

## PAIN MANAGEMENT IN CRITICALLY ILL

### Abstract

Pain is a one the most common problem experienced by critical ill patients. It could be of various types like acute vs chronic and somatic vs visceral. Critically ill patients are at higher risk of experiencing pain as they are likely undergoing various invasive procedures, surgeries. They may also experience long term debility which can increase the chances of pain.

Physiology of pain consists of four phases: transduction, transmission, perception and modulation. There is biological response to pain by body in form of nervous, endocrine and immune system. Body goes in state of stress and this leads to release of stress hormone. As critically ill patients may develop alerted level of consciousness, it becomes increasingly difficult for nurses to conduct pain assessment. Comprehensive pain assessment is important prerequisite for effective pain control. There is various tool available which enables nurses to assess the pain in critically ill. E. g. Behavioral and Physiologic Indicator for Pain Assessment, Critical care pain observation tool (CPOT) etc. In spite of standardized scale for pain management, there are various barriers to pain assessment as well as pain management as nurses needs to rely heavily on behavioral and hemodynamic parameters to check the response to the treatment. Common barriers include difficulty in verbal communication, Elderly patients and neonates and infants.

Management of pain consists of pharmacological and non-pharmacological pain. As critically ill patients experience acute pain, pharmacological management is most common used treatment to control pain. Other than oral and intravenous,

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nurses use various route for medication administration like epidural, intrathecal etc. these routes give good control of pain in case of acute tissue damage. Patient controlled analgesia is popular method which gives patient more control over their pain therapy and greater relief of pain.

In pharmacological management, opioids and NSAIDS are very commonly used drugs. They can be used alone or in combination depending on patient's condition. Steroids, anticonvulsants, sedatives and antidepressants are commonly used drugs to control pain. They have multiple uses and also helps in calming down the patients, inducing sleep, relieving anxiety apart from pain relief. Pharmacological management may result in adverse effect like hypotension, respiratory depression, sedation etc. Nurses need to watch for these side effects and take measures to control them. Commonly used non pharmacological management are massage therapy, heat and cold applications, use of comfort devices, music therapy and provision of distractions.

**Keywords:** Pain Management, Critically Ill, transduction, transmission, perception and modulation.

## I. CONCEPT AND DEFINITION OF PAIN

1. Pain is caused due to actual or potential tissue damage which gives unpleasant sensory and emotional experience to a person.
2. Pain is considered as majorly a subjective experience and almost always affects the person emotionally, psychologically and physically. It may disturb the routine of the patient.
3. It's is described as subjective feelings and thus makes it difficult to assess its' characteristics. Therefore one needs to reply on the description of person who is in pain and must believe his description and experience related to it.
4. Pain experience can have tremendous impact on health of the patient including hemodynamic parameters. Considering the impact of the pain on health, American Pain Society coined the phrase 'pain: the fifth vital sign' to underline its significance in patient care. It also helps to sensitize the health professionals for assessment and professionals of the importance of effective pain assessment and management
5. Pain is multidimensional phenomenon and includes five components as follows
  - Physiologic component of pain includes physical experience like location, anatomy and changes in local tissues causing pain. Tissues have noiceceptor which picks up the sensation and patient becomes the aware about the pain. Process of noiception also determine the quality and intensity of the pain
  - Sensory component of pain describes the perception of various characteristic of pain such as intensity, location, quality etc
  - The affective component of pain includes negative emotions which can accompany the painful experience such as anxiety, feeling of agitation and fear.
  - Behavioral component include the strategies used by the person to express, avoid or control pain such as becoming less physically active or more socially withdrawn. Sometimes patient may become agitated or combative
  - Cognitive component of pain refers to understanding of painful experience. It consists of being aware of certain type of pain, ability to relate the pain to certain causes or factors. It get influenced by person's belief, attitudes, memories and previous pain experience. It also includes coping strategies that people may use to deal with pain. This component also influences the patient expectations and level of satisfaction with pain relief and treatment outcomes. Sometimes factors like use of medication like sedatives, presence of dementia or delirium may affect the cognitive component of pain. These factors may also make the assessment of pain difficult and challenging for nurses.
  - Sociocultural dimension of pain includes factors such as cultural influence, traditional values; person's demographics such as age, gender, education, occupation etc; person's support systems and, his or her social roles. Close family members or

support system likely to influence the patient's pain experiences and his decisions of treatment and his overall behavior.

6. The major type of pain are acute & chronic
  - The pain which is experienced for short duration and generally lasts less than 6 months in duration is described as acute pain. It is relatively easy to identify the causes of pain and commonly associated with inflammatory process in the body.
  - When there is some kind of tissue damage in the body and healing may also have started. But this healing process is incomplete leaving behind the residual pain which is known as chronic pain. It lasts for longer period and may involve the permanent tissue damage.
7. Acute and chronic pain can be divided into somatic, visceral or neuropathic origin
  - Pain arising from organs such as the skin, muscles, joints and bones is known as somatic pain. It results from trauma or inflammation of the tissues and generally well located.
  - Pain arising from internal organs like such as kidney, stomach, liver or heart is known as visceral pain. Its location is not very clear and may cause generalized or referred pain over the particular cavity.
  - Neuropathic pain arises from damage to nerve cells. It may be due to various causes like degeneration, trauma, chemical changes etc. Damage in nerve cells may cause changes in excitability of nerve cells.
    - The nerve involved may be from central nervous system or part of peripheral nervous system.
    - Acute inflammation of nerve cells is common pathophysiological consequences after any kind of damage to nerve tissues.
    - Location of the pain may not be clear and is generally experienced as radiating or aching pain
    - Neurological pain may need different approach than traditional one and involves various different therapies in addition to pharmacological agents.

## **II. IMPORTANCE OF PAIN MANAGEMENT IN CRITICALLY ILL**

1. Pain is most distressing phenomenon in any patient admitted to intensive care unit. Pain can affect the entire experience of patient in ICU and can have major impact on recovery or healing process.
2. Critically ill patients always experience the higher level of pain due to multiple invasive procedures, severer disease and complicated pathophysiological consequences. Thus pain management is very important aspect of critical care nursing.
3. Significant amount of patient experience the physiological and psychological distress caused by moderate to severe pain. Majority of patient also experience pain at rest due to ongoing tissue damage, bed ridden status and poor coping mechanisms. Moreover there

are several invasive and painful procedure that patient would undergo as a part of their ongoing treatment. This increases the pain and discomfort to a extent that it may affect their hemodynamic parameters.

4. Due to painful experiences, patient may also not comply with certain treatment like mechanical ventilation, physiotherapy, wound dressing, suctioning etc.
5. Poor pain assessment and management leaves patient in distress which may seriously impact his recovery.
6. Most of the patients are also semiconscious or unconscious. Conscious patients are also at risk for delirium or confusion and may not be very alert. This makes the task of assessment very challenging for nurses .
7. Poor assessment or incomplete assessment can seriously affect the disease course and it's treatment. Inadequate treatment may have deleterious impact on healing and may leave patient in chronic pain later on.
8. In ICU, nurses can use the regular pain assessment tools where she can ask the patient his or her direct verbal description of pain experiences. In case the patient is not conscious, she can use various behavioral, observational and objective pain scales which are available to assess. These pain scales are also fairly accurate in assessment.
9. Nurses can make use of more than one pain scale to assess and describe the pain adequately. There is always a risk of under diagnosis of pain in critically ill patient.
10. Nurses should also consider the ongoing administration of any sedatives in patient treatment while assessing the pain as sedatives can mask the psychological and physical symptoms of pain. She can make use of sedation assessment scales to determine the sedation level and prevent oversedation or under sedation.
11. Adequate pain management has proven very beneficial for the recovery of the critically ill patients. It is associated with better health outcome, short hospital stay, lesser complications, decreased cost of treatment and less distress to patients.
12. Pain should be considered as an ethical obligation for all health professionals

### **III. PHYSIOLOGY OF PAIN**

- Interaction between nervous system and environment causes the sensory experience of pain. Presence of any unpleasant or noxious stimuli leads to chemical mediators activating the peripheral and central nervous system. This causes the awareness of noxious stimuli.
- Noiceptors are basically chemical mediators at free nerve endings in the skin that are sensitive to intense and potentially damaging stimuli.

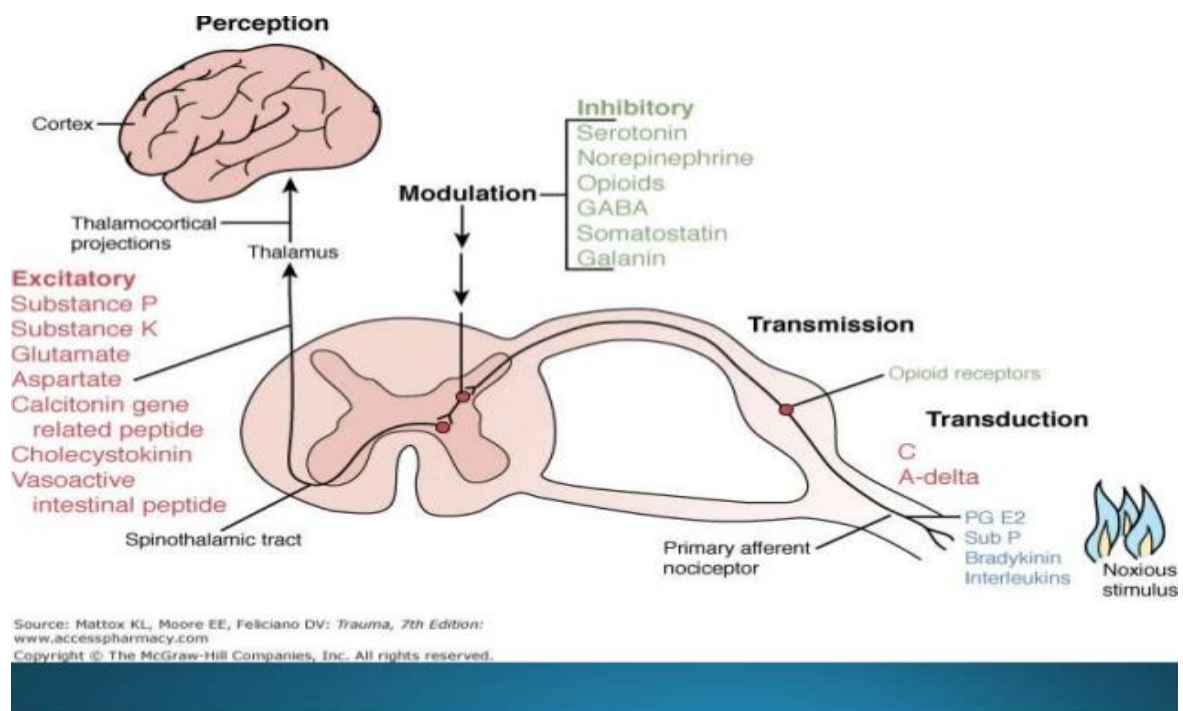
**1. Nociception:** This process involves the experience of person in which one becomes aware of the presence of noxious stimuli. There are four processes are involved in noiception: transduction, transmission, perception and modulation (**Image 1**)

- **Transduction**

- Transduction results from to mechanical, thermal or chemical stimuli which can actually or potentially damages the tissues.
- Examples of noxious stimuli in ICU are disease process, invasive lines, treatments, therapeutic and diagnostic procedures, infections etc.
- Theses noxious stimuli lead to release of various chemical substances such and prostagladins, bradykinin, serotonin, histamines, glutamate and substance P.

- **Transmission**

- Action potential is produced due to transduction and painful stimuli will get transmitted to nerve fibers in spinal cord and thereby to higher centers in brain. This process is known as transmission of pain stimuli.
- There are principal nociceptive fibers mainly; A-delta and c fibers. They are involved in transmitting localized, sharp pain and diffuse, generalized, aching pain respectively



**Image 1:** Stages of Noiception

- **Perception**

- After transmission to brain, the pain stimuli is transmitted by the spinothalamic pathways where is is sensed and an individual becomes aware of the stimuli.
- Pain sensation transmitted by the Neospinothalamic pathway reaches the thalamus, and the pain sensation transmitted by the Paleospinothalamic pathway

reaches brain stem, hypothalamus and thalamus. These lower parts of the CNS contributes to initial perception of pain

- Sensory cortex involved in ability of person to describe the pain with it's characteristics e.g. location, intensity, quality etc
- Cerebral cortex is involved in cognitive components whereas motor cortex is involved in behavioral components of pain experience.

- **Modulation**

- This process is one of the internal coping mechanisms where there is release of endogenous opioids by central nervous system such as beta-endorphins, enkephalins and dynorphins.
- Endogenous opioids decreases transmission of pain sensation in the spinal cord and produce analgesia like effects
- It also inhibit the liberation of chemical mediators which are involved in transmission of pain

#### **IV. BIOLOGIC STRESS RESPONSE TO PAIN**

1. Pain is an obvious stressor and activates the biological stress response.
2. Biological stress response activated by pain allows for the observation of relevant physiologic signs that could be associated with pain.
3. Majorly, nervous, endocrine and immune system are involved in biological response of body in state of pain. The response is initialed by the hypo-thalamo-pituitary-adrenal axis.
4. Hhypoalamus releases corticotorpin releasing factor (CRF) whenever there is pain which in turn activates the sympathetic nervous system. This leads to release of norepinephrine and epinephrine resulting in increased heart rate, blood pressure, respiratory rate etc.
5. If pain arising from visceral tissues lasts longer, parasympathetic nervous system gets activated and decreases the blood pressure and heart rate.
6. In addition, CRF also stimulates anterior pituitary to release adrenocorticotrophic hormone (ACTH) and posterior pituitary to release anti diuretic hormone. ACTH causes aldosterone and cortisol release from adrenal cortex. Aldosterone and ADH causes sodium & water retention which increases intravascular volume and decrease dieresis.
7. When pain persist over a period of time, cortisol influences immune system for immune suppression and release of cytokines which may lead to excretion of tissue damage contributing to chronic pain process.

#### **V. PAIN ASSESSMENT**

1. Pain is regarded as fifth vital sign to consider as important hemodynamic component. It is very vital part in nursing assessment and comprehensive care.

2. Pain assessment is very essential in order to provide better and adequate control over pain.
3. Its subjective nature can make the assessment challenging and complex.
4. Nurses can make use of various objective tools to adequately assess the pain in critically ill patients.
5. Critically ill patients may not be verbalize the pain due to presence of endotrachel tube, administration of sedatives, delirium etc.
6. There are two major types of assessment: subjective and objective.

### 1. Subjective Assessment

- Subjective assessment of pain is most valid method because pain is a personal and subjective experience. One needs to rely on patient description of pain to get accurate information. So patient's verbal reports have more value than objective assessment.
- Preference should always be given to patient's verbal reports first. It should be assessed as often as possible and whenever the change in pain level is expected.
- Subjective component has three main aspects: sensory, cognitive and behavioral.
- There are various ways intubated patients can be encouraged to express the experience of pain. Many non verbal tools may be used to collect the information from intubated patients nurse needs to give sufficient time and be innovative and patience while collecting information from non verbal patients
- If cognition level of critically ill patient allows for more information about pain, a multidimensional assessment tools are available e.g Initial pain Assessment Tool & short form McGill Pain Questionnaire and Brief Pain Inventory.
- The patient self report of pain can obtained by based on following characteristics
  - **Onset:** Onset is the time when pain started. In case of acute pain episode, Patients knows when pain started. Those with chronic pain may be less able to identify onset of their pain but still can give rough idea.
  - **Duration:** Duration is establishing period of time the pain has lasted. It helps to determine is acute or chronic state of pain. It also gives clue for identifying etiology of pain
  - **Pattern:** Pattern of pain describes how pain changes with activities or other factors e.g. time of the day, meal timings, certain procedures etc. Many types of chronic pain come and go over time e.g. osteoarthritis pain. Sometimes, a patient may have pain all the time (constant) or periodically.



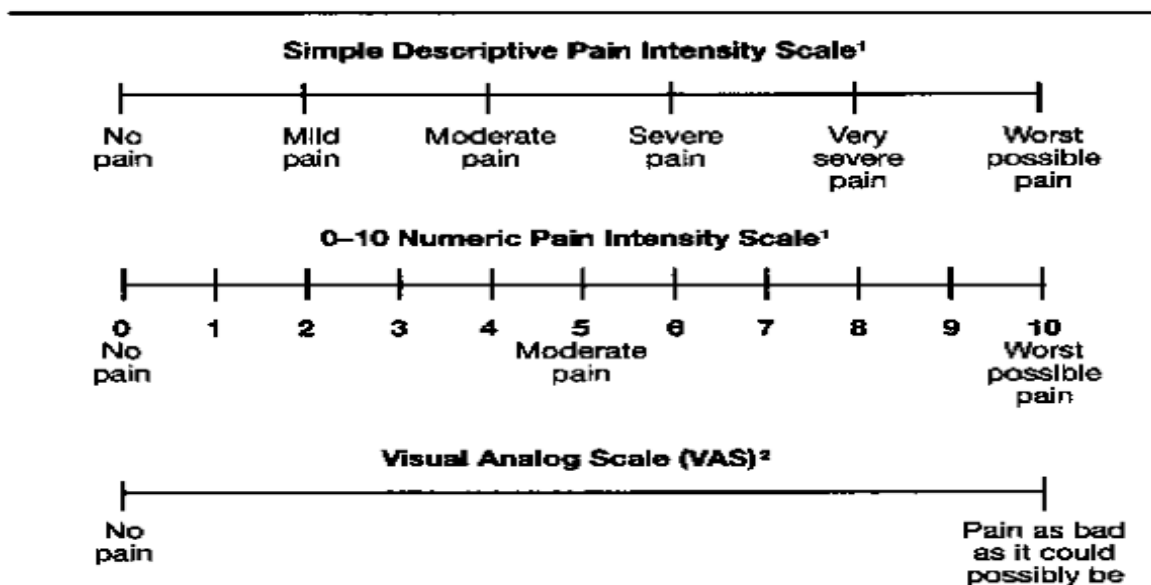
- ❖ When patient is receiving the analgesics, patient may experience the pain for brief period between two dosages of drug. That is known as breakthrough pain. Such pain is common in cancer patients. Such pain is highly different in intensity and frequency. It also indicates that patient analgesic regimen needs to modification to have better control over pain
- ❖ Pain may arise in episodic or incidental way that is transient in nature. It is mostly caused by specific activity that initiated the discomfort e.g. IV line placement, dressing changes, changes in positions etc
- **Location:** the physical location of pain is very important in nursing assessment as it may direct the further assessment and diagnostic procedures in order to diagnose the illness. Sometimes patient gives specific location and sometimes may describe the pain as diffuse and generalized.
- ❖ Referred or radiating pain: pain may radiate from its origin to another site. E.g. angina pectoris radiates from chest to jaw or down to left arm. Radiating pain may be caused because pain gets projected along the course of peripheral nerve e.g sciatica
- **Intensity:** Intensity means how severe the level of pain. It is also very essential part of assessment as it determines the treatment strategies and further assessment. It will be also assessed to evaluate the effectiveness of the measures that are instituted for pain management. Pain scales are popular tool to help assess the patient pain intensity. **(Image 2)** Scales used for measurement of intensity must be adjusted for age & cognitive development of patient. Numeric pain scale are generally used by adults patients who are alert and verbal. Other scales are verbal descriptors scales or visual analogue scale. For nonverbal comatose patients observational tools should be used to detect behaviors that are associated with pain.
- **Quality:** pain quality refers to the nature or characteristic of pain. E.g. patient with neuropathic pain typically describes it as burning, numbing, shooting, stabbing and itchy sensation. Noiceptive (somatic or visceral) pain may be described as sharp, aching, throbbing and cramping.
- **Accompanying Symptoms:** Patient in pain may experience anxiety, fatigue and depression. These elements in turn may also exacerbate pain. Information about activities or situations which exacerbate or alleviate pain should be collected e.g. activities may exacerbate muscle pain and rest may decrease the pain.

## 2. Objective Assessment

- Besides the patients self report of pain, observation of behavioral and physiological indicators makes the pain assessment complete and more informative.
- Nurse should always give more priority to subjective assessment and collect the data skillfully from patient before proceeding to objective assessment. Though objective

assessment yields essential information but inadequate subjective assessment may result in poor objective assessment.

- There are various behavioral indicators that may be associated with pain. (**Table 1**)
  - **Facial Expression:** brow lowering, orbit tightening, levator contraction and eyelid closing have been associated with pain. The presence of first three indicates moderate pain whereas presence of all four facial movements may suggest severe pain. Higher pain intensity is associated with increased number of facial movements. Facial expression of grimacing is an indicator often associated with pain.
  - **Body Movements:** body movements can be used by critically ill patients to communicate their pain. Being immobile, moving slowly or with caution, touching the pain site or tubes are associated with critically ill patients self report of pain. Restlessness is often identified as body movement associated with pain
  - **Muscular Tension:** it is another potential behavioral pain indicator where patient is tense, rigid, spastic and resistive to being turned
  - **Compliance with Ventilator:** Although this indicator is widely used for sedation assessment, it is considered as potential indicator of pain in intubated patients. Patient experiencing pain may cough into endotracheal tube and trigger alarms by blocking ventilation.
  - **Sounds and Vocalization:** patient's sounds and vocalizations may be used to assess pain in critically ill extubated patients. Pain related vocalization include sighing, groaning, moaning, crying or sobbing.



**Image 2:** Pain Intensity Scales

**Wong-Baker FACES® Pain Rating Scale**



- Physiological indicators such as increased mean arterial pressure and increased HR are associated with acute pain caused by noiceptive procedures in critically ill unconscious patients. Physiological indicators are observed when sympathetic nervous system is activated during biological stress response. The vital signs and other parameters monitored in critical care unit can be useful tool to assess the pain of critically ill. Some of these observable indicators were included in tools developed and validated for clinical use in critical care are: Pain assessment and Intervention Notation, Behavioral Pain scale, PACU Behavioral Pain Rating Scale and Critical Care Pain Observation Tool (**Table 2**). Although these tools have limitations, they may help in assessing pain in critical care especially uncommunicative patients.
- Complete pain assessment including subjective and objective component is very essential to ensure adequate and best possible management of pain.

**Table 1: Behavioral and Physiologic Indicator for Pain Assessment**

Sr. No	Indicator for Pain Assessment	Description
<b>A</b>	<b>Behavioral</b>	
1	Facial expression	Grimacing, frowning, wincing, yes squeezed, teeth clenched, wrinkled brow, teary/crying
2	Body movement	Immobile, slow/cautious movements, touching the pain sites or tubes, seeking attention though movements, restlessness
3	Muscular tension	Rigid, tense, stiff, splinting
4	Compliance with ventilator	Coughing, turning alarms, fighting the ventilator
5	Sound and vocalization	Groaning, maoning, sighing, sobbing, grunting
<b>B</b>	<b>Physiologic</b>	
1	Heart rate	Increase or decrease
2	Blood pressure	Increase or decrease
3	Respiratory status	Increase or decrease rate, decrease depth
4	SpO2	Decrease
5	End tidal CO2	Increase or decrease
6	Pallor	Skin
7	Perspiration	General
8	Pupil	Dilation

**Table 2: Critical care pain observation tool (CPOT)**

Indicator	Description	Score	
Facial expression	No muscular tension observed	Relaxed, neutral	0
	Presence of frowning, brow lowering, orbit tightening, levator contraction	Tense	1
	All previous facial movements plus eyelid tightly closed	Grimacing	2
Body movements	Dose not move at all	Absence of movements	0
	Slow cautious movements, touching or rubbing the pain site, seeking attention through movements	Protection	1
	Pulling tube, attempting to sit up, moving limbs, thrashing, not following commands, striking at staff, trying to climb out of bed	Restlessness	2
Muscular tension	No resistance to passive movements	Relaxed	0
	Resistance to passive movements	Tense rigid	1
	Strong resistance to passive movements, incapacity to complete them	Very tense or rigid	2
Compliance with ventilator (intubated patient)	Alarms are not activated, easy ventilation	Tolerating movements	0
	Alarm stops spontaneously	Coughing but tolerating	1
	Asynchrony, blocking ventilation, alarms frequently activated	Fighting ventilator	2
Vocalization (extubated patient)	Talking in normal tone or no sound	Talking in normal tone or no sound	0
	Sighing, moaning	Sighing, moaning	1
	Crying out, sobbing	Crying out, sobbing	2

**Table 3: Neonate Infant Pain Scale (NIPS)**

Parameter	0 point	1 point	2 point
Facial expression	Relaxed	Grimace	
Cry	No cry	Whimper	Vigorous crying
Breathing pattern	Relaxed	Changes in breathing	
Arms	Relaxed	Flexed/extended	
Legs	Relaxed	Flexed/extended	
State of arousal	Sleeping/awake	Fussy	

Pain level: 0-2 points=no pain, 3-4 points=moderate pain, > 4 points=severe pain

## VI. BARRIERS TO ASSESSMENT AND MANAGEMENT OF PAIN

- 1. Difficulty in Communicating:** It is one of the most obvious barrier in critically ill patients. Intubated patients cannot verbalize or describe pain. In such case nurse need to reply on physiological and behavioral clues to assess presence and intensity of pain. The patients family may assist in such situation significantly
- 2. Altered Level of Consciousness:** Unconscious patients are also capable for pain perception and should be treated for pain in same way as in case of conscious patients. Variety of behavioral and physiological indicators can be identified as reaction to pain in unconscious patients.
- 3. The Elderly:** Some of the elderly patients have assumption that pain inevitable and does not always needs attention or interventions. Elderly people believe that pain is normal consequence of aging. Delirium, dementia and cognitive deficit presents additional barrier to pain assessment. Observation of behavior is important in this population. Some tools have developed and validated for members of this specific population who often experience chronic pain e.g. Discomfort Scale-Dementia Alzheimer's Type (DS-DAT), Checklist for nonverbal pain indicators (CNPI) and Pain assessment checklist for seniors with limited ability to communicate (PACSLAC)
- 4. Neonates and Infants:** Term as well as preterm neonates have capacity to sense the pain to major extent. The premature Infant pain profile (**PIPP**) is valid tool for pain assessment of this population. Many tools have been developed and validated for term neonates and preverbal infants e.g. COMFORT scale, CRIES, Nursing Assessment of Pain Intensity (NAPI), Neonatal infant Pain Scale (**Table 3**) and Scale for Use in Newborns (SUN)
- 5. Cultural Influences:** Different languages, cultural assumptions by health care team members and cultural influence on patients may affect the communication and assessment of pain. Sometimes patient tends to think that pain as punishment while some may think it as imbalance in life which may determine their responses to pain.
- 6. Lack of Knowledge:** Public knowledge deficit may affect their treatment choices. Some patients and family think that analgesics are addictive so they may underreport the pain. Some may think that pain is part of disease process and may not opt for treatment for the same.
- 7. Health Care Professional Beliefs and Attitude And Lack Of Knowledge:** - Misconception and lack of knowledge regarding physiological dependence, addiction and drug tolerance among health care professionals may affect pain management of patient. Critical care nurse must remember that pain is what patient state it is and that no additional finding that matches her own understanding is necessary to treat patient's pain.

## VII. PAIN MANAGEMENT

1. Pain management is complex task and requires various interventions form different disciplines.
2. Pain control is more effective when one combines the pharmacological, non pharmacological and alternative methods.
3. In critically ill patients, nurses generally deal with acute pain and therefore use of pharmacological methods is more predominantly used.

### 1. Pharmacologic Control of Pain

- Pharmacology management consists of three major categories of the drugs: opioids agonist, nonopioids, and adjuvants. They are divided based on their mechanism of actions and chemical content.
- Pain management may include single or multiple drugs in combination based on etiology, type of pain and intensity of pain.
- Non opioids are generally sufficient in case of mild to moderate pain but in case of severe pain one may need to add opioids to regimen. Certain types of pain may need combination of adjuvants along with opioids or non opioids especially in neuropathic pain

### 2. Opioid Analgesics

- Important element in action of opioids is their biding to mu receptors in the CNS.
  - It inhibits the of the transmission of noiceptive sensation from peripheral nevers to the pathways leading to spinal cord
  - It may also interfere in limbic system activity
  - It also activates descending inhibitory pathway which modulates transmission of stimuli in the spinal cord
- Both acute and chronic pain can be treated with the help of opioids. But there is better response in case of noiceptive pain than neuropathic pain. But opioids can still be used for neuropathic pain in combination with other drugs
- The opioids are classified as per their physiological action (pure agonist, mixed agonist-antagonists & Partial antagonist) and also depending on their binding site at specific opioid receptors (e.g. mu, kappa & delta) Morphine, hydrocodone, oxycodone, codeine, methadone, hydroxymorphone and levorphanol are example of pure agonist opioids. Mixed agonists-antagonist agonists e.g pentzoncine, buterophanol produce less respiratory depression than pure agonists. Partial agonists e.g. buprenorphine binds weakly to mu receptors so has less analgesic efficacy. Partial angonists and mixed agonists-antagonists have limited availability and clinical value in pain management.

- Some opioids are best to avoid as they have less therapeutic value and more toxic effects.
  - Propoxyphene produces toxic metabolite that can cause seizures
  - Meperidine is associated with neurotoxicity
- Some of the important opioids are described in brief here

### **Morphine**

- It is one of the commonly used opioids in critical care area. It is considered as standard and classic opioids by which all other opioids drugs are measured for their efficacy.
- Water soluble with slower onset and longer duration of action
- It is used for severe pain
- It is also used as an anxiety drug as it has calming effects on mental processes of patients
- It reduces myocardial workload by dilating peripheral veins and arteries
- Ideal for intermittent therapy
- It has major side effects like excessive sedation, hypotension and respiratory depression

### **Fentanyl**

- It is one of the most widely used opioid and choice of drug for sedation in critical care units. It is a synthetic opioid and preferred over other opioids as it has little interference with hemodynamic processes. It is used safely in unstable patients.
- It is lipid soluble and has rapid action and shorter duration
- Effective and safe, preferred for acutely distressed patients
- Rapid administration at higher dosages can cause bradycardia and rigidity in chest muscle wall

### **Hydromorphone**

- It is a semisynthetic opioid that has similar action and duration as morphine
- It is more potent in action than morphine
- In a patient with renal failure, this drug may be used carefully as its metabolites may get accumulated and can cause CNS toxicity.

### **Methadone**

- It is a synthetic opioid with morphine-like properties but provides less sedation
  - It is longer acting than morphine with a long half-life. Thus it is difficult to titrate in critically ill patients
  - It is safer in patients with renal failure as it lacks active metabolites
  - It is a choice of opioid for patients with long recovery
- Opioids are very potent and strong analgesics but they also have some of the serious adverse effects. The most common adverse effects of opioids include constipation, nausea, vomiting, sedation, respiratory depression and pruritus. In case of prolonged use; some of the side effects may wear off to some extent. Less common side effects include urinary retention, myoclonus, dizziness, confusion and hallucination.

- Constipation should be managed by gentle stimulant laxatives and stool softener until patient is on opioids because dietary roughage, fluids and exercise alone may not be sufficient.
- Nausea is common in early phase of treatment as opioids causes delayed gastric emptying. It should be treated with metoclopramide, transdermal scopolamine or prochlorperazine.
- Sedation is common in opioid naïve patients but reduces as tolerance develops. If sedation is persistent, it can be treated with caffeine, dextroamphetamine or methylphenidate.
- Respiratory depression of moderate to severe level is rare in opioid tolerant patients. Patients at risk are elderly, opioid naïve, one with underlying lung disease, patient with renal failure and those receiving concurrent other CNS depressants.
- ❖ Monitoring patients before and after opioid administration for Rate and depth of respiration, Level of consciousness, pain intensity, blood pressure and heart rate, sedation level, oxygen saturation and loud snoring
- ❖ If severe respiratory depression develops, naloxone, an opioid atagonists (0.4 mg in 10cc saline) should be given every 2 minutes until patient becomes responsive to physical stimuli or takes deep breath. If patient is on regular opioids, then naloxone should be used judiciously as it may cause agonizing pain, profound withdrawal symptoms and seizures. Continuous respiratory monitoring should be done.
- Pruritus is common with intraspinal routes and it can be treated with diphenhydramine

### 3. Non Opioid Analgesics

- These drugs are widely used in combination with opioids. These drugs are safer and have less side effects. But they may not be sufficient in severe and acute pain. They are popularly used in addition to opioids to reduce the need of opioids. They have significant analgesic effect through their action at peripheral and central levels.
- Nonopioid analgesics include acetaminophen and NSAIDs. These agents are characterized by following
  - There is an analgesic limits to their analgesic properties (increasing dose beyond their upper limit provide no greater analgesia)
  - These drugs do not produce tolerance or dependence of any kind unlike opioids
- Acetaminophen has analgesic and antipyretic action, used to treat mild to moderate pain. It inhibits synthesis of neurotransmitter prostaglandins in the CNS and this is why it does not anti-inflammatory action. Side effects at therapeutic dosages are rare. Larger dosages may lead to damage to liver.
- Nonsteroidal anti-inflammatory drugs alone or in combination with opioids are commonly used in patient with acute musculoskeletal trauma and soft tissue inflammation. It blocks the action of cyclooxygenase (COX). This enzyme that



arachidonic acid into prostaglandins which is potent inflammatory mediator. This action occurs in both central and peripheral parts of pain perception. These drugs are grouped into two categories: first generation (COX-1 & COX-2 inhibitors e.g. aspirin, ibuprofen, ketorolac etc) and second generation (COX-2 inhibitors e.g. celecoxib, rofecoxib). NSAID has many side effects such as gastric ulceration, bleeding, renal failure etc. Ketorolac is most appropriate NSAID for use in critical care. It is safe and effective for post operative pain.

- Aspirin is commonly used for mild pain but its use as an analgesic is limited. It is popular anti platelet drug and used to control risk of cardiovascular disorder. It also has some common side effect of gastric upset, platelet dysfunction and bleeding

#### **4. Adjuvants**

- Adjuvants, drugs which are not analgesics in nature but can be very helpful for pain relief in patients with complex and chronic pain syndromes such as neuropathic pain.
- Anticonvulsants (carbamazepine, phenytoin, gabapentin) are first line analgesic for lancinating neuropathic pain
- Antidepressants (amitryptiline, imipramine, desipramine) are also considered as an analgesic in variety of chronic pain syndrome such as headache, arthritis, low back pain, neuropathy, central pain and cancer pain. Analgesic dose is generally lower than that requires for depression.
- Corticosteroids (dexamethasone, prednisolone, methylprednisolone) are most potent anti inflammatory agents and thus reduce pain to greater extent. They are commonly used for acute and chronic cancer pain, pain caused by autoimmune diseases, hypersensitive body responses. They are also helpful in pain secondary to spinal cord compression & inflammatory joint syndrome. There are several side effects especially if used for prolonged period. This limits their long term use. Adverse effects consists of fluid retention, dyspepsia and GI bleeding, hyperglycemia impaired healing, muscle wasting, osteoporosis, adrenal suppression & susceptibility to infection. Physician needs to taper off the drug to avoid adrenal failure.
- Anesthetic may also be used in critical care setting. Ketamine is dissociative agent but can be used as an analgesic. It is commonly used for procedural pain and has benefit of sparing respiratory drive over opioids. But it has side effect of release of catcholamine and emergence of delirium. Benzodiazepines may help reduce these side effects
- Lidocaine is one of commonest anesthetic agent used in topical route as well as infiltrative route. It provides local anesthesia during various invasive procedures

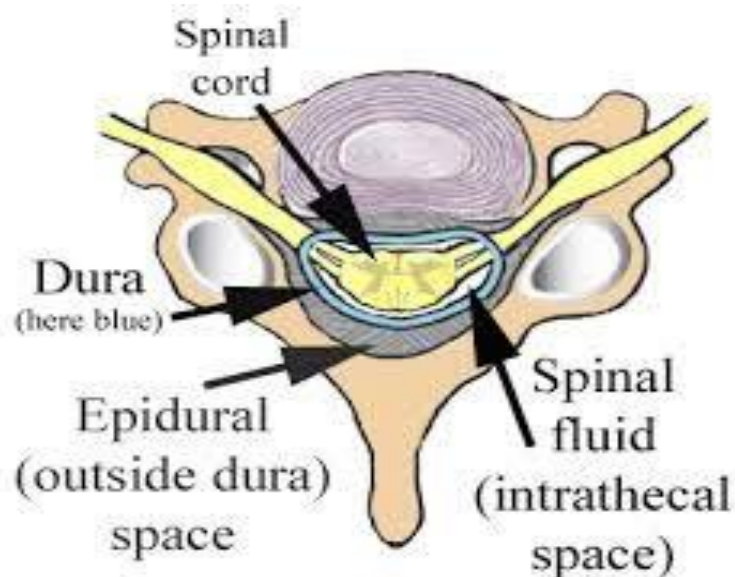
### **VIII. DELIVERY METHODS**

1. The most common route of drug administration for pain control in critical care is intravenous route. Oral route may be used in patients with functioning GI system. But

dosages for oral route are higher than required for parenteral route because of first pass effect of hepatic metabolism. Opioids can be given sublingually or through buccal route which may exempt them from first pass effect. Transdermal route may be used in patient with stable pain. Rectal and intranasal route may be used occasionally depending on patient's condition. Subcutaneous or intramuscular route may be used but are avoided as repeated injection may cause discomfort.

2. Intraspinal route has advantages of excellent pain control, lower dosages, increased mobility, minimal sedation, minimal effect on hemodynamic status and increased patient satisfaction. It is specifically used for pain in throat, upper abdomen and lower extremities and particularly reserved for intraoperative and postoperative use. Patient should be monitored for respiratory status, level of consciousness, urinary retention, pruritus, nausea vomiting and dizziness. There are two intraspinal route: intrathecal and epidural (image 3)

- Intrathecal opioids are placed directly into CSF and attach to spinal cord receptor. Side effects are post dural puncture headache and infection. It needs greater dosages as compared to epidural analgesia because it gets absorbed in systemic circulation.
- Epidural analgesia commonly used after any major abdominal, orthopedic or thoracic surgeries in critical care unit. It provides long lasting pain relief with minimal dosages. Drugs through this route may be bolus or continuously infused



**Image 3:** Intraspinal Spaces

3. There can be continuous infusion, bolus administration or patient controlled analgesia
- Bolus administration leads to rapid action and ease of titration. But it may also lead to unstable serum level of drug leading to breakthrough pain

- Continuous infusion provides constant blood levels of drug which may promote consistent comfort. It is helpful during period of sleep. There should be loading dose given before infusion to achieve circulatory dose of drug.
- Patient controlled analgesia (PTA) gives significant control to patient over their pain management. In this method, there is use of administration of analgesics via IV route and an infusion pump, that allows the patient to self administer small doses of analgesics. Most extensively used drug for PCA is morphine. It avoids peaks and valleys of intermittent dosing and gives greater comfort to patient. PTA is not preferred option for patients with advanced age, altered LOC, renal and hepatic insufficiency. Nurse must monitor the effect of medication and number of boluses the patient delivers. She should also advice necessary changes in prescription.

## **IX. NON PHARMACOLOGICAL MANAGEMENT OF PAIN**

1. Non pharmacologic methods are used for providing support in pain management and to enhance the pain free experience of the patient. They work as complementary therapies along with pharmacologic management of pain. There are many non pain sensory fibers (alpha-beta) present in periphery which can be stimulated to modify pain sensation and transmission. These fibers are stimulated by application heat or cold and simple massage.
2. Massage is generalized cutaneous stimulation of body and generally promotes comfort. It usually used for back and shoulder
3. Heat and cold therapy may significantly reduce requirement of analgesics. Cold application may also be used for decreasing bleeding. Heat therapy increases blood flow to an area and contribute to pain relief by speeding healing. Patient should be monitored closely to avoid injuries like burns or frost bite.
4. Transcutaneous electrical nerve stimulator (TENS) stimulates the non pain sensory fibers for relief of pain. Its use is limited in critical care as it is controlled by patient and requires intact mentation.
5. Relaxation reduces the distress associated with pain. It helps in reducing the oxygen consumption, decreasing tensed muscle tone, Manage the heart rate and blood pressure. It also reduces muscle tension and anxiety. Deep breathing exercises may also help patient for relaxation
6. Distraction may reduce patient pain and anxiety. Clue can be obtained from family to choose the type of distraction therapy for patient. E.g. watching TV
7. Guided imagery uses imagination to provide control over pain. This procedure involves guiding patient to a scenario or a place in his or her imagination that can lead to desirable feelings and pain free experience. These sessions creates the state of relaxation but needs considerable time commitment on the part of nurse.

8. Music therapy can be also used for relaxation. It may have soothing and pleasing effect. It helps in distracting from noises in critical care unit. It should be provided by small set of head phones

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