Pain Management In The Trauma Patient

1.5 Contact Hours

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Pain Management In The Trauma Patient

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OBJECTIVES

At the completion of this course, the learner will be able to:

1. List the steps in the process of pain perception.
2. Understand how the pain signal is physiologically generated and understood by the body.
3. Describe the three different types of pain.
4. Display a clear knowledge of how pain affects the patient with traumatic injuries.
5. Compare and contrast the different ways that pain can be managed using both pharmacologically and non-pharmacologically.

I. The Pathophysiology of Pain

Pain is a perception versus a sensation. It is the sensitivity to chemical changes in the body tissues that are interpreted by the body as harmful. These chemical changes occur as the result of stimulation from noxious stimuli (Noxious stimuli: Tissue damaging stimuli). Nociception is the term used to describe the process of encoding and processing noxious stimuli within the nervous system (peripheral and central).

There are four steps in the process of pain perception:

1. *Transduction*: Cell damage occurs causing the release of chemicals that activate nociceptors and generate an action potential along the peripheral nerve.

   a. Nociceptors also cause the release of neuropeptides from their nerve endings. These neuropeptides cause "neurogenic inflammation" which stimulates the immune system to respond to the cellular damage by inducing vasodilation and attracting macrophages.

2. *Transmission*: The action potential continues a signal to travel along the nerve from the site of injury to the spinal cord and eventually to the brain where it will travel through the brain stem and thalamus before being processed in the cortex.
3. *Perception of Pain*: The conscious experience of pain is induced by the segmental motor pathway (also known as the vegetative reflex pathway). The location, duration, and intensity of the painful stimulus are determined through the lateral thalamocortical system and the unpleasant sensation of pain and adverse reaction are generated in the medial thalamocortical system.
4. *Modulation*: At this point the brain has processed the signal of pain. Neurons that originate in the brainstem travel down the spinal cord signaling the release of chemical substances that INHIBIT nocioceptive impulses and naturally decrease the perception of pain.

II. Types of pain

Acute pain: Acute pain is "new" and it occurs when noxious stimuli is applied to normal tissue. It is used by the body to protect tissue from further damage and is the type of pain experienced by patients with traumatic injury. Example: Gun shot wound → gun shot injures tissue → patient experiences pain → patient runs to avoid further pain/injury. In

fact, the only time patient's who experience a GSW do not run is when they cannot because their injury is too severe (they are unconscious) or they have nerve damage to the lower extremities (in this case they immediately fall to the ground).

Neuropathic pain: Neuropatic pain is related to injury or disease of neurons in the peripheral or central nervous systems after years of damage from a known, systemic disease process. It can be persistent or intermittent and is often described as a burning or electrical feeling. Example: Diabetics often complain of foot pain. This is neuropathic pain related to destruction of peripheral nerves in the feet after years of poor glucose control.

Chronic pain: Chronic pain occurs in patient's who have no obvious stimulus for the pain and it has been occurring for several months or years. In this case there is no tight connection between nocioception and pain and the pain is unrelated to tissue damage. Example: Chronic low back pain with no previous injury that is likely related to multiple factors including muscle weakness, stress, and/or muscle strain.

III. Pain and Trauma

Trauma patients are a special population in pain management because of their clinical presentation and the situation surrounding the injury causing their pain. The majority of trauma patients are young males, many of whom have abused one or multiple substances prior to their admission or injury. These circumstances, along with the

likelihood that the patient has cardiovascular or respiratory compromise, make treating pain in the trauma patient a particular challenge.

Patient's with traumatic injury may or may not be able to verbally express pain depending on the degree of injury. In these patients it is crucial to assess the patient for objective signs and symptoms of pain, keeping in mind that some of the pain may be iatrogenically induced. When performing a pain assessment, consider the patient's age, level of consciousness, severity of injury and medical stability. Trauma patients tend to have higher levels of anxiety related to fear, adrenaline, and pain. They are likely to express pain, fear, and anxiety subjectively or through screaming and moaning (if physically possible). Other objective signs and symptoms of pain include tachycardia, acute increase in blood pressure, and diaphoresis. Objective signs and symptoms of pain are the result of hyperactivity of the autonomic nervous system in response to injury.

Patients with traumatic injury are at high risk for hypoxia from poor ventilation. In some cases, poor ventilation can be avoided with proper pain control. Patients experiencing pain from traumatic injury are likely to "self splint" to control pain causing a mismatch between ventilation and perfusion. When the pain is controlled and the patient is comfortable, he/she will stop "self splinting", feel more comfortable taking deep and "sigh" breaths and resume normal ventilation/perfusion. Tachycardia and hypertension result from the increased workload on the heart to properly perfuse the body. The patient may also display signs of agitation and anxiety from the increased stress response. As a result, in addition to pain control, consider medicating the patient for anxiety and agitation to induce relaxation and promote healing. The body is already

working hard to heal injuries, it does not need to expend unnecessary energy because of agitation or anxiety, and in these cases sedation and pain management are required.

Trauma patients are at high risk for pain because their injuries often include both ischemic and inflammatory processes, and eventually are likely to include infection. They are also likely to experience iatrogenic pain (pain that we, as health care providers, cause) from: the insertion of central lines, invasive monitoring devices, therapies (chest tube, Foley catheter, NG tube, etc), surgical intervention, and immobilization. In fact, that majority of patients remember experiencing unrelieved moderate to severe pain during their time in the ICU.

When treating pain in the trauma patient it is common to use the intravenous route exclusively. IV pain management tends to be more effective in this population given its quicker onset and higher level of efficacy. Keep in mind however that the quicker onset is often associated with a shorter duration of action, meaning that the patient may require more frequent dosing of pain medication. Beyond IV analgesia, when not contraindicated, regional nerve blocks and epidural blocks can also be considered for treating pain caused by certain types of injuries or prior to the beginning of a procedure (ex. orthopedic procedures such as splinting a fractured limb or reducing a dislocated joint).

IV. Pain Treatment Strategies

Pain treatment can be achieved in multiple ways. It can be achieved through the reduction of tissue inflammation, limiting transmission of action potentials to the secondary neurons, and enhancing supraspinal inhibition. While all of these are effective

strategies, when treating severe pain (as occurs with traumatic injury), it is best to use narcotics in combination with adjunct analgesia. However, it is important to understand how medications differ in their treatment of pain and "what medicine does what."

-Reducing Inflammation

NSAIDS are rarely used in treating trauma patients because it is likely that their injuries are too severe to be relieved by NSAIDS alone. NSAIDs also have certain side effects, such as decreasing coagulopathy, which can be especially harmful for patients with traumatic injuries that cause excessive bleeding or patients who are likely going to need surgical intervention to repair their injury. However, NSAIDS are highly effective in decreasing inflammation by blocking the metabolism of arachidonic acid during the transduction phase, causing a decrease in the production of prostaglandins and leukotrienes.

Corticosteroids work in much the same way to reduce inflammation by blocking the production of pain producing chemicals at the transduction stage in the process of pain perception.

-Limited transmission of pain to secondary neurons

This is also known as the "gate control theory" in which the drug causes an increase in the amount that the action potential is inhibited at the dorsal horn. The human body naturally blocks part of the action potential from reaching the dorsal horn and continuing along the CNS to the cortex. The "gate control theory" suggests that interventions can be used to block more of the action potential that is natural, eventually

causing a decrease in the amount of pain perceived by the patient. Some non-pharmacological interventions that decrease transmission of the action potential are massage and the application of warm or cold compresses.

Local anesthetics block the action potential along the preliminary neurons, preventing it from reaching the dorsal horn and ever being processed. Phenytoin is another drug used to inhibit the transduction phase of pain perception. As a result, it can be used in patients with traumatic brain injury to both prevent seizures and treat pain. However, while these strategies are effective, they are often not used in trauma patients due to the nature of their injuries.

-*Enhanced supraspinal inhibition of pain perception*

Narcotics affect the transmission stage of pain perception and are the most common pharmacological intervention in the management of pain for trauma patients. Medications such as Fentanyl Citrate, Morphine Sulfate, and Hydromorphone (Dilaudid) inhibit the perception of pain in both the preliminary and secondary neurons.

Fetanyl Citrate is considered “better” than Morphine because it is not known to cause a rapid drop in the patient’s blood pressure. Fentanyl is highly effective in managing pain during a procedure; however, it has both a rapid onset and peak of action making it difficult to use in patients requiring longer term pain management.

Morphine Sulfate has a longer duration of action and is highly effective in pain management, however, it may be difficult to use in trauma patients because it promotes vasodilation leading to a drop in blood pressure. Trauma patients are usually hemodynamically unstable from their injuries and blood loss. As a result, Morphine

doses should be titrated to best treat the patient's pain while maintaining a stable blood pressure. Other side effects of narcotic administration that should be taken into consideration are nausea and respiratory depression.

Hydromorphone (Dilaudid) is a derivative of Morphine that has the ability to penetrate the blood-brain barrier, making it both faster acting and significantly more potent than Morphine and it does not cause a drop in blood pressure.

-*Continuous IV sedation*

Continuous IV sedation will render the patient unresponsive. Propofol (Diprovan) is the drug commonly used to achieve IV sedation because it can be stopped to perform a neurological exam and restarted effectively. Sedation should be interrupted daily for a check of neurological status and resumed immediately after the exam is performed. While Propofol provides the patient with deep sedation, it does not have any analgesic effect; therefore it is possible for the patient to continue to experience pain. It also has a very short half life, about 30 to 60 mins, making continuous infusion for ICU patients absolutely necessary in order to maintain a proper level of sedation.

RESOURCES

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