



Lecture title: General Systemic States: Pain

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Summary: General Systemic States:

Pain

❖ The Problem of Pain

- ✍ Pain has been described in animals as “an aversive sensory and emotional experience representing an awareness by the animal of damage or threat to the integrity of its tissues.” Pain is basically a protective mechanism to ensure that the animal moves away from noxious (damaging) influences.
- ✍ **endogenous pain**, arising from internal damaging influences, causes its own physiologic and pathologic problems that require the veterinarian’s intervention.
- ✍ A major difficulty with pain in animals is the difficulty of pain measurement.

✍ **Pain is assessed in animals by three methods:**

- ❖ **observation of behavior.**
- ❖ **measurement of physiologic parameters**, including heart rate, blood pressure, sweating and polypnea, that indicate sympathetic activation.
- ❖ **measurement of the plasma concentration of factors** that indicate sympathetic activation, such as plasma cortisol, epinephrine, norepinephrine, and nonesterified fatty acid concentrations.

✍ **The detrimental effects of pain include the following:**

- ❖ Suffering and stress resulting in delayed healing.
- ❖ Increased catabolism and decreased feed intake.
- ❖ Prolonged recovery and longer recumbency, with a greater risk of postoperative complications.
- ❖ The potential to cause ineffective respiratory ventilation with the development of respiratory acidosis and acidemia.
- ❖ Self-mutilation
- ❖ The potential for acute pain to lead to chronic pain.

Etiology

- ♥ Pain sensations are aroused by different stimuli in different tissues, and the agents that cause pain in one organ do not necessarily do so in another.

♥ **In animals there are three types of pain:**



1. Cutaneous (or superficial)
2. Visceral
3. Somatic (or musculoskeletal)

Cutaneous or Superficial Pain

- ❖ Cutaneous or superficial pain is caused by agents or processes that damage the skin, such as **burning, freezing, cutting, and crushing**.
- ❖ Fire burns, frostbite, severe dermatitis, acute mastitis, laminitis, infected surgical wounds, foot rot, crushing by trauma, conjunctivitis and foreign body in the conjunctival sac are all common causes of pain.

Visceral Pain

- ❖ **Examples of visceral pain include the following:**
- ❖ Inflammation of serosal surfaces, as in peritonitis, pleurisy, and pericarditis.
- ❖ Distension of viscera, including the stomach, intestines, ureters, and bladder.
- ❖ Swelling of organs as in hepatomegaly and splenomegaly.
- ❖ Inflammation, as in nephritis, peripelvic cellulitis, and enteritis.
- ❖ Stretching of the mesentery and mediastinum In the nervous system, swelling of the brain caused by diffuse edema, or of the meninges caused by meningitis, are potent causes of pain.
- ❖ Inflammation of (neuritis) or compression of (neuralgia) peripheral nerves or dorsal nerve roots are also associated with severe pain.

Musculoskeletal (Somatic) Pain

- ❖ Muscular pain can be caused by lacerations and hematomas of muscle, myositis, and space-occupying lesions of muscle.
- ❖ Osteomyelitis, fractures, arthritis, joint dislocations, and sprains of ligaments and tendons are also obvious causes of severe pain.
- ❖ Among the most painful of injuries are swollen, inflamed lesions of the limbs or joint caused by deep penetrating injury or, in cattle, by extension from foot rot.
- ❖ Amputation of a claw, laminitis, and septic arthritis are in the same category.
- ❖ Ischemia of muscle and generalized muscle tetany, such as occurs in electroimmobilization, also appear to cause pain.
- ❖ The trauma of surgical wounds is a controversial topic in animal welfare, especially that associated with minor surgical procedures such as dehorning, tail docking, and castration in farm animals.



- ❖ From clinical observation supported by some laboratory examinations, e.g., salivary cortisol concentrations after castration in calves and lambs, it appears that pain after these procedures is short-lived, up to about 3 hours, and the perception of pain is age dependent.

Pathogenesis

- ❖ Pain receptors are distributed as end organs in all body systems and organs.
- ❖ They are connected to the CNS by their own sensory nerve fibers with their cell bodies in the dorsal root ganglion of each spinal nerve and via some of the cranial nerves.
- ❖ Intracord neurons connect the peripheral neurons to the thalamus, where pain is perceived, and to the sensory cerebral cortex, where the intensity and localization of the pain are appreciated and the responses to pain are initiated and coordinated.

Clinical Findings

The general clinical findings of pain are described here and the indications of pain associated with individual body systems or organs are described within each category.

Physiologic Responses




- ❖ Physiologic responses to pain are manifested by the following signs, and the severity of the pain determines the degree of response:

- Tachycardia
- Polypnea
- Pupillary dilatation
- Hyperthermia
- Sweating

The cardiovascular responses of tachycardia and hyperthermia may contribute to a fatal

outcome in animals with reduced cardiovascular reserve, for example, when dehydration, acid-base imbalance, and endotoxic shock are also present.

Behavioral Responses

-  These include abnormal posture and gait when the **pain is musculoskeletal** (e.g., somatic).
-  **The gait abnormalities** include lameness, a shuffling gait, and rapid shifting of weight from one leg to another. These are subjects of importance in orthopedic surgery.
-  The behavioral responses to pain may also include unrelated activities such as **rolling, pawing, crouching, or grinding of teeth** when the **pain is visceral**.



However, the behavioral activities may also be related to the **site of the pain**, e.g., **the horse with colic that looks at its abdomen**, or to a particular function, such as pain manifested on coughing, walking, defecating, urinating, and so forth.

✚ **The behavioral aspects of severe pain** are very important in the horse with severe unrelenting visceral pain caused by colic. **The rolling, falling, and lunging upward and backward (often falling against walls) can result in severe injury and causes panic in many owners.**

✚ **Generally, somatic pain** is more localized and easily identified than visceral pain. Injuries to limbs are usually identifiable by fractures or localized tendon strain or muscle injury. With severe somatic pain, as with a fracture or septic arthritis, the limb is carried off the ground and no weight is taken on the limb. With lesser lesions more weightbearing activity is undertaken.

grunting, and grinding of the teeth (odontoprisis or bruxism) are generally indicative of pain.



Elicitation of Pain by the Veterinarian

+ This is an essential part of a clinical examination. The techniques include the following:

- ❖ **Pressure by palpation**, including firm ballottement with the fist and the use of a pole to depress the back in a horse or to arch the back upward from below in a cow.



- ❖ **Pressure by compression**, as with hoof testers for detecting the presence of pain in the hoof.
- ❖ **Movement by having the animal walk actively or by passively flexing or extending limbs or neck.**
- ❖ **Stimulation of pain related** to coughing by eliciting the cough reflex.
- ❖ Relief of the pain by correction of the lesion.

Treatment

❖ **Relief and the control of pain should be a major consideration and the following principles require consideration:**

- + **Relief of pain is a humane act.** Improved, less painful methods of castration, dehorning, tail docking, spaying cattle, and treating painful lesions of the hooves of farm animals must be explored and implemented.
- + **Surgical operations**, such as laparotomies, must be performed using appropriate **analgesia**.
- + **Analgesia may obscure clinical findings that may be necessary to observe, properly diagnose, or maintain surveillance of a case,** This is of major importance in equine colic.
- + **Control of pain is necessary to prevent animals from inflicting serious selfinjury associated with uncontrollable behavior as a result of severe visceral pain.**
- + Analgesics for visceral pain are readily available and relatively effective.
- + A major problem in the clinical management of pain is for cases of severe, slowly healing, infected traumatic wounds of the musculoskeletal system.

Analgesia

The analgesic agents and techniques available include the following:

- + Surgical procedures, e.g., neurectomy by section of peripheral nerves, as practiced in horses.
- + Local destruction of peripheral nerves by chemical means, e.g., the epidural injection of agents such as ethyl alcohol may prevent straining.
- + Local destruction of peripheral nerves by thermal means, e.g., cautery of the wound edge after gouge dehorning in calves.
- + Analgesia using nonopioid drugs when sedation is not required or is contraindicated.
- + Opioid analgesics (narcotic analgesics) Analgesic Agents.
- + **There are seven main types of analgesic agent administered parenterally or topically to large animals:**



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1. Local anesthetic agents such as lidocaine (lignocaine), mepivacaine, and Bupivacaine
 2. NSAIDs such as flunixin meglumine, ketoprofen, phenylbutazone, carprofen, and meloxicam.
 3. α_2 -Agonists such as xylazine and detomidine.
 4. Opioids such as morphine, fentanyl, butorphanol, and buprenorphine.
 5. N-methyl-D-aspartate receptor antagonists such as ketamine.
 6. Vanilloids such as capsaicin.
 7. γ -Aminobutyric acid analogs such as gabapentin.