

Heatstroke in Canines

Heatstroke is a common problem in pets during the summer months, especially in hot, humid climates. This life-threatening condition can affect dogs of any age, breed, or gender. Heatstroke in dogs is defined as a nonpyrogenic increased body temperature above 104°F (40°C), with a spectrum of systemic signs. The ability to rapidly recognize and begin treatment of heatstroke is vital to maximize the chances of saving the animal's life. Heatstroke is defined as a state of extreme hyperthermia (106°-109° F) resulting in thermal injury to tissues, which occurs when heat generation exceeds the body's ability to dissipate heat.

Heatstroke is classified as exertional or nonexertional (classical). Exertional heatstroke occurs during exercise and is more common in dogs that have not been acclimated to their environment. If a period of temperature acclimation is allowed, dogs become less susceptible to heatstroke. While exertional heatstroke can occur in working dogs, it is less common because handlers are typically more knowledgeable. For example, it is possible for military dogs to work in environmental temperatures reaching 140°F (60°C) without adverse effects. After racing, greyhounds can transiently have rectal temperatures as high as 107.6°F (42°C) without showing signs of heatstroke. Nonexertional heatstroke results from exposure to increased environmental temperature in the absence of adequate means of cooling. This may be due to water deprivation, confinement in a poorly ventilated area, lack of acclimatization, and high humidity.

To prevent heatstroke owners of active dogs-including those involved in hunting, and scheduled runs-and working dogs should be educated about warning signs of heat exhaustion and heatstroke. Most owners are aware of the possibility of overheating and the need to rest their dogs when appropriate, provide plenty of fresh water, and cool them with shade and water hoses. Other preventable causes of heatstroke include prolonged exposure to cage dryers; confinement in a closed, unventilated area (such as a car). Several predisposing factors may decrease a dog's ability to cool itself; therefore, increasing its risk for developing heatstroke. Dogs that have a history of heatstroke are more susceptible to developing it again. Examples of factors that Predispose dogs to heatstroke are brachycephalic syndrome, cardiac disease, laryngeal paralysis, obesity, and tracheal collapse.

To treat heatstroke in canines, cooling measures should be aimed at lowering core body temperature while preventing hypothermia. Thermoregulation is when the body uses several methods to cool itself. Methods of Cooling will be evaporation **which occurs through panting**, which dispels heat via evaporation of water from the surface of the tongue, and is one of the most important ways a dog thermoregulates. Conduction occurs through transfer of heat from one object to another. In dogs, commonly achieved by lying with their sparsely haired abdomen in contact with a cool surface, allowing transfer of heat to this surface. Convection occurs by movement of air over the body to disperse heat, such as wind or air from a fan, which plays an important role in treating heatstroke. **Owners should be instructed to use lukewarm water**, as cold water or ice will cause peripheral vasoconstriction and lead to a decreased ability to lose heat

through convective mechanisms. Cooling Methods of cooling include soaking with lukewarm water, covering the patient with towels soaked with lukewarm water, and placing a fan in front of patients to maximize heat loss through radiation and convection. Cooling the dog with possible heatstroke before presentation to a veterinarian is imperative. In 1 study, only 38% of dogs died when cooled before presentation compared with 61% that died if not cooled. 1. **If severe signs of heatstroke are present, the owners should wet the dog down and immediately present it to a veterinary clinic for further therapy.**

Heatstroke Effects on the pets body system. Heatstroke has multiple deleterious effects within the body. Direct cytotoxicity occurs at body temperatures ranging from 106.7°F to 107.6°F (41.5°C—42°C). At these temperatures enzymes and proteins are denatured. The severity of these effects depends on both degree of body temperature elevation and duration of time it is elevated. In the Central Nervous Susceptibility to cytotoxicity is increased, resulting in injury and death of neurons. Cerebral edema, hemorrhage, and necrosis can occur. In the cardiovascular system, cardiac output, peripheral vasodilation, and central vasoconstriction are increased. When these compensatory measures fail, venous blood pools, and central vasodilation leads to decreased circulating blood volume, hypotension, and shock. Blood is unable to adequately circulate, resulting in electrolyte derangements, and acidosis. Direct injury to the pulmonary vascular endothelial cells can lead to pulmonary edema, increased pulmonary vascular resistance, and acute respiratory distress syndrome. In the gastrointestinal system direct cytotoxicity, prolonged hypotension, hypovolemia, and production of microthrombi cause decreased perfusion and ischemia, compromising the integrity of the GI tract. Cellular hypoxia produces reactive oxygen and nitrogen species and stimulates inflammatory cells that further damage GI mucosa. Increased permeability of GI mucosa can potentially result in translocation of bacteria and bacterial products, such as endotoxin. Bacteremia, endotoxemia, and sepsis can cause further ischemia, cardiac dysfunction, shock, and eventually death. In summary, complications of heatstroke include DIC, acute renal failure, altered mentation, hepatic failure, and gastrointestinal dysfunction. Mortality ranges from 36% to 50%, highlighting the importance of early, aggressive therapy in dogs presenting with heatstroke.

TAKE-HOME MESSAGES: Heatstroke may develop due to environmental or endogenous factors, is most commonly seen in the warmer months, and is often associated with higher humidity. However, exertional activity, confinement in an unventilated space, or prolonged exposure to dryers or other heating units can cause heatstroke at any time. Aggressive cooling measures should be instituted immediately, while avoiding hypothermia, as duration of hyperthermia is associated with a worse outcome and progression of organ failure. Prevention of complications of heatstroke include client and community education about avoiding situations associated with development of hyperthermia, and if heatstroke is present, maximizing tissue perfusion through the use of intravenous fluid therapy.

References- 1. Heat-induced illness in dogs: 42 cases (1976-1993). Drobatz KJ, Macintire DK. *JAVMA* 209:1894-1899, 1996. CANINE HEATSTROKE <https://www.cliniciansbrief.com/article/canine-heatstroke>