University of Mosul
Lecture No.: 1
College of Veterinary Medicine
Date: 29/9/2024
Unit of Scientific Affairs
Website:

Lecture title: **General Systemic States: Hypothermia, Hyperthermia, and Fever**

Lecturer Affiliation: Assistant prof. *Dr. Salam Abd Esmaeel /Department of Internal and Preventive Medicine College of Veterinary Medicine, University of Mosul, Mosul, Iraq*

Summary:

- **Hypothermia:** is a lower-than-normal body temperature, which occurs when excess heat is lost or insufficient heat is produced.
- **Hyperthermia:** is the elevation of core body temperature caused by excessive heat production or absorption, or to deficient heat loss, when the causes of these abnormalities are **purely physical.**

Fever (Pyrexia)

♥ Fever is an elevation of core body temperature above that normally maintained by an animal and is independent of the effects of ambient conditions on body temperature.

♥ It is important to realize that fever is a combination of hyperthermia and infection or inflammation that results from an elevated set point for temperature regulation.

ETIOLOGY

♥ Fever may be **septic**, the more common type, or **aseptic**, depending on whether or not infection is present.

Septic Fevers

♥ **These include infection with bacteria, viruses, protozoa, or fungi as:**

- **Localized infections** such as abscess,cellulitis, and empyema.
- **Intermittently systemic**, as in bacteremia and endocarditis.
- **Consistently systemic**, as in septicemia.

Aseptic Fevers

❖ **Chemical fevers,** caused by injection of foreign protein and intake of dinitrophenols.

❖ **Surgical fever**, caused by breakdown of tissue and blood.

❖ **Fever from tissue necrosis**, e.g., breakdown of muscle after injection of necrotizing material.

❖ **Severe hemolytic crises** (hemoglobinemia).

❖ **Extensive infarction.**

❖ **Extensive necrosis** in rapidly growing neoplasms such as multicentric lymphosarcoma in cattle.

❖ **Immune reactions** such as anaphylaxis and angioneurotic edema.

Pathogenesis

- Most fevers are mediated through the action of endogenous pyrogens produced by granulocytes, monocytes, and macrophages.
- The most important and best-known **endogenous pyrogen** is interleukin-1 (IL-1), produced by **monocytes and macrophages**.
- The febrile response is initiated by the introduction of an **exogenous pyrogen** into the body, include pathogens such as **bacteria, viruses, bacterial endotoxins, antigen–antibody complexes, hemoglobinemia in a hemolytic crisis, and many inorganic substances.**
- **In hypersensitivity states**, soluble antigen–antibody complexes may act as mediators. One of the most potent exogenous pyrogens is the lipopolysaccharide of gram-negative bacteria.
- Interleukin-1 initiates fever by inducing an abrupt **increase in the synthesis of prostaglandins**, particularly prostaglandin E2, in the anterior hypothalamus. The elevated prostaglandin levels in the hypothalamus raise the thermostatic set point and induce the mechanisms of heat conservation (vasoconstriction) and heat production (shivering thermogenesis) until the blood and core temperature are elevated to match the hypothalamic set point.

CLINICAL FINDINGS

- The effects of fever are the combined effects of hyperthermia and infection or inflammation.
- There is elevation of body temperature, an **increase in heart rate** with a diminution of amplitude and strength of the arterial pulse, hyperpnea, wasting, **oliguria often with albuminuria**, **increased thirst**, **anorexia, scant feces, depression, and muscle weakness.**
- The temperature elevation is always moderate and rarely goes above 4° C.
- **The form of the fever may vary. Thus the temperature rise may be**

Transient.

Sustained, without significant diurnal variation.

Remittent, when the diurnal variation is exaggerated.

Intermittent, when fever peaks last for 2 to 3 days and are interspersed with normal periods ,The outstanding example of **intermittent fever** in animal disease is equine infectious anemia.

Atypical, when temperature variations are irregular.

A biphasic fever, consisting of an initial rise, a fall to normal, and a secondary rise, occurs in some diseases, e.g., in strangles in the horse and in erysipelas in swine.

- **In farm-animal practice the most common cause of a fever is the presence of an inflammatory process such as pneumonia, peritonitis, mastitis, encephalitis, septicemia, viremia, etc.**

CLINICAL PATHOLOGY

- ♥ There are no clinicopathologic findings that are specific for fever.
- ♥ The hemogram will reflect the changes associated with the cause of the fever.
- ♥ Inflammation is characterized by marked changes in the total and differential leukocyte count characteristic for each disease.
- ♥ A wide variety of tests can be performed to identify the location and nature of the lesion causing the fever.

♥ **The most common tests include the following:**

- ✍ **Microbiologic testing of blood samples.**
- ✍ **Analysis of serous fluids from body cavities.**
- ✍ **Cerebrospinal fluid analysis.**
- ✍ **Milk sample analysis.**
- ✍ **Reproductive tract secretion analysis.**
- ✍ **Joint fluid analysis.**
- ✍ **Biopsies.**
- ✍ **Exploratory laparotomy Medical imaging may be necessary to detect deep abscesses.**

Necropsy Findings

- ♥ The necropsy findings will be characteristic of the individual disease process and are commonly characterized by varying **degrees of peracute, acute, and chronic inflammation depending on the severity of the disease, the length of illness, and whether or not treatment had been given.**

♥ **Common inflammatory processes include the following:**

- Abscesses of the peritoneum, pleura, and lungs.
- Septic metritis.
- Endocarditis.
- Polyarthritis.
- Pyelonephritis.

TREATMENT

♥ **Antimicrobial Agents**

- ✍ The most important aspects of the clinical management of fever should be directed at its cause.
- ✍ The main objective is to identify and treat the primary disease.
- ✍ Antimicrobial agents are indicated for the treatment of bacterial infections.

♥ **Antipyretics**

- ✍ Because fever ordinarily does little harm and usually benefits the animal's defense mechanism, antipyretic agents are rarely essential and may actually

obscure the effect of a specific therapeutic agent or of the naturalcourse of the disease.

- if the fever is high enough to cause discomfort or inappetence, or is so high that death from hyperthermia is possible, then nonsteroidal anti-inflammatory drugs (NSAIDs) should be administered.
- **Most NSAIDs, such as flunixin meglumine**, are inhibitors of prostaglandin synthesis and act centrally to lower the thermoregulatory set point. Rectal temperatures start to decline within 30 minutes of parenteral NSAID administration but usually do not completely return to within the normal physiologic range.

References:
Constable PD, Hinchcliff KW, Done SH, et al. (2017). Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats. 11th ed. Elsevier, St. Louis, Missouri, USA.