

# ANAPHYLACTIC REACTION TO A SPIDER (*CHAETOPELMA AEGYPTIACA*) BITE IN A DOG

Srugo, I.\*, Aroch, I. and Bruchim, Y.  
Koret School of Veterinary Medicine, Hebrew University of Jerusalem, Israel

\*Corresponding author: Itay Srugo, DVM, Emergency and Critical Care Unit,  
School of Veterinary Medicine, The Hebrew University of Jerusalem, P.O. Box 12, Rehovot 76100  
Israel, Tel: 972-3-9688514, Fax: 972-3-9604079, E-mail: [srugo@agri.huji.ac.il](mailto:srugo@agri.huji.ac.il)

## ABSTRACT

*Chaetopelma aegyptiaca* is the largest spider native to Israel. Although it belongs to a highly poisonous spider family, the Israeli subspecies is not venomous but its bite has been reported as extremely painful by people. Its toxicity to dogs is unknown; however several fatal canine cases were reported in association with spider bites of the same family. A one-year-old, intact, male toy-terrier presented with chief complaints of excitement, vomiting, tremor, diarrhea and hypersalivation that appeared shortly and acutely after it had been bitten by *Chaetopelma aegyptiaca*. Anaphylactic shock was tentatively diagnosed based on the history and clinical signs. The dog was immediately treated with oxygen, intravenous crystalloids, diphenhydramine and ampicillin. Initial improvement was observed within one hour. The present favorable response to therapy suggests that anaphylactic shock due to *C. aegyptiaca* bite can be treated successfully without using epinephrine.

**Keywords:** Anaphylactic shock; arachnide; *Theraphosidae*; antihistamine; epinephrine; canine

## INTRODUCTION

*Chaetopelma aegyptiaca*, (*Theraphosidae*, *Chaetopelma*) is the largest spider in Israel (50-55 mm long) and is common in central and northern Israel, especially during winter and spring. It feeds on insects, small lizards and new-born mice. Although it belongs to a highly poisonous spider family, the Israeli subspecies is not venomous. However, its bite has been reported to be extremely painful in people (1).

Anaphylactic shock (AS) is a potentially life-threatening, rapidly developing, clinical emergency, characterized by a type-I, IgE-mediated hypersensitivity reaction. It has multisystemic clinical manifestations including hypotension, bronchospasm, urticaria, pharyngeal and laryngeal edema, cardiac arrhythmia and vomiting (2, 3). In dogs, initial signs of anaphylaxis may include excitement, vomiting, and diarrhea (4, 5). Initially, AS involves a rapid and massive release of vasoactive mediators, including histamine, leukotrienes, prostaglandins, tumor necrosis factor and other cytokines, from mast cells and basophils that lead to systemic increased vascular permeability and vasodilatation resulting in hypovolemia and shock (6). The diagnosis of anaphylaxis is mostly based on the history and clinical signs rather than on laboratory testing (7). The only reported reliable diagnostic laboratory test for anaphylaxis is serum mast cell tryptase activity that is frequently increased in this syndrome; however this test

is mostly unavailable in a clinical setting in veterinary medicine (7, 8).

In people, anaphylactic reactions have been reported to be triggered most commonly by certain drugs and food constituents (8, 9). Insects, such as honeybees, scorpions, pine processionary moths, mosquitoes and fire-ants were reported to cause hypersensitivity reactions in humans and dogs (10-12).

Epinephrine is considered the treatment of choice in AS and inhibits the release of mast cell inflammatory mediators through  $\beta$ -adrenergic receptors. Constant IV epinephrine infusion in AS has been reported to result in hemodynamic improvement due to increased mean arterial pressure as well as cardiac stroke volume and output (6). In contrast, a single IV epinephrine bolus did not hasten recovery or improve systemic hemodynamics in canine AS (13). Use of  $H_1$ -receptor blockers in canine anaphylaxis led to improved cardiac function, and  $H_3$ -receptor blocking was associated with a higher stroke volume (14).

This report describes a tentatively diagnosed AS associated with a *Chaetopelma aegyptiaca* spider bite in a dog. To the best of our knowledge this is the first report in the veterinary literature of AS-associated with a non-venomous spider bite.

## CASE HISTORY

A one-year-old, intact, male toy-terrier dog 2.3 kg body weight was presented at the Emergency Unit of the Hebrew University Veterinary Teaching Hospital (HUVTH), with chief complaints of excitement, vomiting, tremor, diarrhea and hypersalivation of an acute onset that had developed shortly after it was bitten by a spider, which was later brought to the HUVTH by the owners and morphologically identified as *Chaetopelma aegyptiaca*. At presentation, the dog was in lateral recumbency and had tachypnea (respiratory rate 80 breaths/min), tachycardia (heart rate 180 bpm), hypothermia (body temperature 35°C), prolonged (> 3 sec) capillary refill time (CRT), weak femoral pulses with absence of dorso-metatarsal pulses, right front limb swelling and edema. Small bite marks were observed in the center of the swollen area of the right front limb. Systolic arterial blood pressure using Doppler measurement was unmeasurable.

Complete blood count was unremarkable. Serum biochemistry revealed mild hyperglycemia (7.21 mmol/l, reference interval [RI] 3.6-5.71), increased activities of creatine kinase (CK, 1225 U/l, RI 13-250), alanine aminotransferase (ALT, 131 U/l, RI 5-70) and aspartate aminotransferase (AST, 121 U/l, RI 9-47), hypocarbemia [total CO<sub>2</sub> (TCO<sub>2</sub>) 15 mmol/l, RI 24-30], hyponatremia (124.4 mmol/l, RI 140-154), hypochloremia (102.8 mmol/l, RI 105-122) and hypocalcemia (ionized calcium 0.885 mmol/l, RI 0.950-1.400). Based on the history and clinical signs, AS was tentatively diagnosed. Further tests, such as arterial blood gas analysis and thoracic radiography were offered, but were declined by the owner.

The dog was hospitalized and immediately treated with oxygen (40% FLO<sub>2</sub>) through a mask, IV saline (30 ml/kg, over 10 min, followed by 5ml/kg/h of warm saline), diphenhydramine-HCl 2 mg/kg IM (Benadryl® 50mg/ml; Parke-Davis, USA) and ampicillin 25 mg/kg IV (Penibrin®, 1g/vial, Sandoz GmbH, Austria). Initial improvement was observed within one hour and the CRT, heart rate and body temperature were normalized. Six hours later, the dog was fully recovered and ambulatory and its vital signs were normal. It was discharged 12 hrs of presentation.

## DISCUSSION

Numerous spiders are reported to produce toxic venoms capable of inducing skin lesions and systemic illnesses up to death (15). In venomous spiders, certain venom proteins have IgE-binding activity that may result in anaphylaxis (11). *Chaetopelma aegyptiaca* is considered a non-poisonous spider in humans (1), however, its toxicity in dogs is presently unknown.

*Chaetopelma aegyptiaca* belongs to the family *Theraphosidae*. Spiders of this family are widespread in many parts of the world. Although bites of theraphoside

spiders appear to cause only minor effects in humans, their venom has been reported to lead to significant toxicity in various animal species, including birds, mice, cats and dogs (16, 17). It has been shown that the urticating hair of theraphoside spiders is a potent allergen that can cause hypersensitivity reactions in humans (18). In Australia, seven dogs and nine humans have been reported to be bitten by theraphoside spiders and resulted in death of all dogs, some within 30 minutes after the bite, while eight of the nine human patients had only minor signs and one patient presented mild systemic signs of bleeding and swelling (17). Another study in rodents has shown that the venom of the spider *Selenocosmia stirlingi*, another theraphoside spider, was responsible for three of the seven canine cases, led to severe hypoventilation, decreased heart rate and ECG disturbances (16). All of these signs are also common in anaphylactic reactions (2-5).

The venom of the *Theraphosidae* is a complex mixture of peptides, proteins and proteolytic enzymes (15, 19) all of which are potential allergens capable of precipitating anaphylaxis. Anaphylactic shock may have accounted for the rapid, fatal outcome of the previously reported cases in Australia (17).

The diagnosis of AS in the present dog was based on the history and clinical signs. The history of a *C. aegyptiaca* bite, with the following rapid, acute development clinical signs, typical of anaphylaxis, are highly suggestive of this condition. Most of the presenting clinical signs, including excitement, vomiting, tremors, diarrhea and hypersalivation have been previously described in canine anaphylaxis (4, 5) including the observation that vomiting and diarrhea were the initial signs (4). This tentative diagnosis of AS is further supported by the quick, full recovery after supportive and antihistamine therapy. The latter probably interrupted the IgE-mediated response induced by the bite. The possibility that these signs were due a toxic effect of the venom and a result of anaphylaxis cannot be completely ruled out, although it seems unlikely.

The increased muscle enzymes (CK and AST) activity was most probably a result of local muscle damage at the bite site that was most probably responsible for the increase in serum ALT activity. In dogs, ALT is present in the liver and the skeletal muscles. While under normal conditions, most serum ALT activity is of hepatic origin, and is thus considered liver-specific, when significant skeletal muscle damage occurs, ALT loses its liver specificity (20). Thus, in absence of other clinical and clinicopathological supporting hepatopathy, it is highly likely that the skeletal muscular lesions at the bite site were also its source in this case. Hyperglycemia was probably stress-related and due to sympathetic stimulation, and in agreement with previous reports of canine anaphylaxis (21). Hyponatremia and

hypochloremia in this case were probably due to the acute vomiting and diarrhea. Hypocarbemia was due to a combination of hyperventilation, hypothermia, shock and metabolic acidosis.

The treatment goals in AS include inhibition of the allergic reaction and providing cardiovascular and respiratory support. Emergency intervention should include high-flow oxygen, IV crystalloids, cardiac monitoring and support. Intravenous fluid boluses are required to overcome hypotension and tachycardia (5, 7, 13, 22).

The primary drugs used in acute anaphylaxis include epinephrine and antihistamines. Both interrupt the IgE-mediated allergic response, including mast cell activation and degranulation by high-affinity IgE receptors. Activated mast cells secrete a broad spectrum of inflammatory mediators leading to a rapid increase in vascular permeability and smooth muscle contraction (23, 24). The effects of histamine in AS have been shown to be mediated through both H<sub>1</sub> and H<sub>2</sub> receptors (25). Activation of H<sub>1</sub> receptors has been shown to induce coronary vasoconstriction and cardiac depression in dogs (14).

The use of antihistamines for the treatment and prevention of AS is well documented, and H<sub>1</sub>-antagonists are broadly used in the treatment of human and canine acute anaphylaxis (7, 25-27). Epinephrine has contraregulatory effects to histamine on smooth muscle, especially in the respiratory system and vasculature. This is among the reasons it is considered the drug of choice for the management of human AS. It needs to be employed with caution in cases with uncontrolled hypertension, coronary artery disease and serious ventricular arrhythmias. Studies of epinephrine bolus-therapy in animal models have shown only a short-term beneficial effect on blood pressure, that was followed by a decrease in cardiac output (3, 6, 13). Corticosteroids have been recommended for treatment of human AS, and have a role in reversing the commonly observed bronchospasm and cutaneous manifestations of anaphylaxis in human patients. However, there is no evidence that corticosteroids are effective in reversing the hemodynamic effects in anaphylaxis (7). Since asthma is an uncommon canine presentation, corticosteroids should be mostly reserved to AS cases exhibiting bronchospasm or cutaneous manifestations.

In the present case, diphenhydramine, an H<sub>1</sub>-receptor blocker, was elected as the sole agent to counter histamine effects. In the present dog, that has presented tachycardia and severe hypotension at presentation, it was decided to exclude epinephrine to avoid its potentially negative  $\beta$ -adrenergic side effects, including tachycardia, cardiac arrhythmias and increased myocardial oxygen demand. Acute lung injury and acute respiratory distress syndrome (ARDS) were previously described in canine AS due to a honeybee sting (12). Thus, further assessments of

pulmonary function and status (e.g. thoracic radiography and arterial blood gas analysis) in this case were probably warranted. The rapid recovery in response to therapy makes the presence of acute lung injury or ARDS highly unlikely in this case.

In conclusion, this is the first report of canine AS due to a bite by *Chaetopelma aegyptiaca*. The diagnosis of AS was tentative, and was based on the history and the nature and acute progression of the clinical signs that included excitement, vomiting, tremor, diarrhea and hypersalivation, all of which have been commonly reported in canine AS. Increased serum muscle enzymes activity was observed, and was probably due to local muscle lesions at the bite site. This dog was successfully treated with an H<sub>1</sub>-receptor blocker as a single agent and should be considered when epinephrine's adverse  $\beta$ -adrenergic effects are to be avoided. The cause of death in dogs bitten by theraphosid spiders is currently unknown; however, the present case suggests that AS should be considered as a potential cause of death in such cases.

## REFERENCES

1. Amitai, P., Handbook of the Insects and other arthropods of Israel, Keter Publishing House, Jerusalem (In Hebrew), 244-245, 1998.
2. Atkinson, T. P. and Kaliner, M. A., Anaphylaxis. *Med Clin North Am* 76 (4), 841-855, 1992.
3. Bautista, E., Simons, F. E., Simons, K. J., Becker, A. B., Duke, K., Tillett, M., Kepron, W. & Mink, S. N., Epinephrine fails to hasten hemodynamic recovery in fully developed canine anaphylactic shock. *Int Arch Allergy Immunol* 128 (2), 151-164, 2002.
4. Spink, W. W., Davis, R. B., Potter, R. & Chartrand, S., The Initial Stage of Canine Endotoxin Shock as an Expression of Anaphylactic Shock: Studies on Complement Titers and Plasma Histamine Concentrations. *J Clin Invest* 43, 696-704, 1964.
5. Lori, S., Systemic Anaphylaxis In: Textbook of Veterinary Internal Medicine Diseases of the Dog and Cat, 6<sup>th</sup> edn. Eds: S. J. Ettinger and E. C. Feldman. WB Saunders Co, Philadelphia. pp 458-460, 2005.
6. Mink, S. N., Simons, F. E., Simons, K. J., Becker, A. B. & Duke, K., Constant infusion of epinephrine, but not bolus treatment, improves haemodynamic recovery in anaphylactic shock in dogs. *Clin Exp Allergy* 34, 1776-1783, 2004.
7. Richard, S. K., Anaphylaxis. In: <http://www.emedicine.com/emerg/topic25.htm>; accessed at 13/06/2006.
8. Acero, S., Tabar, A. I., Garcia, B. E., Echechipia, S. & Olaguibel, J. M., Anaphylaxis: aetiological diagnosis. *Alergol Immunol Clin* 14, 133-137, 1999.
9. Rohrer, C. L., Pichler, W. J. & Helbling, A., Anaphylaxis: clinical aspects, etiology and course in

- 118 patients. *Schweiz Med Wochenschr* 128, 53-63, 1998.
10. Vega, J. M., Moneo, I., Armentia, A., Lopez-Rico, R., Curiel, G., Bartolome, B. & Fernandez, A., Anaphylaxis to a pine caterpillar. *Allergy* 52, 1244-1245, 1997.
  11. Sicherer, S. H. & Leung, D. Y., Advances in allergic skin disease, anaphylaxis, and hypersensitivity reactions to foods, drugs, and insects. *J Allergy Clin Immunol* 116, 153-163, 2005.
  12. Walker, T., Tidwell, A. S., Rozanski, E. A., DeLaforcade, A. & Hoffman, A. M., Imaging diagnosis: acute lung injury following massive bee envenomation in a dog. *Vet Radiol Ultrasound* 46, 300-303, 2005.
  13. Mink, S. N., Bands, C., Becker, A., Elkin, J., Sharma, S., Unruh, H. & Kepron, W., Effect of bolus epinephrine on systemic hemodynamics in canine anaphylactic shock. *Cardiovasc Res* 40, 546-556, 1998.
  14. Chrusch, C., Sharma, S., Unruh, H., Bautista, E., Duke, K., Becker, A., Kepron, W. & Mink, S. N., Histamine H3 receptor blockade improves cardiac function in canine anaphylaxis. *Am J Respir Crit Care Med* 160 (4), 1142-1149, 1999.
  15. Diaz, J. H., The global epidemiology, syndromic classification, management, and prevention of spider bites. *Am J Trop Med Hyg* 71 (2), 239-250, 2004.
  16. Atkinson, R. K., A comparison of the toxicity of the venoms of twelve common Australian spider species on rodent vital organ systems. *Comp Biochem Physiol C* 106 (3), 639-642, 1993.
  17. Isbister, G. K., Seymour, J. E., Gray, M. R. & Raven, R. J., Bites by spiders of the family Theraphosidae in humans and canines. *Toxicon* 41 (4), 519-524, 2003.
  18. Castro, F. F., Antila, M. A. & Croce, J., Occupational allergy caused by urticating hair of Brazilian spider. *J Allergy Clin Immunol* 95 (6), 1282-1285, 1995.
  19. Vieira, A. L., Moura, M. B., Baba, E. H., Chavez-Olortegui, C., Kalapothakis, E. & Castro, I. M., Molecular cloning of toxins expressed by the venom gland of *Lasiadora* sp. *Toxicon* 44 (8), 949-952, 2004.
  20. Zinkl J & MB, K., Clinical Enzymology. In: Clinical Biochemistry of Domestic Animals, 5th edn. Eds K. J. H. J and B. M. Academic Press, San Diego. pp 303-323, 1997.
  21. Zeckwer, I. T. & Nadler, J. E., The nature of the hyperglycemia associated with anaphylactic shock in the dog. *J Exp Med* 49 (march), 481-495, 1929.
  22. Wiener, E. S. & Bajaj, L., Diagnosis and emergent management of anaphylaxis in children. *Adv Pediatr* 52, 195-206, 2005.
  23. Williams, C. M. & Galli, S. J., The diverse potential effector and immunoregulatory roles of mast cells in allergic disease. *J Allergy Clin Immunol* 105 (5), 847-859, 2000.
  24. Brown, S. G., Mullins, R. J. & Gold, M. S., Anaphylaxis: diagnosis and management. *Med J Aust* 185 (5), 283-289, 2006.
  25. Lieberman, P., The use of antihistamines in the prevention and treatment of anaphylaxis and anaphylactoid reactions. *J Allergy Clin Immunol* 86 (4 Pt 2), 684-686, 1990.
  26. Winbery, S. L. & Lieberman, P. L., Histamine and antihistamines in anaphylaxis. *Clin Allergy Immunol* 17, 287-317, 2002.
  27. Tokita, S., Takahashi, K. & Kotani, H., Recent advances in molecular pharmacology of the histamine systems: physiology and pharmacology of histamine H3 receptor: roles in feeding regulation and therapeutic potential for metabolic disorders. *J Pharmacol Sci* 101 (1), 12-18, 2006.