

# Spider poisoning: a report of six cases from the Central Anatolian region, Turkey

Başak Akyıldız<sup>1</sup>, Selim Kurtoğlu<sup>2</sup>, Hakan Poyrazoğlu<sup>3</sup>, Ahmet Özcan<sup>3</sup>

Departments of <sup>1</sup>Pediatric Intensive Care, <sup>2</sup>Pediatric Endocrinology, and <sup>3</sup>Pediatric Nephrology, Erciyes University Faculty of Medicine, Kayseri, Turkey

**SUMMARY:** Akyıldız B, Kurtoğlu S, Poyrazoğlu H, Özcan A. Spider poisoning: a report of six cases from the Central Anatolian region, Turkey. *Turk J Pediatr* 2009; 51: 598-604.

Spiders exist in every place and ecosystem. Spiders in tropical regions are particularly poisonous and can be dangerous to humans. Nearly 20,000 spider species are known, and almost all are venomous, although only 60 species worldwide are poisonous in humans. In our area, eight species are reported as poisonous in humans. Although most cases of spider bite are benign and require no intervention, severe local and systemic reactions may occur sometimes in the pediatric population, resulting in admission to the pediatric intensive care unit. In this report, we present the cases of six children from the Central Anatolian region in Turkey who were seriously affected by spider bites, and we review the literature on spider envenomation.

**Key words:** spider, children, poisoning.

Poisoning is one of the most common reasons for a visit to the emergency department and is often caused by insect or animal, generally a bee, scorpion or snake<sup>1</sup>. A study by the Medical Faculty of Mersin University determined that each year, 26.3% of patients who present to the emergency department because of envenomation have been stung by a scorpion, 42% by a snake and 10.5% by a spider<sup>2</sup>. Spider bites are more clinically serious in children, elderly persons, patients with cardiac problems, and individuals who have been bitten in the upper limbs<sup>3,4</sup>. In our society, spider bites are frequent in communities with low socioeconomic level. Additionally, difficulties in reaching a health care center, disregard of symptoms, and economic and social health insurance problems render spider bites more symptomatic than expected. In this report, we present six children who were seriously affected by spider bites. We review the literature on spider envenomation and emphasize the importance of the subject.

## Case Report

### Case 1

A 14-year-old girl admitted to the hospital with intense abdominal pain. When she reached the hospital, abdominal and leg pain had been

added to her complaints of swelling, rubor and pain in the right hip. She was treated with an antihistamine and analgesic treatment and was sent home. The patient's symptoms did not improve, and she then presented to our emergency department with severe abdominal pain.

On admission, the patient was hypertensive (blood pressure 140/100 mmHg (>95 p), heart rate, 95 beats per minute) and she had abdominal tenderness and positive defense. A bite on her right hip was detected. We considered a spider bite with the symptoms of abdominal pain, hypertension and complaints of swelling of the right hip. Other system examinations yielded normal findings. The patient was questioned again about the possibility of a spider bite. She reported seeing a spider in her room but was unaware of the bite until a few hours later when the symptoms began.

Initial complete blood analysis revealed the following: white blood cell count 27,400/mm<sup>3</sup>, hemoglobin (Hb) 15.9 g/dl and platelet count 347,000/mm<sup>3</sup>. Serum electrolyte levels were as follows: calcium (Ca) 4.2 mg/dl, lactate dehydrogenase (LDH) 858 mg/dl, creatine kinase (CK) 932 mg/dl, CK-MB 157 mg/dl, aspartate aminotransferase (AST) 92 IU/L, alanine aminotransferase (ALT) 40 IU/L, and

troponin-I 1.16 ng/ml (normal <0.4 ng/ml). Renal function was normal, but urinalysis showed 2(+) protein. Voltage suppression, ST depression and a prolonged QT interval (corrected QT interval 0.45 seconds) were detected by electrocardiography (ECG).

Analgesic treatment for widespread pain and intravenous Ca support were given to the patient. Over the next four days, leg and abdominal pain continued. LDH, CK and CK-MB levels peaked on day 2 of the hospital stay and then started to decrease. No tachycardia or hypertension was present except on the first day. On day 5, all abnormal biochemical parameters and ECG findings returned to normal, and the patient was discharged from the hospital.

### Case 2

A 15-year-old boy presented to the hospital complaining of a spider bite. While working in the field 12 hours previously, he had been bitten twice in the left arm by a black spider. He had complaints of abdominal pain, swelling, and shivering. Despite administration of an antihistamine, oxygen and steroids, the patient's general condition did not improve, and he was sent to our hospital.

On physical examination, the patient was found to be hypertensive (blood pressure 180/110 mmHg (>95 p), heart rate 90 beats per minute). Shivering and sweating were noted. The patient had ciliary congestion in the scleral vessels in the eye and a pink-red face. Signs of an insect bite were found on the distal left arm. Involuntary contractions of the entire body and voluntary defense at abdominal examination were observed. Other system examination findings were normal.

Initial laboratory findings included the following: white blood cell count 4100/mm<sup>3</sup>, Hb 15 g/dl, platelets 334,000/mm<sup>3</sup>, serum glucose 187 mg/dl, Ca 10 mg/dl, ionic Ca 0.71 mmol/L, LDH 915 mg/dl, CK 1133 mg/dl, CK-MB 193 mg/dl, and troponin-I 0.6 ng/ml. Renal function, hepatic function and serum electrolyte levels were normal. The urinary examination detected 2(+) protein and 1(+) blood reaction and no red cells. The corrected QT interval was 0.46 seconds.

The patient received antihypertensive treatment for hypertension (captopril), bicarbonate to reduce the nephrotoxicity of myoglobinuria,

and analgesic treatment for pain. On the third day of the hospital stay, CK and CK-MB levels peaked. On the fourth day, the patient had no fever, his condition was clinically normal, and his blood pressure normalized. By the seventh day, laboratory findings were normal, and the patient was discharged without any symptoms.

### Case 3

A 15-year-old girl presented to the hospital with facial swelling, abdominal pain and hematuria. Her right arm had been stung or bitten 18 hours earlier.

On the examination, the patient's body temperature was 36°C, pulse 96 beats per minute, and blood pressure 135/90 mmHg (>95p), and bifissure edema was present. Other system examinations yielded normal findings.

Initial laboratory evaluation showed white blood cell count 16,700/mm<sup>3</sup>, Hb 16 g/dl, platelets 395,000/mm<sup>3</sup>, serum glucose 181 mg/dl, Ca 11 mg/dl, CK 1673 mg/dl, CK-MB 122 mg/dl, LDH 816 mg/dl, AST 89 IU/L, ALT 13 IU/L, troponin-I 0.84 ng/ml, prothrombin time 14 seconds, and partial thromboplastin time 28 seconds. ECG findings were normal. Renal function and serum electrolyte levels were normal, but urinary protein and urinary blood were detected as 3(+). The corrected QT interval was 0.46 seconds.

The patient was hydrated, and analgesic treatment was started. CK, CK-MB and LDH levels returned to normal. Hypertension was not detected in the follow-up. Renal function and serum electrolyte levels were normal during therapy. On the fourth day of the hospital stay, an erythematous, maculopapular exanthema occurred all over the body, and it was debated whether it was due to the drug therapy or a spider bite. The patient was discharged with recommendations when the eruptions began to subside.

### Case 4

A 10-year-old boy had a history of a spider bite on his neck three days earlier. He presented to the hospital with abdominal pain, arm paresthesia, diarrhea, fever and hematuria. He was sent to our hospital because of severe abdominal pain, fever, shivering, and involuntary contractions in the arms.

The patient's temperature was 38°C, and abdominal tenderness was noted on the physical examination. Initial laboratory investigations revealed the following: Hb 15 g/dl, white blood cell count 3900/mm<sup>3</sup>, and platelets 167,000/mm<sup>3</sup>. Serum electrolytes were within normal limits, except that hyponatremia (sodium [Na] 130 mEq/L) and hypocalcemia (Ca 7.4 mg/dl) were present.

Other analysis yielded these findings: CK 1033 mg/dl, CK-MB 97 mg/dl, troponin-I 0.1 ng/ml, prothrombin time 244 seconds, and partial thromboplastin time 38 seconds. ECG findings were normal. Urinalysis showed 4(+) blood reaction and no red cells.

The patient was hydrated, and Ca treatment was started. Prothrombin time returned to normal with vitamin K therapy. Symptoms improved in three days, and the patient was discharged and referred to the pediatric nephrology department for unilateral renal agenesis.

#### Case 5

A 14-year-old boy presented with abdominal pain, vomiting and a spider bite on the neck. He had a history of pain originating in the right inguinal region and becoming diffuse in the abdominal area.

On physical examination, blood pressure was 140/60 mmHg (>95 p), and abdominal tenderness and rebound were present. Initial laboratory findings included Hb 14 g/dl, white blood cell count 15,000/mm<sup>3</sup>, platelets 437,000/mm<sup>3</sup>, blood glucose 144 mg/dl, Na 138 mmol/L, potassium (K) 3.6 mmol/L, Ca 6.4 mg/dl, LDH 720 mg/dl, AST 29 IU/L, ALT 18 IU/L, CK 656 mg/dl, CK-MB 180 mg/dl, troponin-I 0.25 ng/ml, prothrombin time 13 seconds, and partial thromboplastin time 38 seconds. ECG findings were normal, and the corrected QT interval was 0.48 seconds. Abdominal X-ray and ultrasonographic investigations yielded normal results.

A probable diagnosis of acute abdomen was made based on the abdominal tenderness and rebound. Shivering and involuntary contractions continued during the hospital stay, and maculopapular exanthema developed on the second day. Intravenous captopril treatment was started for hypertension. On the fourth day, abdominal pain, exanthema and hypertension improved, so captopril and Ca were stopped and the patient was discharged from the hospital.

#### Case 6

A 14-year-old girl presented with chest pain, shivering and abdominal pain. She had been bitten on the left hip by a spider called "böyü" (Fig. 1) 10 hours earlier.

The findings from the physical examination were normal except for fever (37.8°C), agitation, and a 2x2 cm café-au-lait spot on the back. Initial laboratory examination revealed: Hb 13.5 g/dl, white blood cell count 14,700/mm<sup>3</sup>, platelets 330,000/mm<sup>3</sup>, blood glucose 106 mg/dl, Na



Fig. 1. Spider type called solifugae (böyü) detected in case 6

137 mmol/L, K 4.9 mmol/L, Ca 9.3 mg/dl, LDH 624 mg/dl, AST 72 IU/L, ALT 18 IU/L, CK 486 mg/dl, CK-MB 102 mg/dl, troponin-I 0.3 ng/ml, prothrombin time 12.3 seconds, and partial thromboplastin time 31.8 seconds. ECG findings were normal, and the corrected QT interval was 0.47 seconds. Urine analysis revealed 1(+) protein and 2(+) blood.

Intravenous hydration and Ca treatment were started for the contractions, abdominal pain and agitation. Symptoms improved, as did the patient's general condition. She was discharged from the hospital on the third day.

Patient demographics and clinical and laboratory findings are shown in Tables I, II and III.

#### Discussion

Spiders live in every place and ecosystem. Spiders in tropical regions are particularly poisonous and can be dangerous to humans<sup>5,6</sup>.

**Table I.** Patient Demographics

Characteristic	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Age (years)	14	15	15	10	10	14
Sex	Female	Male	Female	Male	Female	Female
City	Yozgat	Yozgat	Niğde	Niğde	Kayseri	Kayseri
Bite site	Right hip	Left arm	Right arm	Neck	Neck	Left hip
Interval <sup>a</sup>	20 hours	12 hours	18 hours	3 days	3 days	10 hours
Previous treatment	Antihistamine, steroid, diazepam, NSAID, furosemide	Antihistamine, steroid	None	None	None	None

NSAID: Non-steroidal anti-inflammatory drug.

<sup>a</sup>Time between bite and presentation at authors' emergency department.

**Table II.** Clinical Findings in Six Cases with Spider Bite

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Local effects						
Swelling	(+)	(+)	(+)	(-)	(-)	(-)
Redness/red area	(+)	(-)	(-)	(-)	(-)	(-)
Puncture marks	(-)	(+)	(+)	(+)	(+)	(+)
Pain						
Local pain (leg pain)	(+)	(-)	(-)	(-)	(-)	(-)
Abdominal pain/tenderness	(+)	(-)	(+)	(+)	(+)	(+)
Chest pain	(-)	(-)	(-)	(-)	(-)	(+)
Systemic effects						
Hypertension	(+)	(+)	(+)	(-)	(+)	(-)
Diaphoresis	(-)	(+)	(-)	(-)	(-)	(-)
Sweating	(-)	(+)	(-)	(-)	(-)	(-)
Respiratory problems	(-)	(+)	(-)	(-)	(-)	(-)
Fever	(-)	(-)	(-)	(+)	(-)	(+)
Diarrhea	(-)	(-)	(-)	(+)	(-)	(-)
Hematuria	(-)	(-)	(+)	(+)	(-)	(-)
Generalized skin eruption	(-)	(-)	(+)	(-)	(+)	(-)
Other						
Paresthesia	(-)	(-)	(-)	(+)	(-)	(-)
Muscle contractions	(-)	(+)	(-)	(+)	(+)	(-)

Nearly 20,000 spider species are known, and almost all are venomous, although only 60 species are poisonous in humans<sup>4</sup>. It has been emphasized that Turkey has a species-rich fauna and continental peculiarity due to its habitat richness and geographic diversity. The most comprehensive list of Turkish spiders was provided by Topçu et al.<sup>7</sup>. In this study, a total of 613 species and two subspecies from Turkey are listed. Three hundred ninety-five of them are detected in the Central Anatolian region<sup>8</sup>. In this area, eight spider species are known as poisonous (Table IV).

Spider bite continues to be a controversial subject worldwide and attribution of clinical effects to different spiders is problematic because of poor case definition and paucity of clinical evidence<sup>9</sup>. The correct diagnosis has

been emphasized as follows<sup>10,11</sup>: 1. Evidence of bite, including clinic effects at the time of or soon after the bite; 2. Collection of the spider at the time of or immediately after the bite; and 3. Identification of the spider at the time of or immediately after the bite. All cases presented here had a history of spider bite and clinical effects. We detected a spider type called Solifugae (böyü) in one case.

The number of spider bites increases in the summer, since people spend more time outdoors and wear loose clothing during the warm seasons. The toxicity of spider venom increases in autumn and decreases in spring<sup>12</sup>. An epidemiologic study in Texas determined that cases of spider bites were increased in summer<sup>13</sup>. The six cases described in this report also occurred in summer.

**Table III.** Laboratory Findings of Spider Bite in Six Cases

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Proteinuria <sup>a</sup>	(++)	(++)	(+++)	(-)	(-)	(+)
Myoglobinuria	(-)	(+)	(+++)	(++++)	(-)	(++)
White blood cells/mm <sup>3</sup>	27,400	4,100	16,700	3900	15,000	14,700
LDH <sup>b</sup> (mg/dl)	858	915	816	789	720	624
AST/ALT <sup>b</sup> (IU/L)	92/40	43/41	89/13	30/23	29/18	72/18
CK/CK-MB <sup>b</sup> (mg/dl)	1259/200	1789/296	1673/122	1033/97	656/180	486/102
Troponin I (ng/ml)	1.16	0.6	0.84	0.1	0.25	0.3
Calcium (mg/dl)	4.2	10	11	7.4	6.4	9.3
Electrocardiographic findings	Prolonged QT interval, voltage suppression, ST depression	Prolonged QT	Prolonged QT	Normal	Prolonged QT	Prolonged QT

AST: Aspartate aminotransferase. ALT: Alanine aminotransferase. CK: Creatine kinase. LDH: Lactate dehydrogenase. (+): present, (-): absent, <sup>a</sup>: 1+ (30 mg/dl), 2+ (100 mg/dl), 3+ (300 mg/dl), 4+ (1000-2000 mg/dl).

<sup>b</sup>: peak laboratory values.

**Table IV.** Poisonous Spiders of the Middle Anatolian Region

Family	Type
Agelenidae	Agelena labyrinthica var. orientalis (CL Koch, 1841)
Araneidae	Araneus diadematus (Clerck, 1757)
Araneidae	Argiope lobata (Pallas, 1772)
Araneidae	Larinioides cornutus (Clerck, 1758)
Clubionidae	Chiracanthium mildei (L Koch, 1864)
Eresidae	Eresus niger (Petagna, 1787)
Theridiidae	Steatoda grossa (CL Koch, 1838)
Theridiidae	Steatoda paykulliana (Walckenaer, 1806)

The majority of the studies of spider bite reported many local or systemic clinical effects and laboratory findings according to different spider types<sup>9</sup>. Pain and discomfort are universal findings in all cases. Additionally, redness or a red mark, which can be variable in size, appears to be a constant finding in 60-80% of spider bites. Itchiness (immediate or delayed), swelling or presence of spine are other local diagnostic findings<sup>9,14</sup>. We noted different local symptoms in all cases. Additionally, in 5% to 32% of the published cases of *Loxosceles* (brown recluse spider), a fine macular or papular eruption develops over the entire body<sup>15</sup> as systemic eruption. The brown recluse spider causes a feeling like a pinch, followed by a biting itch, pain and erythema occurring after 6 hours, and by 24 hours an irregular erythematous configuration presents around the bite site<sup>12,13</sup>. Joshua et al.<sup>16</sup> noted widespread skin eruption like scarlatina. The skin eruption that appeared on the 4<sup>th</sup> day in the third case and on the 2<sup>nd</sup> day in the fifth case was ascribed to spider bite.

Spider bites produce different systemic symptoms depending upon the type of the spider. Wright et al.<sup>17</sup> observed a systemic reaction in 14% of 111 cases of brown recluse spider bite, while Joshua et al.<sup>16</sup> reported this percentage to be 25%. Fever, shivering, nausea and vomiting, arthralgia, and blood abnormalities are generally present in affected children<sup>18</sup>. Anxiety, headache, vertigo, salivation, sweating, tightness in the chest, speech problems, respiratory difficulties, priapism, urinary retention, tremor, increased tendon reflexes, fasciculations, and peripheral paresthesia are the other symptoms<sup>12</sup>. Furthermore, spider envenomation generally causes fatal respiratory failures in children<sup>12</sup>. We detected various systemic symptoms such as respiratory problems, fever, diaphoresis, diarrhea, and hematuria.

Another systemic effect of spider bites is cardiac symptoms, which can result from spider bites especially in the *Latrodectus* species. The neurotoxic effect of spider venom produces neuromuscular symptoms, tachycardia and hypertension<sup>12,19</sup>. Hypertension with

bradycardia was observed in 21% of patients in a period of one hour after the bite<sup>20,21</sup>. Four patients had tachycardia and high blood pressure when they were admitted, and patients 2 and 5 required antihypertensive treatment. The most active component in black widow venom is  $\alpha$ -latrotoxin, which stimulates the secretion of acetylcholine, norepinephrine and other neurotransmitters from synaptic terminals and inhibits their reuptake. This effect has been demonstrated in experimental studies and results in an increase in hypertension and tachycardia<sup>19-21</sup>. Pulignano et al.<sup>23</sup> noted typical angina, ECG findings (ST-T changes at precordial derivations), echocardiographic findings (left ventricular function disorder and akinesia of the interventricular septum) and elevation of myocardial enzymes in a 16-year-old patient bitten by a spider (*Latrodectus tredecimguttatus*). Moss et al.<sup>21</sup> noted myocardial damage due to inferolateral ischemia in a 32-year-old patient with a spider bite. Pneumatikos et al.<sup>24</sup> reported a 19-year-old patient who died from acute myocarditis 36 hours after being bitten by a spider.  $\alpha$ -Latrotoxin affects the nervous system, cardiovascular system and lungs by stimulating secretion of catecholamine from adrenergic nerve endings and using up acetylcholine at motor nerve endings. Researchers have found that spider bite-induced myocarditis is due to catecholamine's cardiotoxic effect or the direct effect of  $\alpha$ -latrotoxin on the myocardium. ECG changes such as a prolonged QT interval, ST-T depression and a widened QRS have been reported in some patients<sup>25</sup>. In the current study, we observed a prolonged QT interval, ST depression and voltage suppression in the first patient and a prolonged QT interval in the second, third, fifth and sixth patients.

On the other hand, urinary proteinuria is an uncommon systemic finding in spider bite cases. Proteinuria was noted in patients 1, 2, 3 and 6, and the hematuria in patients 3 and 4 was related to the nephrotoxic effect of the venom<sup>26</sup>. No hemolytic symptoms or intravascular coagulation occurred in our patients. Elevations in LDH, CK, CK-MB, AST and troponin-I levels were maintained in both skeletal and cardiac muscles. We discussed that urinary blood reaction might be due to myoglobinuria resulting from muscle damage in patients 2, 3, 4 and 6. White blood cell elevations pointed to inflammatory response.

Treatment is as follows: Pressure is applied to the proximal side of the bite site, the area is washed with soap and water, and a cold compress is applied. Antibiotic cream can be used, or ammonia or vinegar<sup>1,12</sup>. The bite site is elevated, and the patient is instructed to rest. Aspirin, antihistamines or a tetanus vaccine may be used in cases involving itching and erythema, etc. Erythromycin and cephalosporin can be used for cellulitis prophylaxis. Dapsone is useful for severe cutaneous reactions such as necrosis or edema. Moderately to severely ill patients, especially children, should be observed for the development of systemic loxoscelism<sup>12,26</sup>.

Patients must be sent to a health center for follow-up and treatment. Intravenous and intramuscular antivenin therapy (2.5 ml) is helpful but must be used carefully because of the possibility of anaphylaxis. Systemic symptoms can be treated with supportive therapy. Systemic steroids can be used to prevent renal failure and to stop hemolysis<sup>17</sup>. Use of systemic steroids to prevent skin necrosis has also been reported but is recommended when only systemic symptoms exist. Some researchers have suggested hyperbaric oxygen, local nitroglycerine and cyproheptadine as an alternative to surgery in cases of dermonecrotic lesions<sup>27,28</sup>.

Calcium gluconate and muscle relaxants are useful for muscle cramps. Morphine is generally not recommended due to the respiratory depression effect. Electrolyte imbalance should be corrected as in our three patients. Sedation may be necessary. Digitalis and loop diuretics should be avoided. Nifedipine, hydralazine, prazosin and angiotensin-converting enzyme inhibitors are useful for correcting afterload in resistant hypertension<sup>31,32</sup>. We observed hypertensive episode in the second and fifth patients, which was controlled with angiotensin-converting enzyme inhibitors. Rhythm disorders with cardiac damage and pulmonary edema may be seen in the first period after envenomation. They are generally of short duration and do not require therapy except in the case of ventricular tachycardia<sup>31</sup>. Patients with systemic symptoms must be followed closely for convulsion, disseminated intravascular coagulation, anuria, delirium, shock, and coma. All patients were sent to our hospital for follow-up and treatment. We carried out supportive therapy according to the patients' systemic and

local symptoms and did not detect any fatal complications associated with spider bite.

In conclusion, spider bite is common in our country. In many cases, diagnosis of spider bite is very difficult. Obtaining a detailed history and observation of systemic and local findings are helpful in the diagnosis and treatment of spider bite.

#### REFERENCES

- Netwig W. Ecophysiology of spiders. Institute of Zoology. Regensburg: Regensburg University Press; 1987: 815-847.
- Mert A, Bilgin NG. Demographical, aetiological and clinical characteristic of poisoning in Mersin, Turkey. *Hum Exp Toxicol* 2006; 25: 217-223.
- Russell FE, Gertsch WJ. For those who treat spider or suspected spider bites. *Toxicon* 1983; 21: 337-339.
- Rhoads J. Epidemiology of the brown recluse spiders. *J Am Acad Nuse Pract* 2007; 19: 79-85.
- Foelix RF. Biology of Spiders. Cambridge: Harvard University Press; 1982: 514.
- Nentwig W. Ecophysiology of spiders. Institute of Zoology. Regensburg: Regensburg University Press; 1987: 815.
- Topçu A, Türkeş T, Seyyar O, et al. A new species for the Aranefauna of Turkey, *Oxyopes ramosus* (Martini & Goeze, 1778). *Turk J Zool* 2006; 117-119.
- Spider list of Turkey. [www1.gantep.edu.tr/~varol/tr](http://www1.gantep.edu.tr/~varol/tr).
- Isbister GK, White J. Clinical consequences of spider bites: recent advances in our standing. *Toxicon* 2004; 43: 477-492.
- Isbister GK. Acute allergic reaction following contact with a spider. *Toxicon* 2002; 40: 1495-1497.
- Isbister GK. Data collection in clinical toxicology: debunking myths and developing diagnostic algorithms. *J Toxicol Clin Toxicol* 2002; 40: 231-237.
- Brent J, Wallace KL, Burkhardt KK (eds). *Critical Care Toxicology: Diagnosis and Management of the Critically Poisoned Patients*. Philadelphia: Mosby; 2005.
- Forrester MB, Stanley SK. Epidemiology of spider bites in Texas, 1998-2002. *Public Health* 2004; 118: 506-507.
- Isbister GK, Hirst D. Injuries from spider spines, not spider bites. *Vet Hum Toxicol* 2002; 44: 339-342.
- Davidovici BB, Dyachenko P, Cagnano E, Rozenman D, Halevy S; EuroSCAR; RegiSCAR study group. Acute generalized exanthematous pustulosis following a spider bite: report of 3 cases. *J Am Acad Dermatol* 2006; 55: 525-529.
- Joshua BG, Joshua EL, Edward KC. Arachnid envenomation from the brown recluse spider. *Clin Pediatr* 2003; 42: 567-570.
- Wright SW, Wrenn KD, Murray L, et al. Clinical presentation and outcome of brown recluse spider bite. *Ann Emerg Med* 1997; 30: 28-32.
- Forks TP. Brown recluse spider bites. *JABFP* 2000; 13: 415-423.
- Parisi L, Pierelli F, Amabile G, et al. Muscular cramps: proposals for a new classification. *Acta Neurol Scand* 2003; 107: 176-186.
- Clark RF, Wethern-Kestner S, Vance MV. Clinical presentation and treatment of black widow envenomation. *Ann Emerg Med* 1992; 21: 782-786.
- Moss HS, Binder LS. A retrospective review of black widow spider envenomation. *Ann Emerg Med* 1987; 16: 188-191.
- Rauber A. Black widow spider bites. *J Toxicol Clin Toxicol* 1983; 21: 473-485.
- Pulignano G, Del Sindaco D, Giovannini M, et al. Myocardial damage after spider bite (*Latrodectus tredecimguttatus*) in a 16-year-old patient. *G Ital Cardiol* 1998; 28: 1149-1153.
- Pneumatikos IA, Galiatsou E, Goe D, et al. Acute fatal toxic myocarditis after black widow spider envenomation. *Ann Emerg Med* 2003; 41: 158.
- Sams HH, Dunnick CA, Smith ML, et al. Necrotic arachnidism. *J Am Acad Dermatol* 2001; 44: 561-576.
- Brent J, Wallace KL, Burkhardt KK. *Care Toxicology*. Philadelphia: Mosby; 2005: 1179-1187.
- Lowry BP, Bradfield JF, Carroll RG, et al. A controlled trial of topical nitroglycerin in a New Zealand white rabbit model of brown recluse spider envenomation. *Ann Emerg Med* 2001; 37: 161-165.
- Phillips S, Kohn M, Baker D, et al. Therapy of brown spider envenomation: a controlled trial of hyperbaric oxygen, dapsone, and cyproheptadine. *Ann Emerg Med* 1995; 25: 363-368.
- Gueron M, Sofer S. Vasodilators and calcium channel agents as treatment of cardiovascular manifestations of human scorpion envenomation. *Toxicon* 1990; 28: 127-128.
- Karnad DR, Dea AM, Apte N. Captopril for correcting diuretic induced hypotension in pulmonary edema after scorpion sting. *Br Med J* 1989; 289: 1430-1431.
- Barzilay Z, Shaher E, Schneeweiss A, et al. Myocardial damage with life threatening arrhythmias during scorpion sting. *Eur Heart J* 1982; 3: 191-193.