos, presença de priapismo, Glasgow 7 (AO:1, RV:2, RM:4).

Segue em anexo o ECG da criança.

A evolução e o diagnóstico final mandarei após ouvir as opiniões.

Um abraço,

Marcelo Garcia Leal M.D. Ribeirão Preto- São Paulo – Brazil

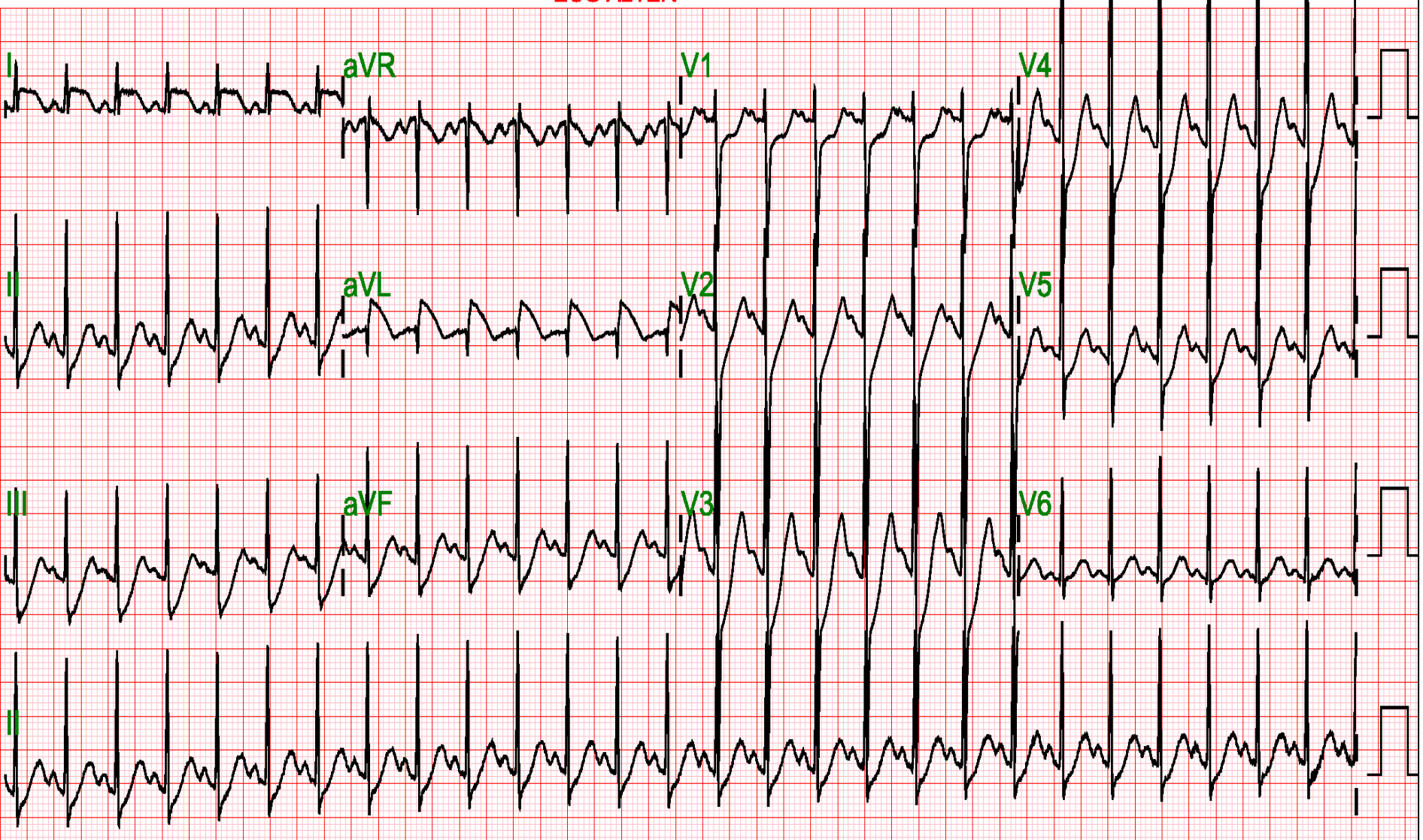
Axes

P	Ind
QRS	29
T	38

Requested by:

- ECG ALTER -

Diagnóstico não confirmado



Colleagues opinions

Do you have some biological and echocardiograph data ? medications ? familial history and ECG from the parents ? looks like lateral "Brugada like" ST elevation

I would suspect myocarditis in this child at least at first look but I'm waiting for other parameters

Philippe Maury mauryjphil@hotmail.com

Marcelo e Andres

A clinica é soberana:

Esta criança tem quadro neurológico compatível com acidente por animal peçonhento (escorpião ou aracnideo).

Criança de baixo peso, com menos de 6 kg, podem ter quadro severo e morte por esse tipo de acidente.

Sendo originario da região de Ribeirão Preto, esta é minha primeira hipótese.

O ECG está alterado em função do quadro neurológico.

Claudio Pinho MD,

English

Marcelo and Andrés: The Clinic is sovereign:

This child has neurological symptoms compatible with accidents caused by venomous animals (scorpion or spider).

Underweight children, (under 6 kg) can have severe and death from this type of accident.

Being from the region of Ribeirão Preto, this is my first hypothesis.

The ECG is abnormal consequence of neurological damage.

Claudio Pinho MD, Brazil,

Professor Cardiologia Faculdade de Medicina na PUC-Campinas Sao Paulo – Brazil,

English

Dear friend Prof Andrés Ricardo Pérez Riera PhD I think that the young male boy suffers from .most probably, a sympathetic adrenergic release . due a feocromocitoma The signs of an high lateral myocardial injury is due to adrenaline effect ,and less noradrenalin as well the very low pressure differences

**The other possibility is a scorpion beat
my kindly regard**

Samuel Sclarovsky M.D. From Israel

Castellano/Spanish

**Querido amigo Profesor Andrés: Pienso que este chico presenta una liberación masiva de adrenalina. Consecuencia de un feocromocitoma. La corriente de lesión el pared lateral alta es causada por la adrenalina, y menos por noradrenalina asi como la diferencial reducida
La otra posibilidad es la picadura de alacrán.**

Samuel

Finals comments

By Andrés Ricardo Pérez-Riera.M.D.Ph.D,

“It seems, from what I gather, to be one of those simple cases which are so extremely difficult”

Sherlock Holmes.

ECG diagnosis:

1. **Heart rate:** 167bpm (Normal maximal limit: 120 bpm at three years old of age)
2. **Sinus tachycardia**
3. **QRS duration** 78ms: Normal. (average 70 ms; maximal normal limit 80 ms at three years old.)
4. **Normal QRS voltage on precordial leads** There are not criteria for LVH because **voltage of QRS Complexes In Precordial Leads in children from three to eight years old** are:**V1:** average voltage of R wave 7 mm. Maximal 18 mm. Average depth of S wave 14 mm. Maximal 30 mm.**V5:** average voltage of R wave 21mm. Maximal 36 mm. Average depth of q wave 2 mm. Maximal up to 6 mm. Average depth of S wave 5 mm. Maximal 14 mm.**V6:** average voltage of R wave 14 mm. Maximal 24 mm. Average depth of q wave 1.5 mm. Maximal up to 4.5 mm.Average depth of S wave 1mm. Maximal 5 mm.
5. **ST segment elevation convex to the top in high lateral leads I and aVL:** Subepicardial Injury current. “Brugada-like ECG pattern in aVL”
6. **Mirror image or reciprocal changes in inferior and anteroseptal leads:** Reciprocal ECG changes generally refer to leads with ST segment depression that face the “ischemic boundary” in patients with acute ST segment elevation ischemic events. During an acute ST-segment elevation myocardial infarction (STEMI) ST segment elevation is present in leads that face the region of transmural injury. ST segment depression in the setting of ST segment elevation in other leads can also be a result of an injury current vector resulting from transmural myocardial ischemia. Reciprocal ST-segment depression simulating additional subendocardial ischemia is commonly observed in STEMI. Consequently, it may be a marker of an independent additional zone of injury. Reciprocal electrocardiographic changes are considered when ST-segment elevation and broad upright T waves in leads that are mirrored perfectly by reciprocal ST depression and T-wave inversion in other leads. Many theories have been advanced to help explain reciprocal changes. Computer modeling has shown that as the ischemic zone extends from the endocardium to the epicardium, it creates a relatively positive area above the ischemic zone, and a relatively negative area at the ischemic boundaries (1).

This computer model explains why reciprocal changes may appear prior to ST segment elevation. Some authors have suggested that the first sign of acute inferior STEMI is a downsloping ST segment in lead I and aVL. Reciprocal changes can be subtle, and may present as nothing more than a flattening of the ST segment in the reciprocal leads. Clinical situations where the direction of the ST injury vector is limited include: the presence of a previous infarction, preexisting abnormalities of the ST segment, LBBB and RBBB, ventricular pre-excitation, multivessel disease, abnormal site of origin of a coronary artery, and dominance or underdeveloped coronary arteries. When the ST segment deviation is minimal it may be difficult to differentiate the abnormal ST segment changes of transmural myocardial infarction from normal ERP. One of the following criteria is required for the diagnosis of a transmural MI: ST segment elevation at the J point of ≥ 1.0 mm in two or more limb leads or ≥ 2.0 mm in two or more precordial leads, and ST segment depression at the J point ≥ 2.0 mm in at least two of the three leads V1 to V3. Reciprocal changes are not the exclusive findings of ST segment elevation acute coronary syndrome. This phenomenon is also observed in patients with the typical type 1 ECG Brugada pattern, the Haïssaguerre ECG pattern (also called atypical Brugada ECG phenotype), and in overlapping Brugada / Haïssaguerre pattern. Also seen in these patients is a lambda wave morphology (QRS complexes resembling the Greek letter lambda) with J point and ≥ 2 mm ST segment elevation in the inferior, lateral, or inferolateral leads with concomitant reciprocal image in the anterior wall. Recently, transient J-wave appearance in the inferior-lateral leads during electrical storm in a patient with BrS it has been reported. (see the next two slides 11 and 12)

7. QT/QTc: 278/476 Prolonged QT interval

Normal ECG parameters in children from three to eight years old

-Heart Rate: Normal minimal limit: 80 bpm at three years old, 85 bpm at four years, 65 bpm at 6 years; after this age the same as adults: 60 bpm. Normal maximal limit: 120 bpm at three years old, 115 bpm at 4 years; after 6 years the same as adults: 100 bpm.

-Rhythm: sinus.

-P wave: SAP: between 0° and $+90^\circ$. Average $+60^\circ$. Duration: up to 100 ms. Voltage: maximal limit 2.5 mm. P polarity: the same as the previous age group between 0° and 90° .

-PR interval: average 130ms (0.13 s). Maximal normal limit 160 ms for rates between 80 and 120 bpm.

-SAQRS In Frontal & Horizontal Planes:

FP: average $+60^\circ$. It may vary between -5° and $+90^\circ$.

HP: slightly intermediary posterior or possibly anterior. R/S ratio in V2 is lower, equal or greater than 1 respectively. Isodiphasism predominates in V2, i.e. AQRS in the HP is intermediary and pointing towards X.

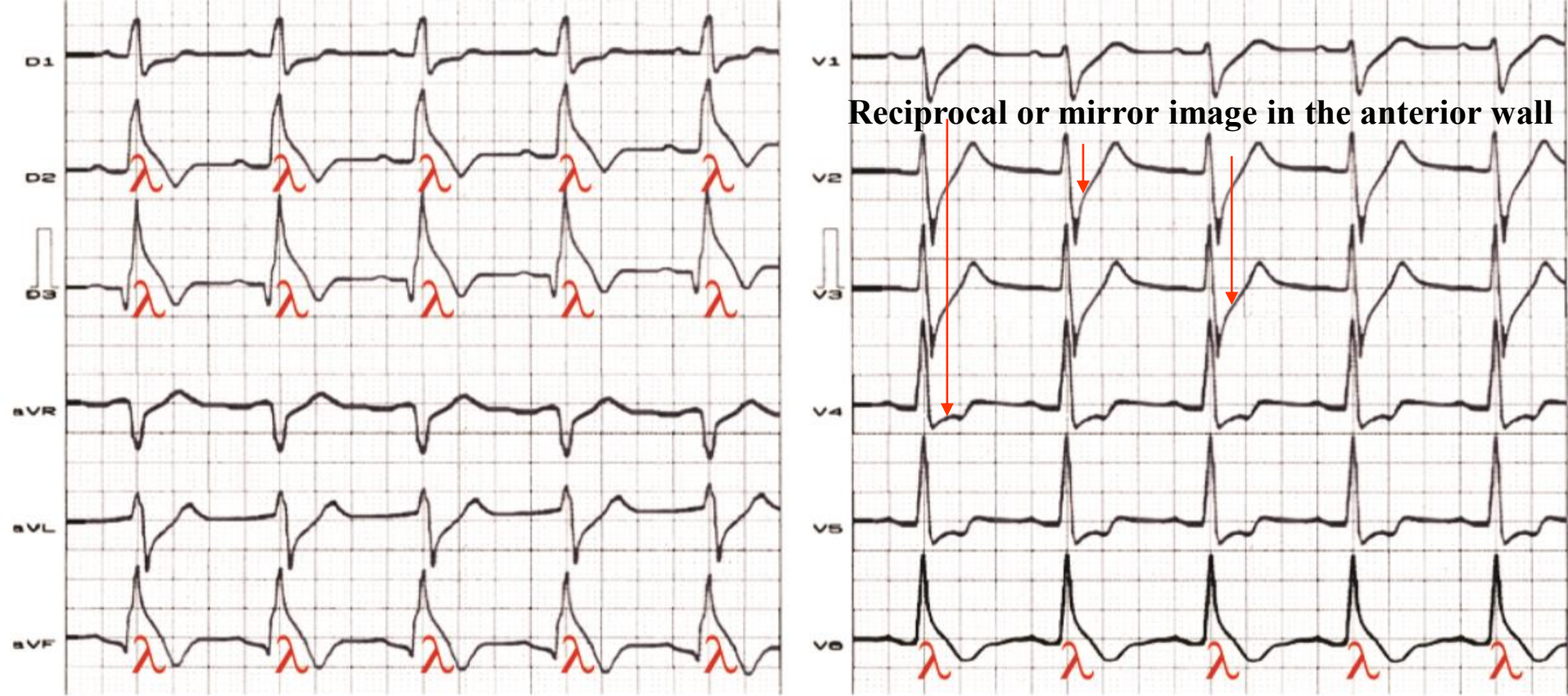
Duration of QRS complex: average 70 ms; maximal normal limit 80 ms. R/S ratio in precordial leads: The so called “adult progression” of the R/S ratio begins in precordial leads, i.e. progressive increase of voltage of R wave from V1 up to V5 and concomitant decrease of S up to V6.

-Voltage of QRS Complexes In Precordial Leads:

V1: average voltage of R wave 7 mm. Maximal 18 mm. Average depth of S wave 14 mm. Maximal 30 mm.

V5: average voltage of R wave 21mm. Maximal 36 mm. Average depth of q wave 2 mm. Maximal up to 6 mm. Average depth of S wave 5 mm. Maximal 14 mm.

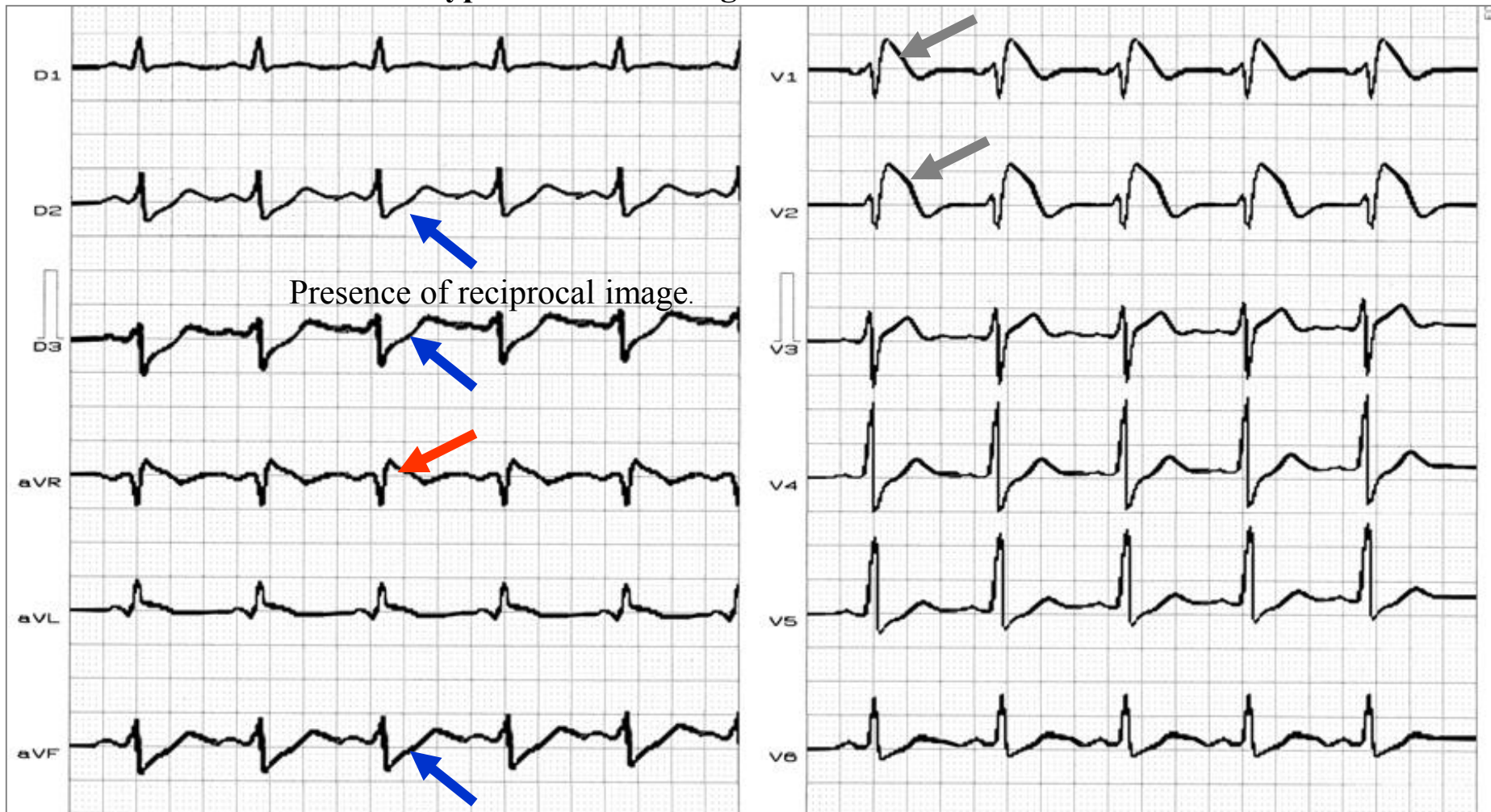
V6: average voltage of R wave 14 mm. Maximal 24 mm. Average depth of q wave 1.5 mm. Maximal up to 4.5 mm. Average depth of S wave 1mm. Maximal 5 mm.



The ECG shows persistent ST segment elevation in the inferior and apical leads, associated to concomitant reciprocal or mirror image in the anterior wall that was not modified with the use of sublingual nitrate in absence of hypothermia, electrolyte imbalance or ischemia.

The patient was a young symptomatic (repetitive syncope episodes) Thai man, with positive familial background of SCD in young first degree relatives. He died 24h after performing this ECG. The ECG shows persistent ST segment elevation in the inferior and low lateral precordial apical leads (V5-V6), associated with concomitant reciprocal or mirror image in the anteroseptal wall that was not modified with the use of sublingual nitrate in absence of hypothermia, electrolyte imbalance or ischemia.(2)

Typical ECG of Brugada Pattern



The ECG belongs to a symptomatic patient with Brugada syndrome who had three previous syncope episodes. The ECG shows the typical ECG Brugada pattern: J point and ST segment elevation (> 2 mm), convex to the top followed by a negative T-wave in right precordial leads. Lead aVR that faces the right ventricular epicardium above the outflow tract shows subtle ST segment and J point elevation (red arrows). Inferior leads show reciprocal or mirror image changes (blue arrows).

And which are the possible clinical diagnosis?

1) **Pheochromocytoma? (Dr Samuel Sclarowsky Hypothesis)** A pheochromocytoma is a rare, catecholamine-secreting tumor that may precipitate life-threatening hypertension. The tumor is malignant in 10% of cases but may be cured completely by surgical removal. Although pheochromocytoma has classically been associated with 3 syndromes—von Hippel-Lindau (VHL) syndrome, multiple endocrine neoplasia type 2 (MEN 2), and neurofibromatosis type 1 (NF1)—there are now 10 genes that have been identified as sites of mutations leading to pheochromocytoma. Scholten et al concluded that pheochromocytoma crisis should be treated with medical stabilization and elective or urgent surgery rather than emergency surgery, based on their study of 137 patients with pheochromocytoma, including 25 who presented in crisis. Their literature review found that emergency resection of pheochromocytoma is associated with high surgical morbidity and mortality

Signs and symptoms

Classically, pheochromocytoma manifests as spells with the following 4 characteristics:

Headaches – Palpitations – Diaphoresis - Severe hypertension(all present in this case)

Typical patterns of the spells are as follows: Frequency may vary from monthly to several times per day

Duration may vary from seconds to hours. Over time, spells tend to occur more frequently and become more severe as the tumor grows. The following may also occur during spells: Tremor, nausea, weakness, anxiety, sense of doom, epigastric pain, flank pain and constipation

Clinical signs associated with pheochromocytomas include the following: Hypertension: Paroxysmal in 50% of cases. postural hypotension: From volume contraction, hypertensive retinopathy, weight loss, pallor, fever, tremor, neurofibromas, tachyarrhythmias, pulmonary edema

Diagnosis

Diagnostic tests for pheochromocytoma include the following:

Plasma metanephrine testing: 96% sensitivity, 85% specificity(3)

24-hour urinary collection for catecholamines and metanephrines: 87.5% sensitivity, 99.7% specificity(4)

Test selection criteria include the following:

Use plasma metanephrine testing in patients at high risk (ie, those with predisposing genetic syndromes or a family or personal history of pheochromocytoma)

Use 24-hour urinary collection for catecholamines and metanephrines in patients at lower risk

Imaging studies should be performed only after biochemical studies have confirmed the diagnosis of pheochromocytoma. Studies are as follows:

Abdominal CT scanning: Has accuracy of 85-95% for detecting adrenal masses with a spatial resolution of 1 cm or greater

MRI: Preferred over CT scanning in children and pregnant or lactating women; has reported sensitivity of up to 100% in detecting adrenal pheochromocytomas

Scintigraphy: Reserved for biochemically confirmed cases in which CT scanning or MRI does not show a tumor.

PET scanning: A promising technique for detection and localization of pheochromocytomas.

Additional studies to rule out a familial syndrome in patients with confirmed pheochromocytoma include the following:

1. Serum intact parathyroid hormone level and a simultaneous serum calcium level to rule out primary hyperparathyroidism (which occurs in MEN 2A)
2. Screening for mutations in the *ret* proto-oncogene (which give rise to MEN 2A and 2B)(5)
3. Genetic testing for mutations causing the MEN 2A and 2B syndromes
4. Consultation with an ophthalmologist to rule out retinal angiomas (VHL disease)

2 Terrestrial Venomous Animals Accidents caused by venomous animals: scorpion or spider ? Drs Claudio Pinho and Samuel hypothesis.

Annually millions of scorpion stings and anaphylactic reactions to insect stings may occur worldwide, causing tens of thousands of deaths in humans each year mostly among children. Envenomation (toxic effects) is also an occupational hazard for populations involved in agriculture and forestry in these regions. Among the animals that can inflict injury on humans by the action of their venom are:

- 1. *Invertebrates, such as Arachnida (spiders, scorpions and sun spiders)***
- 2. *Acarina (ticks and mites)***
- 3. *Chilopoda (centipedes) and Hexapoda (bees, wasps, butterflies, and midges).***

Scorpion envenoming cause multi-system-organ failure, characterized by a massive release of counter-regulatory hormones (catecholamines, glucagon, cortisol), angiotensin-II, and changes in insulin secretion. It is a condition of fuel-energy deficits and an inability to utilize the existing metabolic substrates. Scorpion sting is a hazardous and potentially lethal condition. Venom of some variety of scorpion can cause dramatic cardiovascular and ECG changes, that have been related to heart stimulation by autonomous nervous system. González-Romero et al (7) prospectively studied 722 patients following scorpion sting. Mean age for the group was 25.5 +/- 18.3 years. 67% were less than 30 years of age. In 294 patients (40.7%) they found ECG changes. These cases were followed until those changes disappeared. First degree atrioventricular block was found in 10.2%. Intraventricular conduction disturbances in 12.8% with predominance of RBBB. In 11% the authors found arrhythmias. In 15% reversible ventricular repolarization changes. Of this no one died. This lack of mortality could be attributed to a prompt therapeutic intervention. In Ribeirão Preto SP Brazil Cuppo et al (8) reported the clinical and laboratory data of 4 patients victims of scorpion stings by *T. serrulatus*, who developed heart failure and pulmonary edema, with 3 of them dying within 24 hours of the sting. Anatomopathologic study of these patients revealed diffuse areas of myocardiocytolysis in addition to pulmonary edema. The surviving child presented enzymatic, electrocardiographic and echocardiographic changes compatible with severe cardiac involvement, which were reversed within 5 days. These findings reinforce the need for continuous monitoring of patients with severe scorpion envenoming during the hours immediately following the sting.

Diagnosis & Treatment

In general, scorpions are not aggressive. They do not hunt for prey; they wait for it. Scorpions are nocturnal creatures; they hunt during the night and hide in crevices and burrows during the day to avoid the light. Thus, accidental human stinging occurs when scorpions are touched while in their hiding places, with most of the stings occurring on the hands and feet.

Scorpions use their pincers to grasp their prey; then, they arch their tail over their body to drive their stinger into the prey to inject their venom, sometimes more than once. The scorpion can voluntarily regulate how much venom to inject with each sting. The striated muscles in the stinger allow regulation of the amount of venom ejected, which is usually 0.1-0.6 mg. If the entire supply of venom is used, several days must elapse before the supply is replenished. Furthermore, scorpions with large venom sacs, such as the *Parabuthus* species, can even squirt their venom.

The venom glands are located on the tail lateral to the tip of the stinger and are composed of 2 types of tall columnar cells. One type produces the toxins, while the other produces mucus. The potency of the venom varies with the species, with some producing only a mild flu and others producing death within an hour. Generally, the venom is distributed rapidly into the tissue if it is deposited into a venous structure. Venom deposited via the intravenous route can cause symptoms only 4-7 minutes after the injection, with a peak tissue concentration in 30 minutes and an overall toxin elimination half-life of 4.2 to 13.4 hours through the urine. The more rapidly the venom enters the bloodstream, the higher the venom concentration in the blood and the more rapid the onset of systemic symptoms.

Scorpion venom is a water-soluble, antigenic, heterogenous mixture, as demonstrated on electrophoresis studies. This heterogeneity accounts for the variable patient reactions to the scorpion sting. However, the closer the phylogenetic relationship between the scorpions, the more similar the immunological properties. Furthermore, the various constituents of the venom may act directly or indirectly and individually or synergistically to manifest their effects. In addition, differences in the amino acid sequence of each toxin account for their differences in the function and immunology. Thus, any modifications of the amino acid sequence result in modification of the function and immunology of the toxin.

The venom is composed of varying concentrations of neurotoxin, cardiotoxin, nephrotoxin, hemolytic toxin, phosphodiesterases, phospholipases, hyaluronidases, glycosaminoglycans, histamine, serotonin, tryptophan, and cytokine releasers. The most potent toxin is the neurotoxin, of which 2 classes exist. Both of these classes are heat-stable, have low molecular weight, and are responsible for causing cell impairment in nerves, muscles, and the heart by altering ion channel permeability. The long-chain polypeptide neurotoxin causes stabilization of voltage-dependent sodium channels in the open position, leading to continuous, prolonged, repetitive firing of the somatic, sympathetic, and parasympathetic neurons. This repetitive firing results in autonomic and neuromuscular over-excitation symptoms, and it prevents normal nerve impulse transmissions. Furthermore, it results in release of excessive neurotransmitters such as epinephrine, norepinephrine, acetylcholine, glutamate, and aspartate. Meanwhile, the short polypeptide neurotoxin blocks the potassium channels. The binding of these neurotoxins to the host is reversible, but different neurotoxins have different affinities. The stability of the neurotoxin is due to the 4 disulfide bridges that fold the neurotoxin into a very compact 3-dimensional structure, thus making it resistant to pH and temperature changes. However, reagents that can break the disulfide bridges can inactivate this toxin by causing it to unfold. Also, the antigenicity of this toxin is dependent on the length and number of exposed regions that are sticking out of the 3-dimensional structure.

Frequency Internationally

Scorpion stings occur in temperate and tropical regions, especially between the latitudes of 50°N and 50°S of the equator. Furthermore, stings predominantly occur during the summer and evening times. In addition, the majority of patients are stung outside their home.

A recent 5-year surveillance study in Saudi Arabia found 6465 scorpion sting cases with a mean patient age of 23 years, a male-to-female ratio of 1.9, and a higher incidence of stings in the months of May-October. Furthermore, patients in rural areas tend to fare worse than patients in urban areas because of the delay in getting medical help due to a longer travel time to medical centers. Fortunately, better public education, improved control of the scorpion population, increased supportive therapies, and more technologically advanced intensive care units have combined to produce a substantial decrease in mortality from these envenomations.

Mortality & Morbidity:

The under-reporting of scorpion stings is frequent because most envenomations occur in desert and jungle areas that do not have large medical facilities. Furthermore, reporting is not required. Most deaths occur during the first 24 hours after the sting and are secondary to respiratory or cardiovascular failure. Children and elderly persons are at the greatest risk for morbidity and mortality. A smaller child, a lower body weight, and a larger ratio of venom to body weight lead to a more severe reaction. A mortality rate of 20 percent is reported in untreated babies, 10 percent in untreated school-aged children, and 1 percent in untreated adults.

Race No racial predilection exists. Any differences in individual reactions to the scorpion sting are a reflection of that individual's genetic composition rather than race.

Sex Females are more susceptible than males to the same amount of scorpion venom because of their lower body weight.

Age While adults are stung more often than children, children are more likely to develop a more rapid progression and increased severity of symptoms because of their lower body weight. Furthermore, elderly persons are more susceptible to stings because of their decreased physiologic reserves and increased debilitation.

Scorpion Sting - General First-aid

First aid for a scorpion sting is simple:

- 1. Wash the sting site with soap and water.*
- 2. You may apply a cool compress to the sting site. Ice may or may not be recommended.*
- 3. Numbness and tingling should pass away in time.*
- 4. If symptoms persist or are severe, seek medical attention.*
- 5. Keep your tetanus shots and boosters current.*

Wilderness First-Aid

1. Find out in advance if the wilderness area you are visiting is likely to be populated by centruroides (the only dangerous kind of scorpion). These are found in New Mexico, Arizona, Southern Utah and Mexico.
2. Exercise caution when stepping or reaching into places where scorpions are likely to be: dark places like wood piles, underneath rocks, inside shoes, or roaming the ground after dark.
3. Look for the signs and symptoms of a scorpion sting: burning pain, swelling or numbness at the site of the sting.
4. Clean the sting with an antiseptic cleanser.
5. Apply an ice pack to the site of the sting.
6. Immobilize the extremity which was stung until you can establish whether the sting has produced severe poisoning . Keep the extremity immobilized if an evacuation is necessary.
7. Administer an antihistamine such as Benadryl to reduce swelling and itching.
8. Monitor the injured person for signs and symptoms of severe poisoning: muscle spasms, convulsions, impaired vision or speech, nausea, vomiting, difficulty breathing, impaired circulation. If any of these symptoms are present, evacuate immediately to a hospital to receive an antivenom (antivenin).
9. Evacuate immediately if the person stung is a child or elderly person, or if you suspect the sting was from a centruroide.

The stings from Texas scorpions produce only moderate reactions in most people because the poison has little affect on the nervous system. However, a person who is stung by a scorpion should be watched closely for adverse reactions. An ice pack applied to the affected area will relieve some pain. If swelling and/or pain persists or if breathing difficulties occur, immediate medical attention is necessary. If you are stung by the Arizona Bark Scorpion, the most dangerous of the Arizona scorpions, it is not likely to be fatal. Local Arizona medical centers are familiar with the treatment. The Arizona Bark Scorpion is venomous. Arizona Bark Scorpion sting symptoms are immediate pain or burning, very little swelling, sensitivity to touch, and a numbness/tingling sensation. The Arizona Bark Scorpion sting may have additional symptoms such as numbness or tingling of extremities or face, blurry vision, or muscle twitching. When stung by an Arizona Bark Scorpion, children may start to exhibit hyperactivity and have roving eye movements.

If you are victim of a scorpion sting, wash the area with soap and water. Apply a cool compress on the area of the scorpion sting. Ice (wrapped in a washcloth or other suitable covering) may be applied to the sting location for 10 minutes.

Remove compress for 10 minutes and repeat as necessary. Call the Poison Control Center at (800) 362-0101 or your local poison center (see your phone book). If you develop symptoms of an Arizona Bark Scorpion sting, go to the nearest emergency room.

Very few people die from scorpion stings, even the sting of the Arizona bark scorpion. Scorpion stings are most dangerous to the very young and the very old. Pets are also at risk. While the dangerous scorpions are limited to the southwestern region of the United States, their stings are not necessarily deadly, however they are extremely painful. Compared with their U.S. counterparts, Mexican scorpions are another matter altogether.

Some 2,000 people a year die from their stings. Any type of scorpion stings require emergency medical attention and should be approached in the same way as a snake bite. It is possible for hyper-acute (typically allergic) reactions to occur in susceptible individuals, taking the form of blurring of consciousness, unconsciousness, convulsions, a rapid drop in blood pressure, shock, and, in extreme cases, death.

In general, scorpions are not aggressive. They do not hunt for prey; they wait for it. Scorpions are nocturnal creatures; they hunt during the night and hide in crevices and burrows during the day to avoid the light.

Thus, accidental human stinging occurs when scorpions are touched while in their hiding places, with most of the stings occurring on the hands and feet. Scorpion stings are a major public health problem in many underdeveloped tropical countries.

For every person killed by a poisonous snake, 10 are killed by a poisonous scorpion. In Mexico, 1000 deaths from scorpion stings occur per year. In the United States, only 4 deaths in 11 years have occurred as a result of scorpion stings. Furthermore, scorpions can be found outside their normal range of distribution, ie, when they accidentally crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers. Scorpions are basically immune to most pesticides. If you suspect your house has scorpions, call a professional exterminator.

Clinical Patient History

For patients presenting with scorpion stings, ascertaining the following is essential:

- Time of envenomation.
- Nature of the incident.
- Description of the scorpion.
- Local and systemic symptoms.

The toxicity, variation, and duration of the symptoms depends on the following factors:

1. Scorpion species.
2. Scorpion age, size, and nutritional status.
3. Healthiness of the scorpion's stinging apparatus (telson).
4. Number of stings and quantity of venom injected.
5. Depth of the sting penetration.
6. Composition of the venom.
7. Site of envenomation: Closer proximity of the sting to the head and torso results in quicker venom absorption into the central circulation and a quicker onset of symptoms.
8. Age of the victim.
9. Health of the victim.
10. Weight of the victim relative to amount of venom.
11. Presence of comorbidities.
12. Treatment effectiveness.

Generally, intrathecal and intravenous routes have immediate effects, while subcutaneous and intramuscular routes take effect several minutes to hours later.

Non-lethal scorpion species tend to produce local reactions similar to a hymenopteran sting, while lethal scorpion species tend to produce systemic symptoms. The duration to progress to systemic symptoms ranges from 5 minutes to 4 hours after the sting. The symptoms generally persist for 10-48 hours.

Physical Examination

The signs of the envenomation are determined by the scorpion species, venom composition, and the victim's physiological reaction to the venom. The signs occur within a few minutes after the sting and usually progress to a maximum severity within 5 hours. The signs last for 24-72 hours and do not have an apparent sequence. Thus, predicting the evolution of signs over time is difficult. Furthermore, a false recovery followed by a total relapse is common. A person who has been stung by a scorpion usually has 4 signs, with the most common being mydriasis, nystagmus, hypersalivation, dysphagia, and restlessness. The mode of death is usually via respiratory failure secondary to anaphylaxis, bronchoconstriction, bronchorrhea, pharyngeal secretions, and/or diaphragmatic paralysis, even though venom-induced multi-organ failure plays a large role.

Children present with the same symptoms and signs as adults, except their symptoms are more severe and protracted. Furthermore, they may display a restlessness that is out of proportion when compared to any other disease. A child's symptoms have been described as inconsolable crying; uncontrollable jerking of the extremities; and chaotic thrashing, flailing, and writhing combined with contorted facial grimaces. The symptoms mimic a centrally mediated seizure, but the patient is awake and alert the entire time. The grading of these scorpion envenomations depends on whether or not neurological signs predominate and is as follows:

- 1. Non-neurological Predominance**
- 2. Mild - Local signs.**
- 3. Moderate - Ascending local signs or mild systemic signs.**
- 4. Severe - Life-threatening systemic signs.**

Neurologic Predominance

Grade I - Local pain or paresthesia at the sting site (83 percent).

Grade II - Pain or paresthesia that has traveled from the sting site (9.1 percent).

Grade III - Either cranial nerve or somatic neuromuscular dysfunction (4.7 percent).

Grade IV - Both cranial nerve and somatic neuromuscular dysfunction (3 percent).

Local Signs

Neurotoxic Local Effects

1. Local evidence of a sting may be minimal or absent in as many as 50 percent of cases of neurotoxic scorpion stings. In fact, tissue necrosis is rarely found.
2. A sharp burning pain sensation at the sting site, followed by pruritus, erythema, local tissue swelling, and ascending hyperesthesia, may be reported. This paresthesia feels like an electric current, persists for several weeks, and is the last symptom to resolve before the victim recovers.
3. The tap test is administered by tapping at the sting site. A positive result is when the paresthesia worsens with the tapping because the site is hypersensitive to touch and temperature. In fact, wearing clothing over the area and sudden changes in temperature exacerbate the symptoms.

Cytotoxic Local Effects

A macule or papule appears initially at the sting site, occurring within the first hour of the sting.

The diameter of the lesion is dependent on the quantity of venom injected.

The lesion progresses to a purpuric plague that will necrose and ulcerate.

Lymphangitis results from the transfer of the venom through the lymphatic vessels.

Non-Lethal Local Effects

Pain, erythema, induration, and wheal may be present.

These are secondary to venom activation of kinins and slow-releasing substances.

Neurologic signs: Most of the symptoms are due to either the release of catecholamines from the adrenal glands (sympathetic nerves) or the release of acetylcholine from postganglionic parasympathetic neurons. One study by Freire-Maia et al (1974) found that the adrenergic signs occur at a low venom dose, while cholinergic signs occur at high venom dose concentrations (ie, greater than 40 mcg/100 g in *Tityus serrulatus* scorpion venom). Furthermore, the adrenergic phase tended to be more dependent on the venom dose than the cholinergic phase. However, dual manifestations of the adrenergic and cholinergic signs are possible because of varying organ system sensitivities to these neurotransmitters.

Central Nervous System Signs

Thalamus-induced systemic paresthesia occurs in all 4 limbs.

Patients experience venom-induced cerebral thrombosis strokes.

The level of consciousness is altered, especially with restlessness, confusion, or delirium.

Patients have abnormal behavior.

Ataxia is also a sign.

Autonomic Nervous System Signs - Predominately sympathetic signs, parasympathetic signs, or a combination of signs.

Sympathetic Signs

Hyperthermia.

Tachypnea.

Tachycardia.

Hypertension.

Arrhythmia.

Hyperkinetic pulmonary edema.

Hyperglycemia.

Diaphoresis.

Piloerection.

Restlessness and apprehension.

Hyperexcitability and convulsions.

Parasympathetic Signs

- Bronchoconstriction,
 - Bradycardia.
 - Hypotension.
 - Salivation, lacrimation, urination, diarrhea, and gastric emesis (SLUDGE).
 - Rhinorrhea and bronchorrhea.
 - Goose pimple skin.
 - Loss of bowel and bladder control.
 - Priapism.
 - Dysphagia.
 - Miosis.
 - Generalized weakness.

Somatic Signs

- Rigid spastic muscle of the limbs and torso.
- Involuntary muscle spasm, twitching, clonus, and contractures.
- Alternating opisthotonos and opisthotonus from inactivation of sodium channels, leading to increased sodium and calcium uptake.
- Increased tendon reflexes, especially prolongation of the relaxation phase.
- Piloerection accompanied by goose pimples.

Cranial Nerve Signs

Classic rotary eye movement may result in ptosis, nystagmus, and blurred vision.

Mydriasis is a sign.

Patients may have tongue fasciculations.

Dysphagia, dysarthria, and stridor occur secondary to pharyngeal reflex loss or muscle spasm.

Patients may present with excessive salivation and drooling.

Peripheral nervous system signs - Intense local burning pain with minimal swelling at sting site, followed by ascending numbness and tingling, then paralysis and convulsions.

Non-Neurologic Systemic Signs

Cardiovascular signs

Usually follow a pattern of a hyperdynamic phase followed by a hypodynamic phase.

Hypertension is described as follows: Secondary to catecholamine and renin stimulation. Observed as early as within 4 minutes after the sting.

Lasts a few hours.

High enough to produce hypertensive encephalopathy.

Hypotension - Less common and occurs secondary to excess acetylcholine or catecholamine depletion.

Tachycardia is greater than 130 beats per minute, although bradycardia can be observed.

Transient apical pansystolic murmur is consistent with papillary muscle damage.

Cardiovascular collapse occurs secondary to biventricular dysfunction and profuse loss of fluids from sweating, vomiting, diarrhea, and hypersalivation. Observed in 7-38 percent of cardiovascular cases.

Mild envenomation - Vascular effect with vasoconstriction hypertension.

Moderate envenomation - Left ventricular failure hypotension with and without an elevated pulmonary artery wedge pressure, depending on fluid status of the patient.

Severe envenomation - Biventricular cardiogenic shock. Cardiac dysfunctions attributed to catecholamine-induced increases in myocardial metabolism oxygen demand (leading to myocardial ischemia-induced myocardial hypoperfusion) and to the direct effects of the toxin (leading to myocarditis).

Respiratory Signs

Tachypnea may be present.

Pulmonary edema with hemoptysis and a normal-sized heart is observed in 7-32 percent of respiratory cases. This is secondary to a direct toxin-induced increased pulmonary vessel permeability effect and is also secondary to catecholamine-induced effects of hypoxia and intracellular calcium accumulation, which leads to a decrease in left ventricular compliance with resultant ventricular dilation and diastolic dysfunction.

Respiratory failure may occur secondary to diaphragm paralysis, alveolar hypoventilation, and bronchorrhea.

Allergic Signs

Urticaria, Angioedema is reported, bronchospasm and eventual anaphylaxis..

Gastrointestinal Signs

Excessive salivation, dysphagia, nausea and vomiting, gastric hyperdistention occurs secondary to vagal stimulation, increased gastric acid output may lead to gastric ulcers, acute pancreatitis may lead to hyperglycemia, liver glycogenolysis may occur from catecholamine stimulation and toxic Hepatitis.

Genitourinary Signs

Patients have decreased renal plasma flow, toxin-induced acute tubular necrosis renal failure may occur, rhabdomyolysis renal failure may result from venom-induced excessive motor activity, **priapism may occur secondary to cholinergic stimulation.** One small study by Bawaskar (1982) found a positive prognostic correlation to the development of cardiac manifestations following scorpion stings.

Hematological Signs

Platelet aggregation may occur because of catecholamine stimulation, disseminated intravascular coagulation with massive hemorrhage may result from venom-induced defibrination.

Metabolic Signs

Hyperglycemia may occur from catecholamine-induced hepatic glycogenolysis, pancreatitis, and insulin inhibition. Increased lactic acidosis may occur from hypoxia and venom-induced increased lactate dehydrogenase activity, electrolyte imbalance and dehydration from hypersalivation, vomiting, diaphoresis, and diarrhea.

Pregnancy Signs - Toxin-induced uterine contraction.

Symptoms predictive of hospital admission. **Priapism** (odds ratio 150.59) **vomiting** (odds ratio 15.82) systolic blood pressure (SBP) greater than 160 (odds ratio 13.38), temperature greater than 38°C (odds ratio 3.66) and heart rate greater than 100 beats per minute (odds ratio 3.35)

Symptomology of Specific Scorpion Species

Mesobuthus, Tityus, and Leiurus - Tend to cause severe cardiovascular symptoms

Centruroides - Tend to cause neurological symptoms

Hemiscorpius - Tend to cause tissue necrosis.

Scorpion Venom & Lethal Dose Risks

Scorpions are shy creatures and only sting if threatened, cornered, or disturbed (eg, being sat or stepped upon).

Curious individuals are at risk because of increased interaction with the scorpion.

The median lethal dose 50 (LD50) of various scorpion venoms in mg/kg of a subcutaneous injection into mice and the territorial distribution are listed below. Unfortunately, humans are much more sensitive than mice.

Leiurus quinquestriatus (Middle East) - 0.25 mg/kg

Androctonus crassicauda (Saudi Arabia) - 0.08-0.5 mg/kg

Centruroides noxius (Mexico) - 0.26 mg/kg.

Androctonus mauritanicus (North Africa) - 0.32 mg/kg.

Centruroides santa maria (Central America) - 0.39 mg/kg.

Tityus serrulatus (Brazil) - 0.43 mg/kg.

Buthus occitanus (North Africa) - 0.9 mg/kg.

Centruroides sculpturatus (Southwest United States) - 1.12 mg/kg.

Mesobuthus eupeus (Iran) - 1.45 mg/kg.

Generally, most lethal scorpions have an LD50 below 1.5 mg/kg.

The average yield per scorpion via electrical excitation of the venom gland for a few species is listed below.

Tityus species - 0.39-0.62 mg.

L. quinquestriatus - 0.62 mg.

Buthus species - 0.38-1.5 mg.

Milking the venom gland produces approximately a 4-fold increase in yield amount compared to electrical excitation.

3) Sick cell anemia CRISIS? It is a common cause of priapism, is an inherited disorder characterized by abnormally shaped red blood cells. These abnormally shaped cells can block the flow of blood. Sick cell anemia is the most common cause of priapism in boys. Sick cell anemia is the most common form of sickle cell disease. It is a serious disorder in which the body makes sickle-shaped red blood cells. “Sickle-shaped” means that the red blood cells are shaped like a crescent. Normal red blood cells are disc-shaped and look like doughnuts without holes in the center. They move easily through your blood vessels. Red blood cells contain an iron-rich protein called hemoglobin). This protein carries oxygen from the lungs to the rest of the body. Sick cells contain abnormal hemoglobin called sickle hemoglobin or hemoglobin S. Sick hemoglobin causes the cells to develop a sickle, or crescent, shape. Sick cells are stiff and sticky. They tend to block blood flow in the blood vessels of the limbs and organs. Blocked blood flow can cause pain and organ damage. It can also raise the risk for infection. A team of researchers from the Johns Hopkins Children’s Center, Vanderbilt University and elsewhere have demonstrated that high blood pressure and anemia together put children with sickle cell disease at serious danger for symptom less or so-called “silent” strokes, although either condition alone also signaled high risk. Additionally, a serious complication of sickle cell disease is pulmonary hypertension.

Sickle cell anemia Complications

- I Stroke.** A stroke can occur if sickle cells block blood flow to an area of your brain. Signs of stroke include seizures, weakness or numbness of your arms and legs, sudden speech difficulties, and loss of consciousness. If your baby or child has any of these signs and symptoms, seek medical treatment immediately. A stroke can be fatal.
- II. Acute chest syndrome:** This life-threatening complication of sickle cell anemia causes chest pain, fever and difficulty breathing. Acute chest syndrome can be caused by a lung infection or by sickle cells blocking blood vessels in your lungs. It may require emergency medical treatment with antibiotics and other treatments.

- III. Pulmonary hypertension.** People with sickle cell anemia can also develop high blood pressure in their lungs (pulmonary hypertension). Shortness of breath and difficulty breathing are common symptoms of this condition, which can be fatal.
- IV. Organ damage.** Sickle cells can block blood flow through blood vessels, immediately depriving an organ of blood and oxygen. In sickle cell anemia, blood is also chronically low on oxygen. Chronic deprivation of oxygen-rich blood can damage nerves and organs in your body, including your kidneys, liver and spleen. Organ damage can be fatal.
- V. Blindness.** Tiny blood vessels that supply your eyes can get blocked by sickle cells. Over time, this can damage the retina — the portion of the eye that processes visual images — and lead to blindness.
- VI. Skin ulcers.** Sickle cell anemia can cause open sores, called ulcers, on your legs.
- VII. Gallstones.** The breakdown of red blood cells produces a substance called bilirubin. A high level of bilirubin in your body can lead to gallstones.
- VIII. Priapism.** Men with sickle cell anemia may experience painful, long-lasting erections, a condition called priapism. As occurs in other parts of the body, sickle cells can block the blood vessels in the penis. This can damage the penis and eventually lead to impotence. This little boy had priapism.

4. Acute Myocarditis? Hypertension is rare in Myocarditis.

Definitive Diagnosis

Portuguese: Caro Andrés, Ribeirão Preto é uma cidade que tem um excelente chopp, porém está infestada de escorpiões. Parabéns para este time. Como é bela a medicina simples, apenas com o exame clínico e eletrocardiograma. O escorpião da foto estava na cama da criança.

Evolução enzimática: CK-MB: 55- 105- 77- 44- 40 (normal: <25).Troponina: 2,67 (normal: <0,01)

ECO: normal, sem alteração de mobilidade segmentar

Dúvidas?

- 1. Apesar da elevação dos marcadores de necrose, por que não existe seqüela motora (ecocardiograma) e elétrica**
- 2. Apesar da elevação dos marcadores de necrose, por que não existe seqüela motora (ecocardiograma) e elétrica**
- 3. Porque não existe dor em adultos com acidente escorpiônico e supra de ST ?**
- 4. Qual a semelhança desta injúria miocárdica com o Takotsubo?**

Segue no proximo slide o último ECG Um abraço,

Marcelo Leal

English

Dear Andrés,Ribeirão Preto is a city with an excellent draft beer, however it is infested with scorpions. Congratulations for this team; how beautiful is simple medicine; just a clinical examination and an ECG The scorpion was in the bed of the child.

Enzymatic evolution: CK-MB: 55-105-77-44-40 (normal: <25). Troponin: 2.67 (normal: <0.01)

Echo: normal, without alteration of segmental mobility.

In the following slide, you will find the last ECG.

Doubts:

- 1. In spite of the increase in necrosis markers, why is there no motor and electric sequelae (echocardiogram)?**
- 2. Why is there no pain in adults with scorpion bites and ST elevation?**
- 3. What is the similarity of this myocardial lesion with Takotsubo?**

Warm regards,

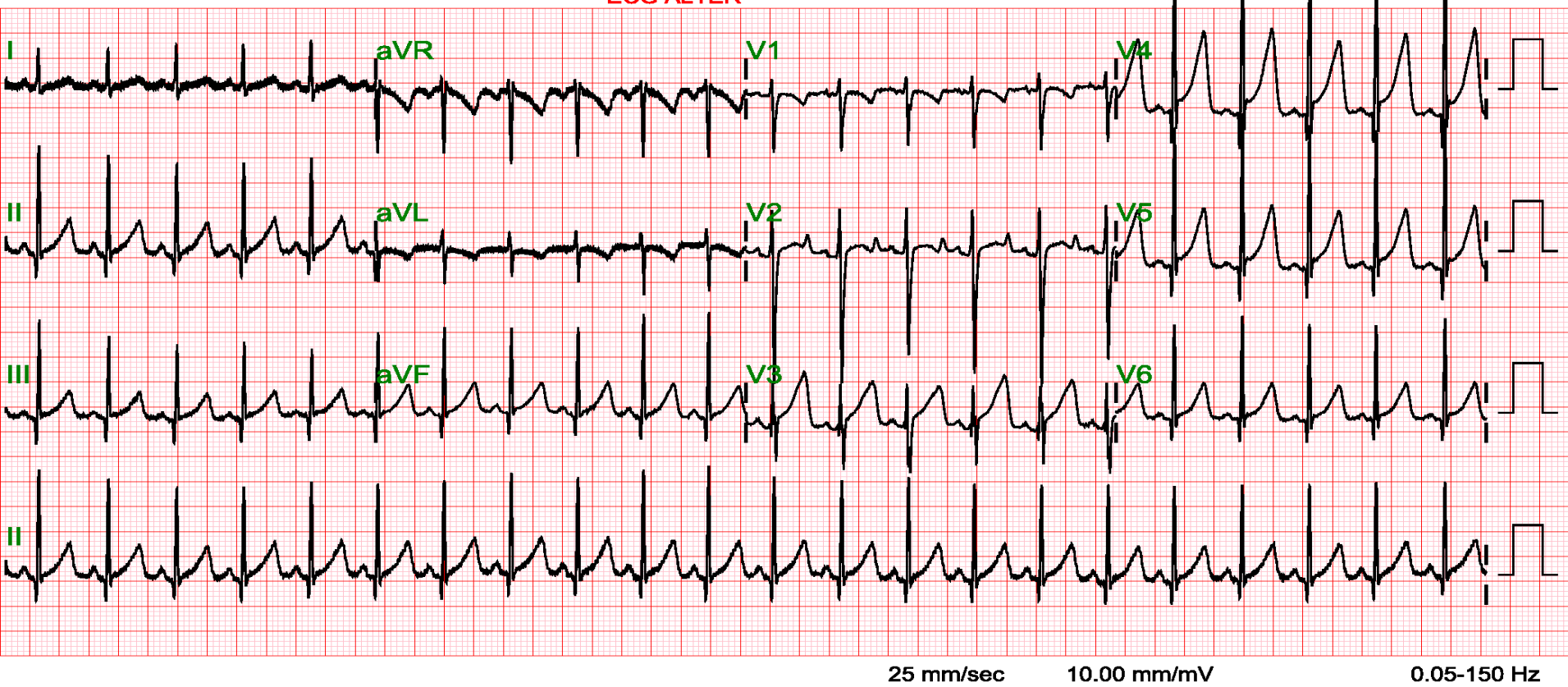
Marcelo Leal Garcia M.DM.

57
QRS 65
T 74

Absolutely normal!!!!!!

- ECG ALTER -

Diagnóstico não confirmado



25 mm/sec 10.00 mm/mV 0.05-150 Hz

Scorpion sting usually follow a pattern of a hyperdynamic phase followed by a hypodynamic phase. **Hypertension is secondary to catecholamine and renin stimulation.** Observed as early as within 4 minutes after the sting.

- Lasts a few hours. High enough to produce hypertensive encephalopathy.
- Hypotension - Less common and occurs secondary to excess acetylcholine or catecholamine depletion.
- Tachycardia is greater than 130 bpm, although bradycardia can be observed.
- Eventual transient apical pansystolic murmur is consistent with papillary muscle damage.
- Cardiovascular collapse occurs secondary to biventricular dysfunction and profuse loss of fluids from sweating, vomiting, diarrhea, and hypersalivation. Observed in 7-38 percent of cardiovascular cases.



1. **Mild envenomation** Vascular effect with vasoconstriction hypertension.
2. **Moderate envenomation** - LV failure hypotension with and without an elevated pulmonary artery wedge pressure, depending on fluid status of the patient.
3. **Severe envenomation** - Biventricular cardiogenic shock. Cardiac dysfunctions attributed to catecholamine-induced increases in myocardial metabolism oxygen demand (leading to myocardial ischemia-induced myocardial hypoperfusion) and to the direct effects of the toxin (leading to myocarditis).

This is the photo of the Scorpion that was in the bed of the child.

. I think that this is a Brazilian yellow scorpion *T. serrulatus* whose venom can cause severe symptoms (which can include death in small children). With Mild envenomation.

Scorpion Description & Habitat

The scorpion is an animal closely related to spiders, mites, and ticks. Scorpions make up the order Scorpiones of the class Arachnida. They are easily recognized by their characteristic shape. Scorpions glow brightly under UV light (black light).

Scorpion

Opisthosoma (abdomen)

Prosoma
(cephalothorax)

Mesosoma
(7 segments)

Metasoma or tail
(5 segments)

Telson

Aculeus
(stinger)

Exoskeleton
ranges from
black to brown to
red to tan.

Claws on
each leg

4 pairs of clawed walking legs

Chela (claw
of pedipalp)

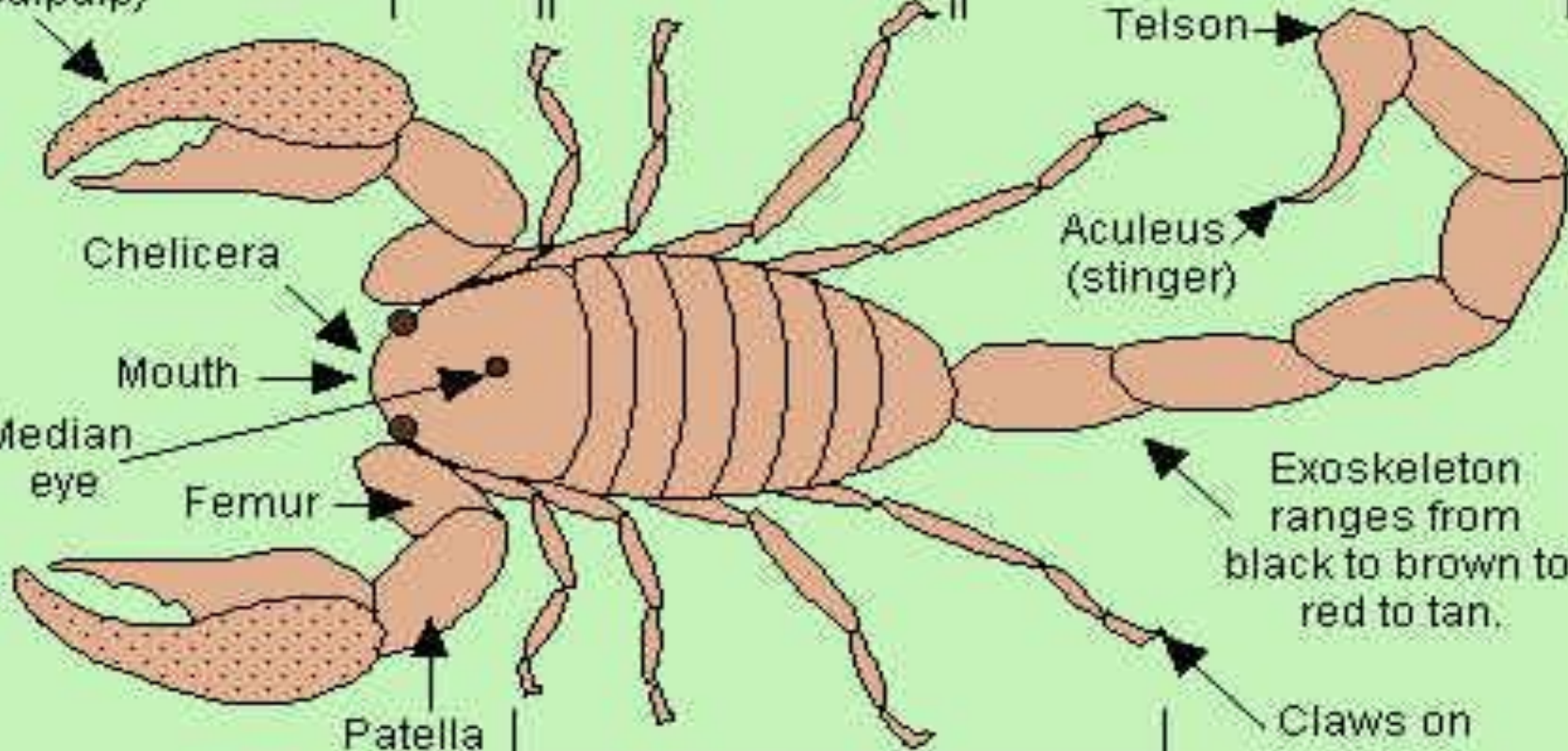
Chelicera

Mouth

Median
eye

Femur

Patella



Brazilian Scorpions Scorpion of Other Countries And Regions Outside The United States

A) Brazilian Yellow Scorpion The Yellow Scorpion (*Tityus serrulatus*) is a Brazilian scorpion which is extensively studied. Even though there are few documented deaths (death mainly comes from children under 7), the symptoms is severe and among 5 percent of the patients studied. There is systemic involvement. This represents a very significant percentage.

B) Brazilian Scorpion (*Tityus Bahiensis*) *Tityus* is a large genus of scorpions belonging to the family Buthidae. There are currently 185 described species distributed throughout the Caribbean and South America and in Central America as far north as Costa Rica. The genus contains several dangerously venomous scorpions, the best known of which is the Brazilian yellow scorpion *T. serrulatus* whose venom can cause severe symptoms (which can include death in small children). *Tityus serrulatus* and *Tityus bahiensis* are considered to be the most venomous.



A scorpion's long, slender body consists of a cephalothorax (joined head and thorax) with six pairs of appendages and an abdomen. Scorpions have four pairs of legs and two large pincer-bearing arms (pedipalps) in front. The first two pairs of appendages are used for catching and mashing prey and for transferring it to the mouth; the last four pairs are legs. The abdomen is a flexible structure made up of 12 segments. All scorpions have a five-segmented tail that can be arched over the back. The tail ends in a sharp, hollow, bulb-like poison gland or venom-injecting stinger.

Scorpions are well equipped to defend themselves or attack prey with their pincers and stinger. Between the last pair of legs is a comb-like structure (pectines) that is used to identify surface textures and to detect prey. Scorpion venom can be deadly to many animals, including humans. They can be a nuisance when they interact with humans because they will sting when disturbed.

Scorpions have two eyes on the top of the head, and usually two to five pairs of eyes along the front corners of the head. They do not see well, however, and must rely on the sense of touch, using their pectines and other organs for navigation and hunting. Their bodies are flat, which allows them to hide in small cracks, under rocks and under bark.

The scorpion lives in warm, dry regions and in the tropics, preferring dry-and habitats. Scorpions are most commonly found in southern Europe, Africa, the western and southwestern region of the United States, and the tropical regions of the Western Hemisphere. There are about 1,500 species of scorpions and there may be as many as 1,000 more species undiscovered.

Worldwide, scorpions range in size from about 1/2 inch up to 10 inches (1.3 to 25 cm) in length (including the tail), depending upon the species. About 70 to 75 species are found in the United States and most of these are found in the desert region of the Southwest. These scorpions are usually about 1 to 3 inches (2.5 to 7.5 cm) in length. Scorpions may be found in many types of habitats in the United States. Although most scorpions live in desert regions such as desert flats and sand dunes, desert and mesic mountains, they also live in rain forests, grassy prairies and grasslands, pine forests, deciduous forests, and chaparral, and others live only beneath the bark of palm trees. Species are most diverse in desert areas. Scorpions hide under stones, bark, wood or other objects on the ground where they wait or search for prey.

Wherever they live, scorpions are nocturnal predators. Hunting at night, a scorpion will eat almost anything, even other scorpions. Chief foods are small insects, spiders, centipedes, earthworms, and other scorpions. In fact, a scorpion's favorite food is another scorpion! Most scorpions are solitary and will attempt to kill and eat other scorpions that invade their territory. Once they capture their prey, they use the large pincers to crush and draw it toward the mouth.

A scorpion grabs prey with its pincers and then stings it. Some scorpions have such powerful pincers they seldom use their stinger. First the scorpion breaks the cricket or beetle into tiny pieces. When the pile is big enough, the scorpion spits strong digestive juices onto the pile of bug bits. The juices melt the bits into soft sticky stew. When the stew is soft enough, the scorpion sucks the gooey pieces into its mouth. The body juices of the prey are eaten by the scorpion.

Some scorpions can survive a whole year with no food. Other scorpions can live for two days under water or survive long periods of cold. Scorpions may also live for a long time. Some species may live for 20 to 25 years, but longevity of the typical scorpion is between 3 and 8 years.

Scorpions hide during the day and become active at night. This behavior helps scorpions manage temperature and water balance, important functions for survival in dry habitats. Many species dig burrows in the soil. During the day, the scorpion rests in an underground burrow, emerging at night to feed on insects and spiders, which it immobilizes and kills with the sting. The sting is also used when the scorpion is threatened. They detect and capture prey by the sense of touch. They also have a well-developed sense of hearing.

According to fossil records, the scorpion has been in existence for about 400 million years. Fossil remains reveal very little change between the ancient and the present-day scorpion. Scorpions have been around for a long time. They have changed very little in 350 million years.

Scorpions Versus Spiders

Like spiders, scorpions are arachnids. They have two main body parts and eight legs. And like spiders, scorpions have hairs, called bristles, along their legs. These bristles feel vibrations on the ground. They tell the scorpion, which has poor vision, when prey is near.

Most scorpions are larger than spiders. Their body parts are larger, too. Look at the scorpion's head. Instead of spider fangs, a scorpion has pincers that grab and tear prey. Instead of leg-like palps, a scorpion has a large set of claws that hold and crush prey. The last few segments of the scorpion's abdomen form a long "tail."

Scorpion Stings

A scorpion often kills its prey with venom. But a scorpion does not use fangs to deliver its poison. It uses the stinger at the end of its tail. First, the scorpion grabs its prey with its claws. Then it raises its tail up and over its head to sting its prey.

The sting of a scorpion is very powerful. It kills insects and spiders instantly. And it can be deadly to larger animals. Still, many animals - such as lizards, snakes, owls, and mammals - feed on scorpions. Scorpions are nocturnal animals. They hunt and feed mostly at night. During the day, scorpions hide among rocks, in cracks on the ground, and under the bark of trees. A scorpion's sting can be painful, but most scorpions are not dangerous to humans

Scorpion Offspring

Adult scorpions may have several broods of young. Prior to mating, the male and female grasp each other's claws and perform a courtship dance. Following an elaborate mating process, which lasts from 24 to 36 hours, the female undergoes a gestation period ranging from 5 months to more than 1 year. A female scorpion gives birth to a litter, or a group, of about 25 baby scorpions (the litter can range from 6 to 90 young). The young are born one at a time and alive in semi-transparent sacs (thin layer of tissue around it's body). With its mother's help, the newborn breaks out of this thin sack. As soon as the young scorpions free themselves from these thin wrappers, they climb onto their mother's back. Newborn scorpions are pale in color. The mother scorpions take care of their young for a short time until they are ready to live on their own. In the first few days of their lives, they are totally defenseless. They depend on their mothers for protection.

Young scorpions stay with their mothers a week or more, until their first molt. Already capable of stinging, the young scorpions leave the mother after several days and begin to fend for themselves. Scorpions reach maturity in a one to five years, depending on availability of food.

Scorpion Myths

Scorpions are often misunderstood. Many people say that scorpions are so aggressive they will sting themselves to death, but this is not a natural behavior of scorpions in the wild. Other people say the sting of a baby scorpion is more dangerous than the sting of an adult, but again, this is false. The venom in a scorpion's stinger is the same all through a scorpion's life. Perhaps the biggest myth is that all scorpions are deadly, and this is totally wrong.

Only a very few scorpions are potentially dangerous to people. Of the 1,500 known scorpion species only 25 have a sting potent enough to be considered potentially dangerous to humans. About 90 species of scorpions have been identified in the United States. Only one lives in the United States. The most dangerous scorpion is found in the southwest region of the U.S. and is known as the Arizona **Bark Scorpion** (*Centruroides sculpturatus*). Arizona is home to a large number of bark scorpions and is also home of the only scorpion antivenom program in North America. Scorpion antivenom is used to treat severe scorpion stings. Despite the large number of people and scorpions in Arizona, only about 100 stings each year receive scorpion antivenom therapy, and most of those are either young children or elderly adults. Most important for severe scorpion stings is immediate access to medical treatment, whether or not antivenom is available. In less developed countries, such as Brazil lack of transportation to medical care contributes to higher numbers of scorpion stings resulting in illness or death. No scorpion sting-related death has been reported in Arizona for more than 40 years.

The most common species in Texas is the **Striped Bark Scorpion (*Centruroides vittatus*)**. The adult scorpion is about 2-1/2 inches long, which is typical of the size of all species found in the state. Texas has 18 species and only one species, *Centruroides vittatus*, occurs throughout the state. It is the only species of scorpion found in the eastern part of Texas. The number of species found in the state increases moving west and south.

One species has been recorded in the Dallas area, two recorded near Austin, four near Amarillo, three near Abilene, five near Ft. Stockton, eight in the Ft. Davis region, eight near Langtry, and 14 in Big Bend National Park.

Scorpion Sting Symptoms (U.S varieties)

If you think a scorpion has stung you there are a few symptoms to watch out for. Symptoms include:

Local pain where stung but no swelling (feels like a hornet sting followed by having a nail driven through the sting site).

Touching the sting area is painful.

Numbness and tingling in parts of the body distant from the sting.

Malaise (general discomfort, feeling out-of-sorts or ill).

Sweating.

Heart palpitations.

Rise in blood pressure.

Trouble focusing eyes or random eye movements

Trouble swallowing, drooling (salivation).

Tongue feels swollen.

Slurred speech.

Nausea.

Vomiting.

Young children may rub their faces which may indicate facial numbness.

Muscle twitching.

Restlessness.

Irritability.

Hyperactivity.

Diarrhea.

Not all these symptoms will occur in every person, although some should appear in the first two-three hours. Children under 10 years are at higher risk than other people. The sting of scorpions may be painful, or even deadly, depending on the species. Of 1,500 species of scorpions worldwide, only about 20 to 25 are regarded as dangerous. Stings from such species may cause paralysis, severe convulsions, cardiac irregularities, or breathing difficulties that may lead to death. Antivenoms are available in areas where dangerous scorpions live. A scorpion's venom is a mixture of compounds including neurotoxins that affect the victim's nervous system. Fortunately, none of the species in southwestern and western U.S. are considered deadly. Stings from most of these species are about as painful as a bee or wasp sting, but the severity of the sting is dependent upon the individual scorpion and the person's reaction to the venom. As with any arthropod venom, allergic reactions are possible. In these situations, immediate medical attention would be required.

Some Common Types Of Scorpions

Almost all of these are considered lethal scorpions, except the Hemiscorpius species, belong to the scorpion family called the Buthidae. The Buthidae family is characterized by a triangular-shaped sternum, as opposed to the pentagonal-shaped sternum found in the other 5 scorpion families. In addition to the triangular-shaped sternum, poisonous scorpions also tend to have weak-looking pincers, thin bodies, and thick tails, as opposed to the strong heavy pincers, thick bodies, and thin tails seen in non-lethal scorpions. The lethal members of the Buthidae family include the genera of Buthus, Parabuthus, Mesobuthus, Tityus, Leiurus, Androctonus, and Centruroides. These lethal scorpions are found generally in the given distribution:

Buthus - Mediterranean area.

Parabuthus - Western and Southern Africa.

Mesobuthus - Asia.

Tityus - Central and South America, Caribbean.

Leiurus - Northern Africa and Middle East.

Androctonus - Northern Africa to Southeast Asia.

Centruroides - Southwest USA, Mexico, Central America.

However, these scorpions may be found outside their habitat range of distribution when inadvertently transported with luggage and cargo.

United States - North America Region



Arizona Bark Scorpion

Perhaps one of the most infamous species, the Arizona Bark Scorpion (*Centruroides exilicauda*) has been previously known under many different names such as Florida Bark Scorpion, Arizona Deadly Scorpion, and the Sculptured Scorpion. The previous scientific name is *Centruroides sculpturatus* which till today is still widely used. Other scientific names referring to the same species are *Buthus exilicauda*, *Centrurus exilicauda*, *Centruroides gertschi*, *Centruroides pallidicep* and *Centruroides zweifeli*. This is an example of how even scientific name can be so messed up. It is recommended that modern reference to stick to *Centruroides exilicauda* to reduce the confusion. The Arizona Bark Scorpion is typically a golden-yellow color or a very light. Body coloration and pattern has numerous variation and is difficult to generalize. The Arizona Bark Scorpion grows to 2-1/2 inches in size. In the United States, the Arizona Bark Scorpion is found in Arizona, California, Nevada, New Mexico and Utah. Outside of the United States, it is found in Northwestern Mexico. This species has a very painful sting. During the 1940s-1960s, over 1000 deaths each year is attributed to this widespread species though these claims may be untrue. Numerous older and supposedly objective scientific studies may have exaggerated the death caused by the species.

Although once an extremely feared scorpion having a sting that was considered lethal, research suggests that this species probably poses no serious threat to a healthy adult. The sting of this species is, however, considered to be medically significant and can be dangerous and potentially lethal to children or the elderly. No death from this species has been recorded in Arizona since 1968. The Arizona State University claims it to be the success of their antivenom but it is more probably due to less use of inappropriate treatments like injection of potent opioids. The use of this species as a 'scapegoat' seems to arise since Stahnke (1928) who's researching on antivenom for this species label it as Arizona lethal scorpion. Various articles and books such as WHO 1981 estimates, Biology of Scorpion (Polis,1990), Venomous and poisonous animals (Habermehl, 1981), Watt and Simard (1984), Merck manual, Medical entomology, Scorpion in Kentucky (Lee Townsend), Smith 1992, Scorpionism in Mexican (Mazotti and Bravo-Brecherelle with use of Mexico statistic board, Death register - 1958) suggest *C.exilicauda* to be "deadly". More recent articles like one by Dehesa-Davila & Possani (1994) which reflects stats up till 1990. No official death is attributed positively to *C.exilicauda*. Others like *C.noxious*, *C.limpidus* ssp, *C.suffusus* are implicated.



Texas Striped Bark Scorpion / Striped Back Scorpion

The common, Striped Bark Scorpion, also known as the Striped Back Scorpion (*Centruroides vittatus*) has two broad, black stripes running the length of its back. The average length of mature Striped Back Scorpions is 2.5 inches. The Stripe-backed Scorpion varies in color from yellowish-tan to brown. The Striped Back Scorpion has 2 dark gray lines that run the length of its back. Older scorpions tend to be a darker brown, and the stripes may not be as obvious. Populations in the Big Bend region of Texas may be only faintly marked or completely pale. Immature scorpions may be lighter in color. There is a dark triangular mark on the front of the head above the eyes. In young scorpions, the base of the pedipalps and the last segment behind the abdomen is dark brown or black. This species can be easily identified by slender pedipalps (pincer-bearing arms) and the long, slender tail. The tail is longer on males than females.

The Striped Bark Scorpion prefers rocky or brushy areas or homes to hide in and hunt for their prey. This scorpion feeds on insects, small centipedes and other scorpions. They prefer to hunt at night and remain hidden during the day to conserve water and avoid high temperatures.

In the United States, the Striped Backed Scorpion is found in Arizona, Arkansas, Colorado, Illinois, Kansas, Louisiana, Mississippi, Missouri, Nebraska, New Mexico, Oklahoma, Tennessee, and Texas. It is the most widespread scorpion in the United States. Outside of the United States, it is found in Northern Mexico.

Late May and the entire month of June mark the most active time of the year for scorpions in San Antonio and South Texas. The Striped Bark Scorpion / Striped Back Scorpion apparently mates in the fall, spring or early summer. Gestation requires about 8 months. Litter size varies from 13 to 47. The average is about 31 young per litter. Immature scorpions molt within 3 to 7 days after birth and remain on the mother for another 3 to 7 days after that. After molting, the baby scorpions leave the safety of their mother's back to live their lives alone. There are five or six molts to maturity. A Striped Bark scorpion probably lives for approximately 4 years. The sting of this species causes local pain and swelling. Deaths attributed to this species have not been substantiated. There seems to be some varied opinions about the potential danger of the Striped Back Scorpion. Some claim it to be harmless, while others have reported its sting as extremely painful and potentially dangerous.

The striped bark scorpion is often found under rocks, under boards and in debris. It can be found indoors or outdoors in a wide variety of habitats (pine forests in East Texas; rocky slopes, grasslands, juniper breaks in other parts of the state). *Centruroides* are active foragers that do not burrow. They are distinctly associated with dead vegetation, fallen logs and human dwellings. It is common for them to climb trees and walls, and many times have been found in the attics of homes. During periods of hot weather, scorpions may move into living areas to escape the high temperatures in attics.

The Toothed Scorpion (*Diplocentrus whitei*) is the largest of the 5 species of *Diplocentrus* in the U.S. The sting is considered harmless and is less dangerous than its pinch (which can draw blood). The family *Diplocentridae* was transferred to the family *Scorpionidae* in Dec 2003, a move with which some professions disagree and opt to continue to keep *Diplocentridae* in family status until DNA evidence proves otherwise. In the USA, the distribution of the Toothed Scorpion is only in the lower Big Bend Region of southern Presidio and Brewster counties, including Big Bend National Park and Big Bend Ranch State Park in Texas. In Chihuahuan Desert, rarely away from rocky hillsides, mountains. In northern Coahuila and Chihuahua in Mexico.



The Giant desert hairy scorpion (*Hadrurus arizonensis*) is the largest scorpion inhabiting the Southwest of North America and one of the 8-9 species of *Hadrurus* in the US, attaining a length of 5.6 to 6 inches. Its large size allows it to feed readily on other scorpions and a variety of other prey, including lizards and snakes. This species is usually yellow with a dark top and has lobster-like pincers. It gets its common name from the brown hairs that cover its body, these hairs help it to detect vibration in the soil. A similar species is *Hadrurus spadix*. The giant hairy scorpion is the largest scorpion in the US and North America, and one of the least-common of Arizona's desert scorpions. It is distributed throughout the Sonoran and Mojave deserts. In Mexico, the species' range flanks the Sea of Cortez in Sonora and Baja California Norte. In the US, it is found in the western two thirds of Arizona, the Colorado and Mojave desert regions of southern California, southern Nevada, and extreme southwestern Utah. Arizona Desert Hairy Scorpions are a warm-desert species, specially adapted to hot and dry conditions. They are usually found in and around washes or low-elevation valleys where they dig elaborate burrows (up to 2.5 meters deep) and emerge at night to forage for prey and mates. Although they are burrowing scorpions, it is commonly found under rocks containing moisture. Their diet consists of large insects, spiders, and small vertebrates. This is an aggressive and active scorpion, which, as with all scorpions, is nocturnal. Like all scorpions, the Giant Desert Hairy Scorpion gives birth to live young, which remain on the mothers back for a week or more before leaving. Other species commonly encountered living sympatrically with this species are: *Smeringurus mesaensis*, *Vaejovis confusus*, and *Vaejovis spinigerus*. Arizona Bark Scorpions are commonly encountered in rocky habitats but sometimes stray to sandy soils and are found alongside the Desert Hairy Scorpions. Desert Hairy Scorpions are not especially venomous. Although its size may make it scary-looking, its sting is mild, causing only local pain and swelling. However, an allergic reaction to its venom can be fatal. Symptoms can include difficulty breathing, excessive swelling and prolonged pain.



Scorpion Sting Prevention

When handled or disturbed, scorpions can inflict a painful sting using the poison gland at the end of the tail.

- Avoiding their habitats helps prevent stings.
- Do not put your fingers or toes where you cannot see them.
- Shake out your clothes and shoes before putting them on, especially if you are outdoors. Always wear shoes when outdoors, particularly around swimming pools or other water sources.
- Be careful when camping or during other outdoor activities to make sure that a scorpion has not made a home in your clothes, shoes or sleeping bags.
- If you find scorpions in your home be sure to look under your bed linens before getting into bed.
- Remember scorpions are active at night. Watch out for them after dark.
- Never play with scorpions. Even though they are interesting, they are wild creatures and might hurt you.

Scorpions As Pets

Scorpions have been kept as pets, but this practice is strongly discouraged. Scorpions should never be kept indoors or around small children. Scorpions with even relatively low poison levels can produce fatal reactions in young children and also in adults allergic to the toxin.

Scorpion Pest Control

Scorpions are difficult to control with insecticides alone. Therefore, the first control strategy is to modify the area surrounding a house.

Remove all trash, logs, boards, stones, bricks and other objects from around the home. Keep grass closely mowed near the home. Prune bushes and overhanging tree branches away from the house. Tree branches can provide a path to the roof for scorpions.

Store garbage containers in a frame that allows them to rest above ground level. Never bring firewood inside the house unless it is placed directly on the fire. Install weather-stripping around loose fitting doors and windows.

Plug weep holes in brick veneer homes with steel wool, pieces of nylon scouring pad or small squares of screen wire.

Caulk around roof eaves, pipes and any other cracks into the home.

Keep window screens in good repair. Make sure they fit tightly in the window frame.

To control scorpions with chemicals, use insecticide products that contain any of the following:

Permethrin (Prelude, Dagnet).

Cyfluthrin (Tempo).

Cypermethrin (Demon).

Lambda-cyhalothrin (Demand CS).

Deltamethrin (Suspend).

Propoxur (Baygon).

Diazinon.

Chlorpyrifos (Dursban).

Malathion.

Synergized pyrethrins.

Apply pesticides around the foundation of the house and up to 1 foot above ground level on the exterior walls. Also apply pesticides around doors, window eaves and other potential points of entry. Follow directions on the package for dosage, mixing and application methods.

Tips For Extermination Professionals

Wettable powder formulations provide better residual control for crawling pests when applying perimeter sprays.

When using pyrethroids or other insecticides labeled for scorpion control, be sure to use the highest permissible label rate.

Contact your local Department of Agriculture Office about the use of suggested pesticides and their uses in your region and policy changes. The person using pesticides is always responsible for the effects of pesticide residues on his/her livestock and crops, as well as problems that could arise from drift or movement of the pesticide from his/her property to that of others.

The Common European Scorpion (*Buthus occitanus tunetanus*) represents well the genus *Buthus*. This scorpion is found in South France and has much less potent venom.



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