METROPOLITAN VETERINARY ASSOCIATES

NEWSLETTER

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Dear Friends,

I am happy to announce that Metropolitan Veterinary Associates has recently partnered with an exceptional veterinary hospital group in Connecticut named Pieper Veterinary allowing us to stay privately owned while leveraging a larger combined infrastructure. Pieper Veterinary is a family operated network of veterinary hospitals that has been operational for over 85 years. Partnering with Pieper has provided my partners, Jim Dougherty and Jon Nannos, a path to retire, while allowing me to continue to operate MVA into the next chapter. While we have enjoyed being a fully independent hospital, we truly believe this partnership with a like-minded hospital group is key to the future growth and success of MVA. Furthermore, and probably most importantly, we feel strongly aligned with Pieper's values of medicine first, teaching and training, integrated care, and family culture.

I am very proud to be part of the Pieper family and look forward to continuing to support all of our local referral partners for decades to come.

Best,
Dr. John DeBiasio

Introducing Three New Doctors to Our Team

Internal Medicine | **Jennifer Adler, MSc, VMD, DACVIM (SAIM)**

Dr. Jennifer Adler attended Boston College and The London School of Economics prior to graduating with honors from the University of Pennsylvania School of Veterinary Medicine in 2003. She completed a small animal internship at VCA West Los Angeles Animal Hospital and then returned to Penn for residency. She became board certified in Small Animal Internal Medicine in 2007.

Dr. Adler grew up in Media, Pennsylvania and has been practicing in the Philadelphia area since completing her residency. She was at the Center for Animal and Emergency Services (CARES) in Langhorne from 2008 until 2023 where she cared for patients and was in a medical leadership role. She joined Metropolitan Veterinary Associates in 2023.

Dr. Adler enjoys helping pets with complicated internal medicine conditions, guiding their owners with an individualized approach. Her professional interests include gastrointestinal disease, immune mediated diseases, as well as the developing field of Veterinary Patient Safety and Medical Quality. She appreciates the opportunity to continually learn which is afforded by practicing at a large, multispecialty hospital.

In her free time, Dr. Adler enjoys spending time with her husband, three school aged children, two dogs and a green Severum fish named Razor. Her hobbies include skiing, gardening, playing squash and reading.

Radiology | **Kaitlin Fiske, DVM, DACVR**

Dr. Kaitlin Fiske, originally from South Florida, earned her undergraduate Bachelor of Science at the University of Central Florida in Orlando before attending the University of Florida for her doctorate in veterinary medicine degree. Following veterinary school, she completed a small animal rotating internship at Mississippi State University. After moving to the Northeast, she spent the next three years working as an ER veterinarian, completing a specialty diagnostic imaging specialty internship, and diagnostic imaging specialty fellowship in Massachusetts and New York. She completed her Diagnostic Imaging Residency at Auburn University in Auburn, Alabama in 2023. Dr. Fiske joined MVA in September 2023.

She has two cats, Cody and Rory, who are the most spoiled cats in the world. In her free time, Dr. Fiske likes reading, crafts, and exploring coffee shops.

Emergency Services | **Ashley Genetti, BScVMS**

Dr. Genetti, a PA native, attended Philadelphia University for undergrad where she received her Bachelor of Science degree in Health Science in 2016. She then moved across the pond to attended veterinary school in sunny Scotland at the University of Edinburgh's Royal (Dick) School of Veterinary Studies. There she obtained a Bachelor of Veterinary Medicine and Surgery (BVM&S) and obtained her higher education teaching certificate (AFHEA).

Following graduation in 2022, she returned stateside and completed a companion animal rotating internship in Annapolis, MD. Moving back to the Greater Philadelphia region, Dr. Genetti joined the MVA team in August 2023. Her professional interests include toxicology, managing neurologic cases, urinary obstructions and client communication.

In her free time, she enjoys traveling, hiking, and spending time with family, friends and her pets. She shares two French bulldogs (Nero and Panzer) and two cats (Desmond and Cher) with her partner, Matt.

On-Line CE for rDVM's

Stop and Catch your Breath – Review and Updates in Brachycephalic Airway Syndrome

In this 90-minute lecture we will review the anatomy and pathophysiology of brachycephalic airway syndrome (BAS). We will discuss surgical technique for common surgical procedures for correction of stenotic nares and elongated soft palate, as well as management options for other components of BAS. The lecture will end with an update on the most recent literature including temporary palatoplasty for emergent transport of patients, modifications to the standard palate surgery options, and updates on BAS in cats.

Thursday, November 9th at 6:30pm | 2 RACE CE credits

Speaker: Dominique Sawyere, BVSc, MS, DACVS-SA

Register Now!

Overview of Pathophysiology and Treatment of Crotalidae Envenomation in Dogs and Cats

Rachel Morgan, DVM, DACVECC

It is estimated that up to 100,000 venomous snakebites affecting dogs and cats occur each year, with a mortality rate of anywhere between 1 to 30% (Peterson 2006 and Wells 2023). While venomous snakebites involving companion animals in Pennsylvania occur less commonly than they do in the western, southeastern and gulf coast areas of the United States, they do occur, and it is therefore important to be familiar with the associated clinical signs and treatment recommendations.

Generally, venomous snakes in the United States are divided into two families—Elapidae and Crotalidae (Peterson 2006). The crotalidae family includes species that are typically referred to as pit vipers, and in the United States, is composed of rattlesnakes,copperheads, and cottonmouth water moccasins (Ernst 2003, Keyler 2016). There are 21 species of snakes in Pennsylvania, three of which are venomous. Venomous species include Northern Copperhead (Agkistrodon contortrix), Timber Rattlesnake (Crotalus horridus) and Eastern Massasauga Rattlesnake (Sistrurus catenatus catenatus) (Ernst 2003, Keyler 2016). The Elapidae family consists of species like the coral snake, and as they are not present in Pennsylvania, they will not be discussed here.

Pit vipers have specific characteristics, including front fangs that can be retracted to fold back against the roof of the mouth, triangular-shaped heads, elliptical pupils, and heat sensing areas or "pits" between the nostrils and eyes (Keyler 2016, Peterson 2006). The crotalus and sistrurus genera of this family have rattles on their tails comprised of keratin. In terms of habitat, northern copperheads (See Figure 1) are spread throughout Pennsylvania and are most often found in open fields, under rock outcroppings or around brush piles. The timber rattlesnake (See Figure 2) is also found widely throughout the state and prefers similar areas as well as mature forests with fallen logs and leaf litter for cover (Hulse 1998). The Eastern Massasauga Rattlesnake (See Figure 3) is more rarely encountered and is found only in a few counties in western Pennsylvania. It prefers damp areas such as swamps and low-lying areas with poor drainage (Ernst 2003).

When bites occur, crotalidae species open their mouths wide and the maxilla and fangs rotate forward. Strikes and subsequent bites can occur very quickly with speeds that have been documented up to 8 feet per second (Peterson 2006). Sites of envenomation do not always consist of 2 paired puncture wounds from the snake's fangs—bites can sometimes result in just 1 puncture wound. Statistics for companion animals are unknown, but 25 percent of pit viper bites in human victims are reported to be "dry" and do not result in envenomation (Keyler 2016, Armentano et al 2011).

When there is envenomation, the severity of bite depends on the location, species of snake, number of bites, the depth of the bite and volume of venom injected (Peterson 2006, Wells 2023). Multiple factors can impact the volume of venom released by the snake's fangs, including whether it has recently ingested prey. The longer the snake has gone without eating, the more venom will be present in the venom sac at the time of the bite (Peterson 2006). Larger snakes also have the capacity to inject larger volumes of venom. Other factors that can influence the severity include the site of the bite on the victim and the time it takes until medical aid can be rendered (Armentano et al 2011, Peterson 2006). Bite wounds on the head or neck or inside the mouth of the dog or cat can lead to upper airway swelling and obstruction (Keyler 2006, Wells 2023). Some studies report that dogs are more likely to be struck in the face as opposed to human envenomation which more commonly involves a distal extremity (Keyler 2016). Bites may be witnessed or unwitnessed, unwitnessed bites in dogs and cats may not be identified initially as envenomation as the puncture marks may be obscured by the haircoat, however, classic clinical signs include acute, rapid swelling, pain, tissue necrosis, swelling and localized hemorrhage (Peterson 2006, Armentano et al 2011).


Dr. Rachel Morgan

Apart from local damage and hemorrhage due to myotoxins, crotalid venom can also cause numerous and variable systemic effects including muscle weakness, hypotension, hypovolemic shock, neurologic impairment, abnormalities in the hematologic profile including thrombocytopenia, hemolysis and coagulopathies as well as secondary consequences following shock and muscle necrosis including cardiac arrhythmias such as ventricular tachycardia, acute kidney injuries, rhabdomyolosis, and multiple organ dysfunction (Armentano et al 2011, Wells 2023). Due to the variable

Images top to bottom: Nothern Copperhead, Timber Rattlesnack, Eastern Massasauga Rattlesnake

manifestations of the venom and its variety of enzymatic properties, almost any organ system in the body can be affected (Wells 2023). The onset of clinical signs typically begins 30-45 minutes after the initial bite, however, delays in clinical signs have been reported up to 6 hours (Keyler, 2016). If large volumes of venom are injected or if the venom is arterialized, the victim can experience shock within minutes (Armentano et al 2011). Effects of crotalidae venom are numerous, have both localized and systemic effects and are mediated by a wide variety of peptides as well as enzymatic and nonenzymatic proteins.

Commonly implicated enzymes within crotalidae venom include phospholipase A2, phosphatases, exopeptidase, hyaluronidase, and L-amino oxidase (Armentano et al 2011). Phospholipase A2 contributes to the accumulation of inflammatory cells to the original bite wound site and damages red blood cell membranes, resulting in the development of alterations in red blood cell morphology, including echinocytes which are closely associated with snakebites, with some studies reporting that up to 89% of patients will exhibit echinocytosis if venom has been injected (Keyler 2016, Armentano et al 2011). Spherocytes and other red blood cell morphology changes may also be appreciated. Release of proinflammatory compounds such as arachidonic acid and thromboxane A2 contribute to aggregation of platelets and thrombocytopenia (Armentano et al 2011). Proteases and endopeptidases contribute to soft tissue damage and coagulopathies, and the accumulation of hyaluronidase and collagenases exacerbate the systemic spread of the venom (Wells 2023). Various species of crotalidae can also manifest particular venom properties—for example, thrombocytopenia and depletion of fibrinogen are reported to be particularly severe in certain types of North American rattlesnakes, including the eastern and western diamondback (Crotalus adamanteus and C. atrox), timber (C. horridus), blacktail (C. molosus), and Mojave (C. scutulatus). Protein particles called snake venom metalloproteinases (SVMPs) can also contribute to thrombocytopathy (platelet dysfunction)

which can also contribute to altered coagulation status (Wells 2023, Kamiguti et al 2005). The pygmy rattlesnake (Sistrurus miliarus) contains a component called barbourin, which specifically inhibits platelet aggregation and contributes to thrombocytopenia (Armentano et al 2011). Some Crotalus species including the Mojave rattlesnake (C. scutulatus) and canebrake rattlesnake (C. horridus atricaudatus) venom containneurotoxins (Keyler 2016, Wells 2023, Armentano et al 2011).

The particular form of coagulopathy associated with crotalid envenomation is not similar to that seen with disseminated intravascular coagulation (DIC) and is characterized by a normal D-dimer concentration, decreased fibrinogen and platelets as well as prolonged PT (prothrombin time) and PTT (partial thromboplastin time). Crotalus atrox (the Western Diamondback Rattlesnake) venom is often implicated as one of the more potent venom types regarding its anticoagulant properties. The specific coagulopathy caused by pit vipers results in a deficit of fibrinogen (whose transformation into fibrin is necessary for clot stabilization) a lack of ability to form an effective thrombus and is often referred to as venom-induced consumptive coagulopathy (VICC) (Altemus Bailey et al 2022).

Initial assessment of cats and dogs with crotalid envenomation includes routine screening at the time of triage for signs of systemic shock as well as hospitalization for observation in case of manifestation of the previously discussed clinical signs, and patients should be monitored closely for hypotension, tachycardia, changes in mentation and signs of coagulopathy including ecchymoses and melena as well as refractory hemorrhage from the original bite wound itself. A complete blood count, blood smear, chemistry panel, venous blood gas with electrolytes, in house coagulation profile such as PT/PTT, blood pressure monitoring and EKG testing should be performed in order to obtain baseline values, especially in patients that are systemically depressed (Wells 2023, Armentano et al 2011). Studies have reported various frequencies of hematologic abnormalities in canine patients with rattlesnake envenomation, with one study reporting prolongation of either PT or PTT in 56% of patients, while another study reported thrombocytopenia in 88% of dogs (Armentano et al 2011). Free catch urinalysis (due to the risk of coagulation abnormalities) can also be considered to monitor for the presence of hematuria, myoglobinuria or hemoglobinuria which may occur secondary to coagulation abnormalities or rhabdomyolysis (Wells 2023).Creatinine kinase concentrations may be elevated due to muscular damage (Keyler 2016).

A 2015 study by Witsil et al proposed a canine snakebite severity scoring system (cSSS) based on an established human snake bite severity score that is used to gauge severity and progression in humans with pit viper envenomation. The adaptation by Witsil et al attributes a score of 0 if absent or 1 if noted for clinical signs associated with the bite (termed bite factors) including swelling, ecchymoses, pain, and drainage). A score of 1 is added for each clinical sign affecting the following categories: cardiovascular, pulmonary, gastrointestinal, neurological, thermal, or other. The total canine snake bite severity score is the sum of the bite factor sum and the clinical sign score (Witsil et al 2015).

A snake venom detection kit (SVDK) is

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available for clinical use in Australia in both people and companion animals and is used to detect the presence of venom of brown, tiger, black snakes, death adders and taipans within the urine, blood, or bite-site swabs of patients with potential snakebites (Valenza et al 2021). While not currently available for detection of crotalidae venom in the United States, development of such kits in the future may prove helpful for veterinary patients, in whom visual snake bites may be more difficult to detect or confirm if unwitnessed by the family.

Initial treatment and stabilization depend on the individual manifestation of venom components and degree of hypovolemia, but supportive care typically includes IV fluid therapy (typically with isotonic crystalloid solutions) blood product administration, analgesia, and possible antimicrobial administration in selective cases. No evidence-based information exists to document any benefit of corticosteroid use in snakebite envenomation, and concerns exist that they may exacerbate of the risks of developing gastrointestinal ulcers or immunosuppression (Keyler 2016, Armentano et al 2011, Wells 2023). The use of nonsteroidal anti-inflammatories is likewise contraindicated due to risks for acute kidney injury in this patient population due to shock and myoglobinuria secondary to rhabdomyolysis as well as the potential for exacerbation of coagulopathies (Wells 2023). Due to the fact that numerous studies have not revealed that bacteria is routinely found in oral secretions of rattlesnakes (and that in fact their venoms may actual contain antimicrobial properties), the use of prophylactic antibiotics for rattlesnake bites remains controversial and is not currently recommended in human medicine—however, some wounds may develop secondary bacterial infiltration as a result of decreased perfusion and opportunistic infections, in that case current general recommendations are to use a narrow spectrum for a short duration with guidance from a culture and susceptibility panel (Wells 2023, Armentano et al 2011).

The use of fresh frozen plasma (FFP), especially without having administered antivenom to neutralize the anticoagulant effects of the venom, is controversial when treating a venom induced coagulopathy as many feel that providing FFP will not replace the depleted fibrinogen concentrations that are particular to snakebite patients (Wells 2023). Typically, current recommendations extrapolated from human medicine is that FFP administration may have a place for patients that are displaying refractory or persistent signs of coagulopathy after appropriate doses of antivenom have already been administered, but that mainstay of therapy is antivenom administration in order to neutralize the volume of venom in circulation (Armentano et al 2011, Wells 2023). If an appropriate blood donor is available in a timely fashion, administration of fresh whole blood can be considered in patients who are demonstrating both anemia and coagulopathy. Analgesic drug options to control the pain resulting from the initial wound include opioids such as fentanyl and methadone as well as the partial opioid agonist buprenorphine. Continuous rate infusions of ketamine and lidocaine can also be considered. It is recommended to avoid morphine as an analgesic choice due to the potential for histamine release that can exacerbate hypotension (Armentano et al 2011).

The use of a polyvalent crotalid antivenom is recommended for moderate to severe cases of pit viper envenomation. Benefits of administration include reversal of anticoagulant effects and limitation of swelling and progression of neuropathic signs (Armentano and Shaer 2023). Reversal of tissue necrosis does not occur with administration of antivenom and the wound will need to be managed serially. The three approved, commercially available products for use in pit viper envenomation in dogs and cats in the United States are: 1.) Antivenin (Croatalidae) Polyvalent (ACP) 2.) Venomvet (Antvenin Crotalidae Polyvalent Equine Origin) 3.) Rattler Antivenin (Armentano and Shaer 2023). Two other products (Antivipmyn (Polivalent Anti-Snake Fabrotherapic) and Polyvient-ICP, require permits for import into the United States (Wells 2023). In general, antivenom is thought to be most effective when administered within 4 hours of the bite, but benefits

have been noted when administered up to 24 or more hours later (Armentano and Shaer 2023).Each antivenom has pros and cons in regard to allergenic risk, presence or absence of excess proteins such as albumin that can contribute to that risk, the time it takes for reconstitution, and volume and dosing recommendations. Dosing recommendations for dogs are extrapolated from human medicine and therefore vary widely, depending on the specific antivenom product as well as the severity of the clinical signs and response to initial dosing. Repeat administration may be necessary in some cases. General risks of antivenom administration include both type I and type III hypersensitivity reactions. Type I reactions include anaphylaxis type symptoms such as vomiting, facial pruritis, urticaria, shock, collapse and are mediated by IgE (Armentano and Shaer 2023). Frequencies of type I reactions vary by study but have been reported to range between 0.7% in a study by Witsil et al, while others have reported acute hypersensitivity reactions in 6-7% percent of dogs during administration of antivenom (Armentano and Shaer 2023). A less commonly appreciated risk of antivenom administration is a type III delayed hypersensitivity reaction also referred to as “serum sickness” that can cause symptoms such as vomiting, diarrhea, dermatological changes, enlarged lymph nodes and fever. Incidences of serum sickness are reported to be much higher in humans who receive Antivenin (Crotalidae) Polyvalent, but case reports from both 2019 (Lee et al) and 2005 (Schaer et al) document serum sickness in canine patients following administration of antivenom (Armentano et al 2011).

Specific therapeutic endpoints in terms of treatment and stabilization for these patients overlap those in any case of hypovolemic shock and wound management, including normalization of perfusion parameters such as heart rate, blood pressure, capillary refill time, correction of cardiac arrhythmias, and documentation of resolution of coagulopathies if present via monitoring of serial platelet counts and coagulation profiles. New areas of study in regard to pit viper envenomation in companion animals includes comparison of the ability of various types of antivenom products to correct coagulation abnormalities using thromboelastography (Altemaus Bailey et al 2022). Novel therapeutics that still require peer review evidence to further gauge safety and efficacy include an equine plasma protein derivative, RTLRTM which is manufactured using plasma components from horses vaccinated against several types of rattlesnakes, including the eastern diamondback, western diamondback, Mojave, and prairie rattlesnake (Wells 2023). Exploration of the use of laser therapy as an adjunctive component of wound management has been suggested by some but has yet to be properly studied (Wells 2023). Established components of current standard of care for canine and feline patients with suspected pit viper envenomation include hospitalization, supportive care, ongoing resuscitation with end-goal directed therapy in cases of hypovolemic shock, baseline and serial monitoring for hematological derangements, timely administration of antivenom in moderate to severe cases, correction and monitoring of coagulopathies, and appropriate pain control and serial wound management. Though less common in Pennsylvania, due to increased efficacy of antivenom when administered in a timely fashion, prompt recognition of pit viper envenomation by the clinician is essential as many bites may be unwitnessed by the family and instead reported as nonspecific trauma.

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