

When The Thermometer Goes Way Up – Review on Hyperthermia: causes, management & nursing considerations.

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The thermoregulatory center is located in the hypothalamus. Changes in core body temperature are sensed by peripheral and central thermoreceptors, which then trigger the body's "thermostat", (the hypothalamus) to maintain normal body temperature.

Elevation of core body temperature can often be seen in the hospitalised patient, ranging from the post-operative orthopaedic patient, to the critically ill. The veterinary nurse should be able to determine the difference between hyperthermia, pyrexia or fever and manage each accordingly. Febrile dogs and cats may have a temperature between 39.2C – 41.1C. A core body temperature above 41.1C may be due to non-febrile causes of hyperthermia.

Hyperthermia and pyrexia refer to any elevation in core body temperature. Hyperthermia is when the thermostat has not been reset. Causes can be from external heat sources, such as heat stroke. Physiological factors that may contribute to increased body temperature are brachycephalic syndrome, laryngeal paralysis, obesity, seizures activity or thyroid toxicity (through increased heat production). The patient may attempt to decrease their own body temperature through panting, inactivity or seek cooler areas for comfort. These animals are also at risk of respiratory distress and/or failure due to the increased respiratory workload to attempt to self cool or exacerbating a pre-existing condition such as laryngeal paralysis (older doliocephalic breeds) or brachycephalic syndrome. Veterinary staff may aid in reduction of body temperature through active external cooling using tepid water baths, cold packing the inguinal region (cover icepacks with towels to minimise freezer burn) and fans. Applying alcohol on foot pads and inguinal areas has grown out of favour due to the belief the alcohol can be absorbed, particularly with felines. One should never plunge an over-heated animal in cold water in an attempt to reduce core body temperature. Doing so may cause shock or seizure activity. Close monitoring of rectal temperature is vital to ensure active cooling is ceased once the ideal body temperature has been reached. This is usually when rectal temperature reaches 39C. The animal's temperature often continues to drop once 39C is reached. In hyperthermic states, the set point is not reset by the hypothalamus, hence the response to external cooling methods.

Fever occurs when the set point is reset to a higher temperature by conserving heat via vasoconstriction and/or generating heat through muscle contraction. This is a protective physiological response to inflammation from either infectious or non infectious agents. The process of generating a fever is complex. In short, inflammatory cytokines (interleukin-1 & 6 and tissue necrosis factor) stimulate the release of prostaglandins by the hypothalamus to prompt phagocytosis. These cytokines are able to up regulate and down regulate each other and bind to their own receptors close to the anterior hypothalamus to activate decreased heat loss and increased heat production. A fever is usually either recurrent or intermittent. Causes of a physiologic increase (fever) in the set point are categorised as infectious, immune mediated, neoplastic and inflammatory. Some tranquilisers, phenothiazines and antihistamines can alter the thermoregulatory centre.

Deleterious side effects, although rare, can be seen with fever. These side effects are poorly tolerated in patients with limited cardio-respiratory capacity as increased cardiac output leads to an increase in oxygen consumption. Prolonged increased body temperature can lead to organ damage or disseminated intravascular coagulopathy (DIC). However, this is uncommon with true fever. Fever is rarely harmful to the patient! It is a physiologic mechanism attempting to neutralise a perceived internal threat and

studies show may be beneficial. Active cooling can be detrimental to the febrile patient by continuing to reset the thermoregulatory set point thus increasing metabolism through increased energy demand. In a critical patient, unnecessarily burning of more energy will take away what energy stores are saved for fighting the disease process responsible for the illness of the patient. The set point will remain elevated until prostaglandins are no longer present and the internal threat neutralised.

Diagnostic evaluation of a patient with a fever can range from a complete blood count with blood chemistry, serial blood cultures, serologic/polymerase chain reaction (PCR) testing for infectious disease, urinalysis with culture and sensitivity, imaging using radiographs or ultrasound. Further invasive diagnostic tests may include cerebrospinal tap, fine needle aspirates of suspect organs, joint taps and bone marrow aspirates.

If an increase in body temperature is newly observed in the veterinary patient, one must consider and evaluate the possibilities. All indwelling apparatuses ie: intravenous/jugular catheters, feeding tubes should be unwrapped and inspected for signs of inflammation, discomfort, exudates or swelling. If any of these signs are present, the apparatus should be removed and re-sited if possible ie: IV catheter. However, thoracic drains, gastrostomy tubes, Jackson Pratt drains etc cannot be re-sited, therefore should be cleaned with dilute chlorhexidine at least once daily and as needed. It is vital for urinary Foley catheters to be cleaned with dilute chlorhexidine solution every 8 hours from proximal to distally. After 3 days in situ, they should be aseptically replaced to help reduce nosocomial urinary tract infection.

Other considerations for a spike in core body temperature in a hospitalised patient include pain, presence of heating devices, anxiety, inflammatory reaction at surgical sites or an extension of disease. Assessing an animal's vital parameters and demeanour will aid in determining which factor is contributing to an elevated temperature. Anti-inflammatories, antibiotics or analgesia may be indicated depending on the cause of pyrexia or fever and is at the discretion of the attending veterinarian. Due to the ulcerogenic effects, non steroidal anti-inflammatories should not be used in conjunction with steroids and avoided in dehydrated patients.

Temperature is an important physical sign in our patients. Not all patients with an infection have a fever. Furthermore, fever is an important evolutionary defense mechanism which does not necessarily warrant medical intervention.



About the Author:

Lisa Thomson has gained extensive nursing experience over the past 15 years working in specialty referral hospitals in Sydney. She currently works in the ICU & Internal Medicine Dept at Canada's largest private referral hospital, Canada West Veterinary Specialists in Vancouver. She is a Certified and Accredited Veterinary Nurse, and is one of four Veterinary Technician Specialists in emergency critical care in Australia. Lisa was awarded the 2009 VNCA Professional Development Scholarship and has presented seminars and workshops for the VNCA NSW & National Division. She is pictured here with her beloved 12 year old Boxer Molly.
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References available upon request