ENVIRONMENTAL EMERGENCIES

Michael Karagiannis
DVM, DACVECC
Veterinary Specialty Services
Outline

- Heatstroke
- Hypothermia
- Drowning
- Smoke inhalation
- Burn injury
- Electrocution
- Snakebites
- Spiderbites
Heatstroke

Predispositions

Brachycephalic
Laryngeal paralysis
Obese dogs
Thick or dark hair coat
Underlying illnesses
Lack of acclimation
Confinement/poor ventilation
Increased humidity
Water deprivation
Heatstroke

- Initial treatments
  - Cooling prior to presentation
  - Clip hair if indicated
  - IV fluids
  - Tepid/cool water on extremities/body
  - Alcohol on pads
  - Fans
  - Internal cooling
    - Dialysis, rectal cooling, gastric lavage
  - Sedation/intubation if exertional

Stop cooling at 103 F to prevent iatrogenic hypothermia
Heatstroke

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Diagnostics</th>
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<tbody>
<tr>
<td>IV fluids- crystalloids and colloids</td>
<td>Blood pressure</td>
</tr>
<tr>
<td>Transfusions</td>
<td>Serial Blood glucoses</td>
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<tr>
<td>Antibiotics</td>
<td>Serial PCV/TP</td>
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<tr>
<td>GI protectants</td>
<td>PT/PTT</td>
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<tr>
<td>Oxygen</td>
<td>Urine output</td>
</tr>
<tr>
<td>Nutritional support</td>
<td>Electrolytes/Renal</td>
</tr>
<tr>
<td></td>
<td>ECG</td>
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</tbody>
</table>

No indication for steroids or NSAIDS
Heatstroke

- **Prognosis**
  - Highest temperature
  - Rapidity of treatment
  - Persistent hypoglycemia
  - Hyperbilirubinemia
  - Acute renal failure
  - Neurologic status - seizures usually indicate poor/grave prognosis
Hypothermia

- Primary or accidental hypothermia refers to subnormal temperature caused by excessive exposure to low environmental temperature.
  - Mild- 90-99 F
  - Moderate- 82-90 F
  - Severe- less than 82 F
- Secondary hypothermia is a result of disease, trauma, surgery, or drug induced alteration in heat production or thermoregulation
  - Mild- 98-99.9 F
  - Moderate-96-98 F
  - Severe- 92-96 F
  - Critical- less than 92 F

Predispositions:
- Neonates
- Geriatrics
- Cachexic
- Debilitated/comorbidities
Hypothermia

- Cardiovascular effects- bradycardia, hypotension, and cardiac arrhythmias
  - Early hypothermia- increased HR and hypertension
  - Decreased adrenoreceptor affinity leading to vasodilation
  - Bradycardia at 96.8 F
  - 50% of dogs go into fibrillation as temp approaches 74.3 F
- Respiratory effects- decreased RR and depth, tissue injury, and oxygen dissociation
  - Decreased CO2 production- 50% for every 10.8 degrees F
  - Shift of oxygen hemoglobin dissociation curve to left
- Neurologic effects- Decreased mentation and metabolism
- Metabolic effects- cold diuresis, immune compromise, decreased hepatic enzyme activity, coagulation effects-especially thrombocytopenia
Hypothermia

- **Treatment**
  - **Passive rewarming in mild hypothermia**
    - Wrapping in insulated blankets
  - **Active rewarming in moderate or unstable mild hypothermia**
    - Circulating hot water blankets, heat lamps, and forced air warmers. Prevent direct contact with warming devices to prevent vasoconstriction and burns. Avoid rewarming extremities
  - **Active core rewarming for severe hypothermia**
    - Warm IV fluids and peritoneal and pleural lavage
Drowning

- Not common in dogs and cats
- Drowning is a process involving primary respiratory impairment from submersion or immersion in a liquid medium
- Dry drowning results when no aspiration occurs due to laryngospasm
- Fresh vs saltwater
- Cold water vs warm water
Drowning

- Attempt CPR at the scene
- Oxygen +/- intubation and ventilation
- Fluids (not excessive fluids)
- Neurologic resuscitation if signs of increased ICP
  - Optimize perfusion pressure- CPP = MAP-ICP
  - Stabilize CO2 in normal range
  - Hyperosmotic fluids such as mannitol for increased ICP
  - Seizure prevention/treatment if necessary
Smoke inhalation

- Pathophysiology
  - Carbon Monoxide
    - Anemic Hypoxia
    - Shift of oxygen hemoglobin dissociation curve to left
  - Hydrogen Cyanide - Wools, silks, nyons
    - Cytotoxic hypoxia
- Thermal Injury
- Irritant Gases and Superheated Particulate matter
- Concurrent Dermal Burn Injury
Smoke Inhalation

- History- duration of exposure and types of items involved, and patient’s neurologic status at the scene.
- PE- CV, Resp, Soot in hair coat, mucosal edema or oral burns, ocular irritation.
- Diagnostics-
  - Radiographic findings may appear within 24 hours. Asymmetric or patchy radiographic pattern with alveolar, interstitial, and peribronchial changes
  - Pulse oximetry not accurate due to COHb- Co-oximetry can directly measure oxyhemoglobin and COHb.
Smoke Inhalation

- Treatment
- Oxygen
- Airway management
- Sedation
- Mechanical Ventilation
- IV fluids-
  - Caution with fluid therapy due to lung damage, but not restriction of fluids
- Bronchodilators- terbutaline, aminophylline, albuterol
- Antibiotics?
- Sodium thiosulfate +/- sodium nitrite?
- CYANOKIT (hydroxocobalamin)
- Diuretics?
- Bathing, ocular care, burn care

Steroids increase incidence of pneumonia without any clear benefit
Smoke Inhalation

- 46% mortality if presenting with neurologic signs
- Initial improvement may precede delayed neurologic signs within 2-6 days
- Concurrent thermal burn injury worse prognosis
Burn Injury

- If more than 20% TBS, or if second or third degree burns, CV shock, metabolic derangements may occur.
- May take several days for burn to declare itself
- Remove eschar early– may take 7-10 days to form
- Silver sulfadiazine is the mainstay of topical treatment

<table>
<thead>
<tr>
<th>Degree</th>
<th>Depth</th>
<th>Appearance</th>
<th>Area</th>
<th>% TBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Superficial</td>
<td>Erythematous</td>
<td>Head and neck</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Each Forelimb</td>
<td>9</td>
</tr>
<tr>
<td>Second</td>
<td>Superficial partial</td>
<td>Charred epidermis, hair follicles</td>
<td>Each Rear Limb</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>thickness</td>
<td>spared</td>
<td>Thorax</td>
<td>18</td>
</tr>
<tr>
<td>Second</td>
<td>Deep partial thickness</td>
<td>Black to yellow-white</td>
<td>Abdomen</td>
<td>18</td>
</tr>
<tr>
<td>Third</td>
<td>Full thickness</td>
<td>Black, leathery</td>
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Electrocution

- Usually due to chewing through electrical cords
- Mechanism of injury
  - Electrical current disrupts electrophysiologic activity-muscle/cardiac, neurologic including neurogenic pulm edema
  - Electroporation- temporary pores in cell membranes
  - Thermal injury- oral burns and nasopharyngeal edema
- Current (amperage) is a function of voltage divided by the resistance
  - Dry skin has high resistance, while moist MM have low resistance
  - Alternating currents vs direct currents
Electrocution

- **Treatment**
  - Unplug prior to owner touching the animal
  - Low volume fluids due to neurogenic edema- hypertonic saline, colloids
  - Bypass airway obstruction
  - Oxygen
  - Pain management
  - Burn management

- **Prognosis**
  - Mostly dictated by respiratory signs
  - Most cases of neurogenic pulmonary edema resolve quickly
  - Cataracts may form several months after incident
Snake bites

- Copperheads
- Water Mocassins (Cottonmouths)
- Timber rattlesnakes
- Pygmy rattlesnake, Massagaga
1) Cotton Mouth, 2) Timber Rattle, 3) Pygmy rattle, 4) Massasauga
Copperheads

- Most abundant venomous snake in area.
- Defense mechanisms- instead of fleeing, snake with freeze to blend into environment. Warning consists of strike
- Warning strike is usually dry or minimal venom expelled.
- Antivenin generally not administered with Copperhead bites.
Cottonmouths

- This species lives in two distinctly different habitats; in southeastern Missouri, they live in swamps and oxbow lakes, and in the southern Ozarks, they live in cool, spring-fed rocky creeks and river sloughs.
- Southeastern corner; a spotty distribution throughout the Ozark Region. None occur north of the Missouri River in our state.
- Has a limited range in Missouri. Missouri is the northwestern limit of this species. Low winter temperatures limit its distribution.
Timber Rattlesnake

- Very reclusive but are occasionally now showing up in suburbia
- Do not use rattle as warning
- Most venomous snake in Missouri
  - Coagulopathy, tissue necrosis/edema, relative hypovolemia, pain
  - Myokymia- muscle fasciculations
  - 50% of human bites are dry bites
  - Antivenin effective for pain, coagulation, neurologic effects but not for thrombocytopenia of Timbers
Envenomation

- Most bitten around head/neck, with limbs being second most common
- Cats may get bitten on torso after trying to play with snake. Cats also are usually found some time after being bitten. Cats may be more resistant to venom on a Kg basis
- Although snake identification is ideal, instruct owners to keep away from snake
Treatment for snakebite

- First aid measures ineffective- including toruniquets, ice, hot packs, electroshock, or venom extractors
- Hospitalize because signs may not become apparent for over 8 hours
- Pain medications- opioids, and delayed NSAIDs
- IV fluids as needed
- +/-antibiotics
- Antivenin- usually not given but should be given if Timber rattlesnake suspected
- Smaller the dog, more antivenin. Usually 1-2 vials per pet. After reconstituting, do not oversheke or overheat. Dilute to 100-250 ml saline. Can give benadryl as premedication and watch for anaphylactic reaction.

Glucocorticoids not currently recommended unless rxn to antivenin
Antivenin

- Sheep based F(ab) antivenin (Crofab, BTG international)
- Horse based F(ab’)2 crotalid Antivenom Bioveteria (Antivipmyn)
- Horse based pre-reconstituted F(ab)2 antivenin (Venom Vet, MT Venom Co.)
- Horse based antivenin (Crotalid antivenin from Boehringer-Ingelheim)

The differences lie in (A) the host species used to produce the antibodies (sheep vs horse), (B) the purification of the product (removal of host-species serum etc), and (C) the removal of the FC portion of the antibody with the F(ab) products. Further, the Bioveteria product (F(ab’)2) couples 2 F(ab) portions together to increase half-life and potency.
Spider Bites

- **Black widow spiders**
  - No local symptoms
  - Alpha latrotoxin - neurotoxin - neurotransmitter release
  - Muscle cramping, hypertension, abdominal rigidity followed by flaccid paralysis
  - Cats particularly susceptible
  - Treat with antivenin

- **Brown recluse spiders**
  - Sphingomyelinase D - local dermonecrotic factor
  - Stinging sensation for 8 hours
  - Target lesion followed by bulla formation
  - Delayed healing and scarring of lesion
  - Systemic signs can include fever, arthralgia, GI distress, life threatening hemolysis.
  - Treat symptomatically, and treat as open wound. Surgical excision no longer recommended