Heatstroke

A PowerPage Presented By

Temperature related illness, particularly heatstroke, can be a life-threatening emergency. It is seen most commonly in dogs and prompt recognition and treatment are important. Heatstroke must always be differentiated from a true fever from pyrogens which all should be handled differently. This PowerPage emphasizes the important clinical manifestations, sequelae, and treatment considerations.

Key Points

- **Obese** and **brachycephalic dogs predisposed**, cats relatively resistant
- Primary heat dissipation method for dogs is **panting**
- Clinical signs- **Panting, tremors,** in shock
- Leads to cardiovascular collapse, hypercoagulability (DIC), SIRS, renal, GI, and neurologic dysfunction
- Requires intensive supportive care but recovery is possible if instituted prior to organ failure

Relevant Pathophysiology

- When the body's ability to dissipate heat is exceeded by the heat load placed upon it, hyperthermia develops
  - This can occur when high external temperatures reduce dissipation from conduction, convection, and radiation and/or high humidity reduces effectiveness of evaporation
- Hyperthermia results in protein denaturation, apoptosis, and activation of heat shock proteins
  - The following cascade of events have the potential to lead to life-threatening complications
    - Cardiovascular collapse
    - Hypercoagulability
    - A proinflammatory state (SIRS)
    - Thermal cellular injury and dysfunction
  - The exact critical temperature is debated but is stated to be around 106° F
    - The exact number may be of negligible importance because at presentation, you cannot know how high a patient's temperature was or for how long it was raised

Recognition and Signs

- Obese pets or pets that have other illness or cardiovascular and respiratory disease are predisposed
  - Should avoid hot, humid, poorly ventilated environments
  - Should always be provided accessible water, cooled surface, and shaded areas
- Clinical signs (in an environment with potential for heatstroke)
  - Incessant panting
  - Staggering
  - Collapse
  - Altered mentation
  - Elevated temperature should be documented but treatment and presentation to vet clinic should not be delayed in order to get a measurement
    - Patients with heatstroke **can present with normal or subnormal temperatures depending on the timeline**

Emergency Treatment

It is important to address the thermal injury, cardiovascular compromise, hypercoagulability, and SIRS while also addressing the underlying cause

- Possible underlying causes
  - Seizures
  - Tremorigenic intoxication
  - Eclampsia
  - Upper airway obstruction (i.e. laryngeal paralysis)
- Normalizing body temperature
  - **Emergency cooling** at home or in hospital
    - Soaking fur with tepid water and fanning
      - To avoid peripheral vasoconstriction, cooling efforts should be stopped at a temp=103° F
    - IV fluids
      - Cool or room temperature
    - Therapies that are advocated by some but controversial due to questionable efficacy or safety
      - Ice packs to groin, axilla, and head/neck
      - Immersion in cold water
      - Cold saline enemas or peritoneal, pleural or gastric lavage
      - Alcohol baths
- ABCs of Emergency Treatment
  - **Airway**
    - Insure an adequate airway is allowing minimal work or breathing and adequate heat dissipation through panting
  - **Breathing**
    - Oxygen supplementation may help decrease work of breathing provided that it can be administered in a way that does not interfere with panting (i.e. nasal canula)
    - Ventilation for patients at risk of respiratory failure
  - **Circulation**
    - 1-2 Large bore catheters for administration of crystalloids and/or colloids at rapid infusion rates
    - Assess for arrhythmias (ECG) and treat appropriately if indicated
  - **Disability**
    - Neurologic disability may result from hypoglycemia, increased intracranial pressure, or seizures and should be managed accordingly
      - Dextrose, mannitol, diazepam
- Coagulation
  - Monitor for petechia, bleeding, thrombocytopenia, coagulopathy
  - Evidence for heparinization in hypercoagulable phase is lacking (no consensus)
  - In hypocoagulable state, plasma and red blood cells may be needed
- Renal
  - Monitor electrolytes, renal values (BUN/Creatinine), acid-base status, bladder size, urine output, specific gravity, and color
  - Treatment of acute renal failure with mannitol, furosemide, or hemodialysis in severe cases
  - Urine alkalinization to pH=8 may prevent myoglobin precipitation in kidney in cases of rhabdomyolysis
- Gastrointestinal
  - Monitor for vomiting and diarrhea (especially bloody)

- Replace volume loss with IV fluids
- Consider protectants such as famotidine and sucralfate and if gut compromise is present, consider antibiotics

Prognosis

- Overall, a guarded prognosis should be given as 25-50% of patients do not survive due to arrhythmias, DIC, renal failure, hypoglycemia, hypotension, seizures, and gastrointestinal or hepatic damage
- However, patients that survive the first 24 hours can often recover with aggressive treatment