JOINT TRAUMA SYSTEM K9 CLINICAL PRACTICE GUIDELINE

Arachnid and Snake Envenomation (K9CPG:11)

This Clinical Practice Guideline (CPG) provides guidance on supportive care for MWDs following scorpion stings, spider and snake bites.

CONTRIBUTORS

LTC Rachel Acciacca, VC, USA	MAJ Levi Hoffman, VC, USA

Previous contributors: LTC (Ret) Michael Lagutchik, VC, USA; LTC Janice Baker, VC, USAR; MAJ Jamie Brown, VC, USA; COL (Ret) Walter Burghardt, BSC, USAF; LTC(P) Matthew Enroth, VC, USA; LTC Shannon Flournoy, VC, USA; LTC (Ret) James Giles, III, VC, USA; MAJ Patrick Grimm, VC, USA; LTC Jennifer Hiniker, VC, USA; COL Jacob Johnson, VC, USAR; COL (Ret) Kelly Mann, VC, USA; MAJ (Ret) Eric Storey, VC, USAR; LTC Matt Takara, VC, USA; MAJ (Ret) Todd Thomas, VC, USA; LT Cory Frappier, MC, USN

Original publication date: 19 Nov 2018	Publication Date: 29 Mar 2025	Supersedes: 19 Nov 2018

TABLE OF CONTENTS

SUMMARY OF CHANGES

Removed U.S. Central Command specific guidance for antivenin product selection and expanded supportive care guidelines for affected military working dogs.

BACKGROUND

Arachnid and snake envenomation of dogs is possible in deployed settings. This K9 CPG discusses general management of these injuries.

When arriving in theater, refer to the JTS Snake Envenomation Management and Spider and Scorpion Envenomation CPG for currently available antivenom products. Consult with a veterinary clinical specialist (MOS 64F Veterinary Clinical Medicine Officer) to see if any of these products can be used for Military Working Dogs (MWDs). Be aware that many antivenom products, including newly developed polyvalent antivenoms, such as POLYSERP™ have not been tested or approved for use in dogs.

For MWDs with severe clinical signs, prompt treatment with antivenom can be advantageous, if an appropriate product is available.

Antivenom is the only product that can neutralize venom thereby decreasing morbidity and mortality. It is optimally given within 4 hours after a snake bite, although it can be effective up to 24 hours or longer after envenomation. Mortality rates in snake bite envenomated dogs ranges from 1-30% and depends highly on the snake involved.[1-4]

Antivenom is often only available in select Role 2 and Role 3 facilities because of availability and several products requiring cold storage requirements. However, newly developed products such as POLYSERP™ are freeze dried and shelf stable.

Antivenoms, especially those that contain whole immunoglobulin components, must be used with caution due to the potential to induce Type I (immediate) and Type III (delayed) hypersensitivity reactions.[1,3-6] Additionally, due to the equine and ovine origin of products, acute anaphylaxis has been documented as a complication and has been noted in 0.7% - 7% of patients receiving antivenom.[1]

Avoid cutting and/or suctioning the wound, ice, prophylactic antibiotics, prophylactic fasciotomy, routine use of blood products, and tourniquets. Try to minimize patient activity and movement of affected site.

Establish a timeline and note trend changes over time. Serial assessments and documentation are essential because the resolution or continuance of clinical signs will drive recommendations for antivenom therapy. Use of a permanent marker directly on the skin can be helpful in monitoring tissue effects over time.

ARACHNID ENVENOMATION

Arachnid envenomation typically causes local pain, erythema and swelling (angioedema or urticaria). Some venoms cause a locally extensive wound that often takes several days to manifest, while others may cause systemic anaphylaxis.

Venomous Scorpions

Venomous scorpions that typically induce severe clinical signs include the Arabian or Asian Fat-Tailed Scorpion (*Androctonus crassicauda*), *Hottentotta genus* scorpions, and *Hemiscorpius lepturus*. The sting causes minimal local inflammation, but the systemic effects can be serious and include nystagmus, paresthesia, referred pain, myoclonus, hypersalivation, tachycardia, hypertension, fever, and increased respiratory secretions.

Venomous Spiders

Venomous spiders that typically induce severe clinical signs include the Mediterranean Black Widow (*Latrodectus tredecimguttatus)* and the Tarantula or Wolf spider (*Lycosa singoriensis*). Patients usually present with severe pain after a painless bite and death can occur with severe envenomation. Note that *sopulgids* (camel spiders) are NOT venomous but may cause a painful bite.

SUPPORTIVE CARE FOR SCORPION STINGS & SPIDER BITES

Coordinate urgent Medical Evacuation (MEDEVAC) directly to appropriate medical facilities where antivenom is stored, if it is known that those products can be used in MWDs.

Ensure a patent airway and provide supplemental oxygen and ventilation, as needed.

Place an IV catheter and obtain a Complete Blood Count (CBC), blood chemistry panel, and urinalysis.

Administer isotonic crystalloids at a rate based on clinical signs and laboratory findings. A fluid rate of 1.5 – 2 times maintenance is often an appropriate initial starting point; however, fluid boluses may initially be necessary. General maintenance fluid rate is 40-60 mL/kg/day. Adjustment to fluid rate is based on patient's clinical response, monitoring ins and outs and clinical parameters such as body weight, CBC and chemistry values. Monitor for signs of fluid overload such as increasing body weight (>10%), tissue edema, serous nasal discharge, or increased respiratory rate or effort.

Administer 2-4 mg/kg diphenhydramine IM. Repeat diphenhydramine every 8 hours for 72 hours.

> ***NOTE: MWD handlers may have been issued diphenhydramine and may have initiated therapy before presentation. Do not give diphenhydramine IV because it can cause severe hypotension in dogs.***

Manage any open wounds that develop. (See K9 Wound Management CPG.)

Treat pain if noted. (See K9 Analgesia and Anesthesia CPG.)

> ***NOTE: Do not treat with NSAIDs given the propensity for envenomated dogs to develop coagulopathies, thrombocytopenia, thrombocytopathia, and secondary acute kidney injury.***

If systemic anaphylaxis is suspected based on the history and clinical signs (weakness, peracute vomiting or diarrhea, collapse, or hypotension), treat the MWD as above, and treat with IV fluid therapy as for shock (see K9 Shock Management CPG) and start an epinephrine CRI at 0.1-1 mcg/kg/min. Though a CRI takes longer to set up, it has demonstrated superiority in the treatment and resolution of anaphylaxis over bolus dosing.[7,8] If a CRI is unavailable, give epinephrine (0.01 mg/kg, IM or IV; repeat, if necessary, every 20-30 minutes).

Hospitalize the patient and provide supportive care until resolved or evacuated. During hospitalization, measure and track swelling and progression of local tissue effects.

ANTIVENOM USE FOR SCORPION STINGS & SPIDER BITES

Scorpion Stings

Administer scorpion antivenom if the specific scorpion is identified and if systemic clinical signs of envenomation are present.

For the specific product available, follow manufacturer recommendations for dilution and dosing, and with consultation by the respective theater veterinary clinical specialist (AOC 64F).

Spider Bites

Antivenom is only available for black widow spider bites. Administer *Latrodectus mactans* antivenom for witnessed black widow spider (*Latrodectus tredecimguttatus*) bites and with systemic envenomation clinical signs.

Reconstitute 1 vial and dilute according to manufacturer recommendations and infuse IV over 15 minutes.[1]

SNAKE ENVENOMATION

Clinical signs of bites by venomous snakes can vary tremendously, principally depending on the type of snake involved, location and number of bites, and the amount of venom injected. Providers should become familiar with indigenous snakes in deployed areas and seek guidance on specific management recommendations in preparation for deployments. Information on

indigenous venomous snakes in each area of operation can be found in the Veterinary Medical Threat Brief from the Medical Detachment Veterinary Service Support or the component command veterinarian.

In general, snakebites by most venomous vipers cause severe pain, variable degrees of local swelling that may spread, and varying degrees of local tissue necrosis. Many MWDs will also develop systemic signs of pain. Some dogs can develop life-threatening complications of envenomation. Conversely, snakebites by most venomous elapids (i.e. cobras, mambas, coral snakes, and taipans) produce minimal swelling but are potent neurotoxins that can progress to life-threatening paresis and respiratory failure. Elapid venom can also cause marked intravascular hemolysis that may require red blood cell transfusions. It is prudent to recommend that any MWD bitten by a venomous snake be evacuated URGENTLY for optimal management. Follow guidelines below while coordinating evacuation.

Unwitnessed envenomation is common. The presence of fang marks does not mean that envenomation has occurred – "dry bites" are common. Approximately 25% of pit viper bites in humans are "dry" and do not cause envenomation.[9] Conversely, envenomation may have occurred without obvious puncture wounds evident.

Note: Echinocytosis seen on blood smear evaluation can confirm snake envenomation.

Injection of viper venom typically causes marked localized swelling and edema, intense local pain, and discoloration of the surrounding tissues due to necrosis, with oozing of venous blood. Clinical signs of pit viper envenomation occur within the first 30 minutes from time of bite, but the patient should be observed for delayed effects over 24 hours.[9]

Systemic signs frequently observed include pain, lethargy, vomiting, weakness, hypotension, tachypnea, tachycardia, ecchymosis, diarrhea/hematochezia, and occasionally neuropathies. Many MWDs will develop laboratory evidence of thrombocytopenia and coagulopathy but true spontaneous hemorrhage is rare.

Injection of elapid venom typically causes rapid paresis that can occur within minutes but may be delayed for up to 24 hours. Paresis can progress to the diaphragm requiring mechanical ventilation. Elapid venom can also cause significant hemolysis that may require a packed red blood cell transfusion. Monitoring for early clinical signs includes serial checks of the patellar reflex, measuring respiratory parameters on a blood gas analysis, and serial evaluations of serum for hemolysis. In addition to respiratory paralysis, life-threatening acute kidney injury can occur with severe hemolysis, therefore kidney values should be monitored if hemolysis develops.

If no clinical signs of envenomation are present, do not administer antivenom and observe the patient for 12-24 hours. Perform baseline database on intake, if any clinical signs develop, and prior to discharge.

In severe envenomation cases, blood products such as canine fresh frozen plasma, packed red blood cells, whole blood, or other interventions may be needed. Refer to the Transfusion for the MWD CPG for guidance.

Patients presenting in or that later develop shock should be treated as recommended in the K9 Shock Management CPG, in addition to receiving antivenom treatment.

SUPPORTIVE CARE FOR VENOMOUS SNAKE BITES

Coordinate urgent MEDEVAC directly to appropriate medical facilities where antivenom is stored, if it is known that those products can be used in MWDs.

Hospitalize any MWD with history or signs suggesting envenomation for at least 24-48 hours to monitor progression.

Ensure patent airway, provide supplemental oxygen, and ventilation, as needed. Remove any canine equipment that may become restrictive due to local tissue swelling.

Place an IV catheter.

DIAGNOSTICS

Obtain initial vital signs measurements including a blood pressure to assess for hypotensive shock.

Perform a CBC, blood chemistry panel, and urinalysis. Do not perform a cystocentesis due to risk of coagulopathy.

If possible, perform a PT/aPTT or ACT. Coagulation machines meant for human blood are not reliable for canine coagulation parameters.

Examine a blood smear to evaluate for echinocytosis and perform a manual platelet count.

TREATMENT

Antivenom

Antivenom choice should be determined by the MWD's geographical area and suspected species of snake involved. Many antivenom products, included recently developed polyvalent antivenoms, such as POLYSERP™ have not been tested or approved for use in dogs.

Dose based on the severity of envenomation and clinical response to antivenom therapy.

Follow manufacturer directions for reconstitution (if applicable), dilution, and administration if antivenom is clinically indicated and available.

Monitor for hypersensitivity reactions.

Analgesia

Fully reversible opioids preferred until patient is no longer a risk for hypotension. (See Analgesia and Anesthesia K9 CPG).

> ***NOTE: Do not treat with NSAIDs, given the propensity for envenomated dogs to develop coagulopathies and secondary acute kidney injuries.***

Administer isotonic crystalloids at a rate based on clinical signs and laboratory findings. A fluid rate of 1.5 – 2 times maintenance is often an appropriate initial starting point; however, fluid boluses may initially be necessary. General maintenance fluid rate is 40-60 mL/kg/day. Adjustment to fluid rate is based on patient's clinical response, monitoring ins and outs and clinical parameters such as body weight, CBC and chemistry values. Monitor for signs of fluid overload such as increasing body weight (>10%), tissue edema, serous nasal discharge, or increased respiratory rate or effort.

Manage any open wounds that develop. (See K9 Wound Management CPG)

Do NOT use tourniquets, ice packs, heating, or local vasoconstriction (e.g., injection of epinephrine locally) in an attempt to slow venom spread.

Confine MWDs to minimize venom distribution.

MONITORING

Snakebite Severity Score (SSS) should be considered as an objective tool to guide antivenom administration. A SSS assigns a score of 0-3 or 0-4 for six body areas to assess neurological, gastrointestinal, cardiac, coagulation, local wound, and pulmonary parameters.[10] A score of 20 is consistent with severe envenomation. SSS is most helpful for monitoring trends and can be misleading in the subacute setting as signs can be delayed.[11] Consider completing a SSS every six hours during patient hospitalization. (See Table 1.)

Repeat diagnostics as necessary (to include PCV/TS, blood chemistry panel, platelet count, blood pressure) 4-6 hours after initial baseline, as needed based on clinical signs, and at time of discharge.

Measure and track swelling and progression of local tissue effects.

Antivenom Adverse Reactions

Type I hypersensitivity reactions can be minor and local or severe and generalized. Clinical signs include facial swelling, hyperemia of the sclera or pinnae, agitation, bradycardia, tachycardia, vomiting, ptyalism, urticaria, facial pruritus, tachypnea, and/or fever. Most reactions can be treated by slowing the antivenom infusion rate. Additional treatments include

diphenhydramine (2-4 mg/kg, IM) and +/- an anti-inflammatory dose (0.1 mg/kg/day), IV) of dexamethasone. Pretreatment with antihistamines or steroids is not recommended to influence development of Type I hypersensitivity.

Delayed Type III hypersensitivity reactions, or serum sickness, can manifest 3 to 21 days after antivenom administration and include fever, lethargy, diarrhea, painful joints, lymphadenomegaly, vasculitis, urticaria, and gastrointestinal signs. Treatment involves a tapering dose of glucocorticoids and antihistamines.[12] For gastrointestinal signs, gastroprotection therapy can be initiated with a proton-pump-inhibitor (omeprazole PO 1 mg/kg q 12 hours or pantoprazole IV 1 mg/kg q 12 hours).

Anaphylaxis to antivenom is rare but can have an acute or a delayed onset. Reported anaphylactoid adverse reactions include Type I hypersensitivity clinical signs in addition to hypotension, dyspnea, shock, collapse, and death. Providers should be prepared to treat signs of anaphylaxis with an epinephrine CRI (0.1-1 mcg/kg/min IV) or bolus dosing (0.01 mg/kg, IV or IM), diphenhydramine (2-4 mg/kg IM), and +/- an anti-inflammatory dose (0.1 mg/kg/day, IV) of dexamethasone. Though an epinephrine CRI takes longer to set up, it has demonstrated superiority in the treatment and resolution of anaphylaxis over bolus dosing.[7,8]

Table 1. Snake Bite Severity Score

SNAKE BITE SEVERITY SCORE	
Pulmonary System	0 – Signs within normal limits. 1 – Minimal: Slight dyspnea. 2 – Moderate: Respiratory compromise, tachypnea, use of accessory muscles. 3 – Severe: Cyanosis, dyspnea, extreme tachypnea, respiratory insufficiency, or respiratory arrest from the cause.
Cardiovascular System	0 – Signs within normal limits. 1 – Minimal: Tachycardia, general weakness, benign dysrhythmia. 2 – Moderate: Tachypnea, hypotension (but tarsal pulse still palpable). 3 – Severe: Extreme tachypnea, hypotension (nonpalpable pulse or systolic blood pressure <80 mm Hg), malignant dysrhythmia or cardiac arrest.
Local Wound	0 – Signs within normal limits. 1 – Minimal: Pain, swelling, ecchymosis, erythema limited to bite site. 2 – Moderate: Pain, swelling, ecchymosis, erythema involves less than half of extremity and may be spreading slowly. 3 – Severe: Pain, swelling, ecchymosis, erythema involves most or all of one extremity and is spreading rapidly. 4 – Very severe: Pain, swelling, ecchymosis, erythema extends beyond affected extremity, or significant tissue to slough.
Gastrointestinal System	0 – Signs within normal limits. 1 – Minimal: Abdominal pain, tenesmus. 2 – Moderate: Vomiting, diarrhea. 3 – Severe: Repetitive vomiting, diarrhea, or hematemesis.
Hematological System	0 – Signs within normal limits. 1 – Minimal changes of coagulation parameters: PT and PTT above normal and up to 2 times above normal, platelets 100,000 to 150,000/mm^3. 2 – Moderate increase in coagulation parameters: PT increased by a factor of 2-5 times above normal and PTT increased by a factor of 2-3 above normal, platelets 50,000 to 100,000/mm^3. 3 – Severe: Increases of coagulation parameters: PT increased by a factor of 5-10 times above normal and PTT increased by a factor of 3-4 times above normal, platelets 20,000 to 50,000/mm^3. 4 – Very severe: Coagulation parameters markedly abnormal with bleeding present or the threat of spontaneous bleeding, including PT immeasurable, PTT immeasurable, platelets <20,000/mm^3.
Central Nervous System	0 – Signs within normal limits. 1 – Minimal: Apprehension. 2 – Moderate: Chills, weakness, faintness, and ataxia. 3 – Severe: Lethargy, seizures, coma.
Total Severity Score: (Sum of 6 sections)	Time:_____ Score:_____ Time:_____ Score:_____

PERFORMANCE IMPROVEMENT (PI) MONITORING

POPULATION OF INTEREST

All MWDs with diagnosis of arachnid (spider or scorpion) or snake bite.

INTENT (EXPECTED OUTCOMES)

- Recovery from bite incident.
- No evidence of organ injury (sustained kidney injury, etc.)
- No long-term morbidity from wound occurrence and subsequent management.

PERFORMANCE/ADHERENCE MEASURES

- Number and percentage of patients in the population of interest (deployed MWDs) that sustained arachnid or snake bites.
    - Specify what type of bite if information is available.
- Number and percentage of patients in the population of interest (deployed MWDs) that required sustained wound management (> 7 days) because of arachnid or snake bite.
- Number and percentage of patients in the population of interest (deployed MWDs) that recovered from arachnid or snake bites.
    - Number and percentage of MWDs that returned to duty versus those that were medically retired following the bite event or that died as result of the bite incident.

DATA SOURCE

- Patient Record
- Department of Defense Military Working Dog Trauma Registry

SYSTEM REPORTING & FREQUENCY

The above constitutes the minimum criteria for PI monitoring of this K9 CPG. System reporting will be performed annually; additional PI monitoring and system reporting may be performed as needed.

The system review and data analysis will be performed by direction of the K9C4 Chair.

REFERENCES

1. Armentano RA, Schaer M. Antitoxins and Antivenoms. In: Silverstein DC and, Hopper K, eds. Small Animal Critical Care Medicine. St. Louis: Saunders/Elsevier, 2023.
2. Gilliam LL, Brunker J. North American Snake Envenomation in the Dog and Cat. Veterinary Clinics of North America: Small Animal Practice 2011:41;1239-1259.
3. Katzenbach JE, Foy DS. Retrospective evaluation of the effect of antivenom administration on hospitalization duration and treatment cost for dogs envenomated by Crotalus viridis: 113 dogs (2004-2012). Journal of Veterinary Emergency and Critical Care 2015:25;655-659.

4. Peterson ME, Matz M, Seibold K, Plunkett S, Fitzgerald K. A randomized multicenter trial of Crotalidae polyvalent immune Fab antivenom for the treatment of rattlesnake envenomation in dogs. Journal of Veterinary Emergency and Critical Care 2011:21;335-345.
5. Woods C, Young D. Clinical safety evaluation of F(ab')2 antivenom (Crotalus durissus-Bothrops asper) administration in dogs. Journal of Veterinary Emergency and Critical Care 2011:21;565-569.
6. Lund HS, Kristiansen V, Eggertsdottir AV, et al. Adverse reactions to equine-derived F(ab')2-antivenin in 54 dogs envenomated by Vipera bersus bersus. Journal of Veterinary Emergency and Critical Care 2013:223;532-537.
7. Fujizuka K, Nakamura M, Tamura J, Kawai-Kowase K. Comparison of the efficacy of continuous intravenous infusion versus intramuscular injection of epinephrine for initial anaphylaxis treatment. Acute Med Surg. 2022 Oct 20;9 (1):e790.
8. Mink SN, Bands C, Becker A, et al. Effect of bolus epinephrine on systemic hemodynamics in canine anaphylactic shock. Cardiovasc Res. 1998 Dec;40(3):546-56.
9. Schaer M. Overview and controversies in the medical management of pit viper envenomation in the dog. Journal of Veterinary Emergency and Critical Care 2011:21;461-470.
10. Peterson ME. Snake bite: pit vipers. Clin Tech Small Anim Pract. 2006;21(4):174-182.
11. Southern CJ, Allen-Durrance AE, Schaer M. Pit viper envenomation in pediatric dogs: 5 cases. Clin Case Rep. 2021 Nov 12;9(11):e05065.
12. Lee BM, Zersen KM, Schissler JR, Sullivan LA. Antivenin-associated serum sickness in a dog. J Vet Emerg Crit Care (San Antonio). 2019;29(5):558-563.