

# Increased Body Temperature

## (Hyperthermia) and Heat Stroke

### Basics

#### OVERVIEW

- “Hyperthermia” is defined as an elevation in body temperature above the generally accepted normal range of body temperatures; although published normal values for dogs and cats vary slightly, it usually is accepted that body temperatures above 103°F (39°C) are abnormal
- Hyperthermia can be categorized into “fever” and “non-fever” hyperthermia; “fever” hyperthermia results from inflammation in the body (such as secondary to a bacterial infection); “non-fever” hyperthermia results from all other causes of increased body temperature
- “Heat stroke” is a form of “non-fever” hyperthermia that occurs when heat-dissipating mechanisms of the body cannot accommodate excessive heat; heat stroke can lead to multiple organ dysfunction
- Temperatures of 106°F (41°C) or higher, without signs of inflammation are suggestive of “non-fever” hyperthermia
- “Malignant hyperthermia” is an uncommon familial (runs in certain families or lines of animals) “non-fever” hyperthermia that can occur secondary to some anesthetic agents
- Other causes of “non-fever” hyperthermia include excessive exercise, thyrotoxicosis (excessive levels of thyroid hormones in the body), and lesions in the hypothalamus, the part of the brain that regulates body temperature
- The following information primarily relates to “non-fever” hyperthermia



#### SIGNALMENT/DESCRIPTION OF PET

##### Species

- Dogs
- Cats—uncommon

##### Breed Predispositions

- May occur in any breed
- Long-haired pets
- Short-nosed, flat-faced (known as “brachycephalic”) breeds

##### Mean Age and Range

- All ages, but often age extremes
- Young dogs may tend to overexert
- Old dogs with preexisting disease

## **SIGNS/OBSERVED CHANGES IN THE PET**

- Identifiable underlying cause, such as a hot day, being locked in car or other confined area without adequate ventilation, grooming accident associated with drying cages, excessive exercise, restricted access to water
- Underlying disease that increases likelihood of developing hyperthermia, such as paralysis of the voice box or larynx (known as “laryngeal paralysis”), heart and/or blood vessel disease, nervous system and/or muscular disease, previous history of heat-related disease
- Panting
- Excessive drooling (known as “hypersalivation”)
- Increased body temperature (hyperthermia)
- Reddened gums and moist tissues of the body (known as “hyperemic mucous membranes”)
- Pale gums and moist tissues of the body (mucous membranes)
- Bluish discoloration of the skin and moist tissues (mucous membranes) of the body caused by inadequate oxygen levels in the red blood cells (condition known as “cyanosis”)
- Rapid heart rate (known as “tachycardia”)
- Irregular heartbeats (known as “arrhythmias”)
- Shock
- Breathing distress
- Vomiting blood (known as “hematemesis”)
- Passage of blood in the bowel movement or stool (known as “hematochezia”)
- Black, tarry stools (due to the presence of digested blood; condition known as “melena”)
- Small, pinpoint areas of bleeding (known as “petechiae”)
- Changes in mental status
- Seizures
- Muscle tremors
- Wobbly, incoordinated or “drunken” appearing gait or movement (known as “ataxia”)
- Unconsciousness in which the pet cannot be stimulated to be awakened (known as “coma”)
- Production of only small amounts of urine (known as “oliguria”) or no urine (known as “anuria”)
- Stoppage of breathing (known as “respiratory arrest”)
- Stoppage of the heart and breathing (known as “cardiopulmonary arrest”)

## **CAUSES**

- Excessive environmental heat and humidity (may be due to weather conditions, or accidents such as being enclosed in unventilated room, car, or grooming dryer cages)
- Upper airway disease; the “upper airway” (also known as the “upper respiratory tract”) includes the nose, nasal passages, throat (pharynx), and windpipe (trachea)
- Exercise
- Poisoning; some poisonous compounds (such as strychnine and metaldehyde [slug and snail bait]) lead to seizures, which can cause increased body temperature
- Anesthesia (leading to a condition known as “malignant hyperthermia”)

## **RISK FACTORS**

- Previous history of heat-related disease
- Age extremes
- Heat intolerance due to poor acclimatization
- Obesity
- Poor heart/lung conditioning
- Underlying heart/lung disease
- Increased levels of thyroid hormone (known as “hyperthyroidism”)

- Short-nosed, flat-faced (brachycephalic) breeds
- Thick hair coat
- Dehydration

## Treatment

### HEALTH CARE

- Early recognition is key
- Immediately correct increased body temperature (hyperthermia)
- Pets should be hospitalized until temperature is stabilized
- Most affected pets need intensive care for several days
- Treat complications, such as the blood-clotting disorder (“disseminated intravascular coagulopathy” or DIC), kidney failure, fluid buildup in the brain (known as “cerebral edema”)
- Treat underlying disease or correct factors that increase likelihood of developing increased body temperature, if possible

### External Cooling Techniques

- Spray with water or immerse in water prior to transport to veterinary facility, as directed by your pet’s veterinarian
- Convection cooling with fans
- Evaporative cooling (such as isopropyl alcohol on foot pads, groin, and under the forelegs)
- Stop cooling procedures when temperature reaches 103°F (39°C) to avoid dropping to too low a body temperature (known as “hypothermia”)
- Avoid ice, as this may cause blood vessels near the surface of the body to constrict (known as “peripheral vasoconstriction”) and may decrease heat dissipation; shivering response also is undesirable, as it creates heat

### Other Care

- Continuous temperature monitoring
- Fluid therapy
- Provide oxygen supplementation via mask, cage, or nasal cannula
- Breathing or ventilatory support, if required

### ACTIVITY

- Restricted

### DIET

- No food or water by mouth, until the pet is stable

### SURGERY

- Surgical opening into the windpipe or trachea (known as a “tracheostomy”) may be required, if upper airway obstruction is an underlying cause or a contributing factor

## Medications

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- No specific drugs are required for treating increased body temperature (hyperthermia) or heat stroke; therapy is dependent on clinical presentation
- Broad-spectrum antibiotics (such as first-generation cephalosporins in combination with fluoroquinolones) may decrease the incidence of bacteria moving from the intestinal tract into the body
- Sudden (acute) kidney failure—medications to dilate the blood vessels in the kidneys and to increase blood pressure, such as dopamine; medications to stimulate urine production (known as “diuretics”), such as furosemide
- Fluid buildup in the brain (cerebral edema)—medications to remove excess fluid from the body, such as mannitol; furosemide 30 minutes following mannitol administration; medications to decrease brain swelling

and inflammation, such as steroids (examples are dexamethasone sodium phosphate, prednisone sodium succinate, and methyl prednisolone)

- Irregular heartbeats (arrhythmia)—heart medications, such as lidocaine or procainamide
- Metabolic acidosis (a condition in which levels of acid are increased in the blood)—sodium bicarbonate
- Blood-clotting disorder (disseminated intravascular coagulopathy or DIC)—fresh frozen plasma and heparin
- Decreased number of platelets (known as “thrombocytopenia”)—severe thrombocytopenia can be treated with whole blood, platelet-rich plasma, lyophilized platelets, or frozen platelet concentrates; “platelets” and “thrombocytes” are names for the normal cell fragments that originate in the bone marrow and travel in the blood as it circulates through the body; platelets act to “plug” tears in the blood vessels and to stop bleeding
- Vomiting or diarrhea with presence of blood—broad-spectrum antibiotics, histamine-2 (H-2) blockers (such as famotidine) or proton pump inhibitors (such as omeprazole) in combination with sucralfate (medication that forms a protective barrier over ulcers in the gastrointestinal tract)
- Seizures—medications to control seizures, such as diazepam, midazolam, or Phenobarbital

## **Follow-Up Care**

### **PATIENT MONITORING**

- Pets should be monitored closely during cool-down period and for a minimum of 24 hours post-episode of hyperthermia; most pets must be monitored for several days, depending on clinical presentation and complications
- A thorough physical examination should be performed daily
- Body temperature
- Body weight
- Blood pressure
- Blood-clotting status (known as “coagulation status”)—blood tests, such as activated-clotting time (ACT), prothrombin time (PT), partial thromboplastin time (PTT), and fibrogen-degradation products (FDP)
- Electrocardiogram (ECG, a recording of the electrical activity of the heart)
- Listening to the chest (heart and lungs) with a stethoscope (known as “thoracic auscultation”)
- Urine output
- Urinalysis
- Packed cell volume (PCV, a means of measuring the percentage volume of red blood cells as compared to the fluid volume of blood) and total protein (a quick laboratory test that provides general information on the level of protein in the fluid portion of the blood)
- Complete blood count (CBC) and serum biochemical profile

### **PREVENTIONS AND AVOIDANCE**

- Avoid risk factors

### **POSSIBLE COMPLICATIONS**

- Irregular heartbeats (arrhythmias)
- Organ failure
- Unconsciousness in which the pet cannot be stimulated to be awakened (coma)
- Seizures
- Sudden (acute) kidney failure
- Blood-clotting disorder (disseminated intravascular coagulation or DIC)
- Generalized (systemic) inflammatory response syndrome
- Fluid buildup in the lungs (known as “pulmonary edema”); sudden (acute) breathing distress
- Disease characterized by the breakdown of red-muscle tissue (known as “rhabdomyolysis”)
- Death of liver cells (known as “hepatocellular necrosis”)
- Stoppage of breathing (respiratory arrest)
- Stoppage of the heart and breathing (cardiopulmonary arrest)
- Death

## **EXPECTED COURSE AND PROGNOSIS**

- Prognosis is dependent on underlying cause or disease process
- Prognosis may be dependent on the time lag between the cause of the hyperthermia and arrival at the veterinary hospital
- Prognosis is guarded, depending on complications (such as kidney failure and blood-clotting disorder [disseminated intravascular coagulopathy]) that occur and duration of episode
- One episode of hyperthermia or heat stroke increases the likelihood that the pet may have other episodes because of damage to the body-temperature regulatory center of the brain

## **Key Points**

- Be aware of clinical signs, so you may respond quickly to an episode of hyperthermia or heat stroke
- Know how to cool off your pet; talk to your pet's veterinarian for information on the appropriate procedure
- Heat stroke is a life-threatening emergency
- An episode of heat stroke may increase the likelihood of additional episodes