Pain management
What is pain?

• Pain is a difficult word to define

• Patients use different words to describe pain

• eg. Aching, Pins and needles, Annoying, Pricking, Biting, Hurting, Radiating, Blunt, Intermittent, Burning, Sore, Miserable, Splitting, Cutting, Nagging, Stabbing, Crawling, Stinging, Crushing, Tender, Dragging, Numbness, Throbbing, Dull, Overwhelming, Tingling, Electric-shock like, Penetrating, Tiring, Excruciating, Piercing, Unbearable

• The fifth vital sign” - American Pain Society 2003

Identifying pain as the fifth vital sign suggests that the assessment of pain should be as automatic as taking a client’s BP and pulse
what is pain?

- Pain is: an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.
- It is a symptom.
- Associated signs are crying, sweating, increased heart rate, blood pressure, behavioral changes.
What is the pain score for this player?

✓ Pain is whatever the patient thinks it is at the present time.

✓ Pain is always subjective to the patient’s report.
PAIN types:

**Acute pain** - lasts only through the expected recovery period whether it has a sudden or slow onset and regardless of intensity.

**Chronic pain** - is prolonged, usually recurring and persisting over 6 months or longer, and interferes with functioning.
**ACUTE VS CHRONIC PAIN**

- **ACUTE:**
  - Onset is well defined,
  - Response to tissue injury,
  - Responds to pain treatment,
  - Associated with anxiety,
  - Affects the individual

- **CHRONIC PAIN:**
  - Onset is ill defined,
  - Response to change in nervous system,
  - Less response to medication,
  - Associated with depression,
  - Involves social network
Another classification of pain according to source

**NOCICEPTIVE**

- **Somatic**
  - bones, joints
  - connective tissues
  - muscles

- **Visceral**
  - Organs – heart, liver, pancreas, gut, etc.

**NEUROPATHIC**

- Deafferentation
- Sympathetic Maintained
- Peripheral
Pathophysiology of pain
Pain - Receptors

• Nociceptors are special receptors that respond only to **noxious** stimuli and generate nerve impulses which the brain interprets as “pain.”

• There are two types of fibers that transmit pain: C-fibers and A-delta fibers.

• Activated by stimuli (mechanical, thermal, chemical).

• Distinguished from other receptors by
  – their higher threshold, and
  – they are normally activated only by stimuli of noxious intensity—sufficient to cause some degree of tissue damage.
NOCICEPTION

The peripheral nervous system includes primary sensory neurons specialized to detect mechanical, thermal or chemical conditions associated with potential tissue damage. The signals, when these nociceptors are activated, must be transduced and transmitted to the spine and brain where signals are modified before they are ultimately understood or “felt”.

4 physiologic processes involved (transduction, transmission, perception, and modulation)
1- TRANSDUCTION

During this stage, noxious stimuli (with potential to injure tissue) trigger the release of biochemical mediators (prostaglandins, bradykinin, serotonin, histamine, substance P) that sensitize nociceptors. Noxious or painful stimulation also causes movement of ions across cell membranes, which excites nociceptors.
Pain medication can work during this phase by blocking the production of prostaglandin (e.g., ibuprofen or aspirin) or by decreasing the movements of ions across the cell membrane (e.g., local anesthetic).
2- TRANSMISSION

Includes 3 segments.

First segment- pain impulse travels from the peripheral nerve fibers to the spinal cord. Substance P serves as neurotransmitter. Two types of nociceptors cause this transmission to dorsal horn of the spinal cord: C fibres transmit dull pain and Adelta fibres which transmit sharp, localized pain.

Second segment- transmission from the spinal cord and ascension via spinothalamic tracts, to the brain stem and thalamus.

Third segment- involves transmission of signals between thalamus and somatic sensory cortex where pain perception occurs.
Substances Released from Damaged Cells
- Bradykinin
- Cations (protons, potassium ions)
- Free radicals (nitric oxide)
- Histamine
- Prostanoids (prostaglandins, leukotrienes)
- Purines (adenosine, adenosine triphosphate)
- Serotonin
- Tachykinins (substance P, neurokinin A)
Pain control can take place during this second process. Opioids (narcotic analgesics) block the release of neurotransmitters, particularly substance P, which stops the pain at the spinal level. Capsaicin may also deplete substance P that could inhibit the transmission of pain signals.
Often described as “descending System” Occurs when neurons in the thalamus and brain stem send signals down to the dorsal horn of the spinal cord. These descending fibers release substances such as endogenous opioids, serotonin, and norepinephrine which can inhibit the ascending noxious(painful) impulses in the dorsal horn.
4- PERCEPTION

Is when the client becomes conscious of the pain. Pain perception is the sum of complex activities in the Central Nervous System that may shape the character and intensity of pain perceived and ascribe meaning to the pain.
Theories of pain

Intensity theory

- Touch
- Pain

Less intensity produces touch
Increased intensity produces pain

Specificity theory

- Touch
- Pain

There are two different pathways for touch and pain
Gate control theory

• This explains how pain can be relieved very quickly by a neural mechanism

• First described by P.D. Wall & Melzack (1965)

• “There is an interaction between pain fibres and touch fibre input at the spinal cord level in the form of a ‘gating mechanism’
Gate control theory

When pain fibre is stimulated, gate will be opened & pain is felt
Gate control theory

When pain and touch fibres are stimulated together, gate will be closed & pain is not felt
Gate control theory

- This theory provided basis for various methods of pain relief
  - Massaging a painful area
  - Applying irritable substances to a painful area (counter-irritation)
  - Transcutaneous Electrical Nerve Stimulation (TENS)
  - Acupuncture
Pharmacological Treatment of Pain

A. Non-Opioids
B. Opioids
C. Adjuvants
A-Non-Opioids

- **Paracetamol (Panadol):** PO, IV. *Act centrally & peripherally*

  - **Non-steroidal Anti-inflammatory Drugs (NSAIDs):**
    - Ketorolac (Toradol)- inj
    - Ibuprofen (Advil, Neurofen, Brufen)
    - Diclofenac Na/K (Voltaren, Olfen, Cataflam)
    - Mefanemic acid (Ponstan)

  - **Cox-1, Cox-2 inhibitors:**
    - Naproxen (naproysen)
    - Celebrex (Celecoxib)
    - Etoricoxib (Arocoxia)
A- **NSAIDs mechanism of action**

![Diagram showing the mechanism of action of NSAIDs](image)

**FIGURE 1.** Algorithm of the biochemical pathway shows that the formation of prostaglandins occurs via both cyclooxygenase enzymes (COX-1 and COX-2).
**NSAIDs**

**Ketorolac (Toradol):**
- Postoperatively for max 5 days
- Reduce amount of opioid requirement, reduce S.E’s
- Dose = 15 – 30 mg IV / IM Q6hrs

**Cox-2 inhibitors:**
- Effective anti-inflammatory in arthritis
- Carry cardiovascular risk warning
- Less GI S.E’s
NSAID

Side effects:

- Prolong bleeding time
- Gastric erosions/ ulceration/ perfusion
- Affect kidney function:
  - Water / electrolyte balance
  - Interfere with diuretics/ antihypertensive
  - Renal injury / nephrotic syndrome
B- Opioids
Opioid Receptors

- Opioid receptors found in the brain, spinal cord and peripheral nervous system
  - Mu ($\mu_1$ and $\mu_2$)
  - Kappa (k1 & k3)
  - Delta ($\delta$)
  - Nociceptin/Orphanin (N/OFQ)

So the opioid will bind to these receptors leading to different reactions that produce its analgesic effect.
Spinal sites of opioid action.

- Hyperpolarize second-order pain transmission neurons by increasing K+ conductance, evoking an inhibitory postsynaptic potential.

- Reduce transmitter release from presynaptic terminals of nociceptive primary afferents.
Opioid drugs that I will discuss

- 1-Morphine
- 2-Codiene (Methyl Morphine)
- 3-Pethidine
- 4-Fentany1
- 5-Tramadol
1-Morphine
Efficacy

• Morphine is a strong analgesic.
• Higher doses can decrease even severe pain.
• Degree of analgesia increasing with dose.
• Simultaneous action at spinal and supraspinal sites greatly amplifies the analgesic action.
Mood and subjective effects

• Morphine has a calming effect.

• The associated reactions to intense pain
  – apprehension,
  – fear,

• Perception of pain and reaction to it are both altered so that pain is no longer as unpleasant or distressing, i.e. patient tolerates pain better.
Mood and subjective effects

In patients - Pain relief
No addiction

In normal persons
Dependence and Addiction
Therapeutic uses

- Morphine / parenteral congeners indicated as analgesic in traumatic, visceral, ischaemic (myocardial infarction), Postoperative, burns, cancer pain.
- Relieves anxiety and apprehension in serious and frightening disease accompanied by pain: myocardial infarction.
- Dose:
  - Bolus: 2-5 mg slowly over 5min (Q 1-3 hrs).
  - IM: 5-10 mg (Q3-4 hrs).
  - SC: not recommended in repeated dose
2-Codiene (Methyl Morphine)

- low-efficacy opioid
- lacks efficacy for severe pain
- most of its actions $1/10^{th}$ those of morphine.
- Large doses cause excitement.
- Dependence much less than with morphine.
- principal use: mild to moderate pain & cough
3-Pethidine

- Pethidine differs from morphine in that it:
  - does not usefully suppress cough
  - less likely to constipate
  - less likely to cause urinary retention & prolong childbirth
  - little hypnotic effect
  - shorter duration of analgesia (2-3 h).
- Dose: 50-100mg SC or IM
4-Fentanyl

- Fentanyl is 80-100 times potent than morphine in analgesia and resp. depression
- High lipid solubility, peak effect in 5 min
- Duration of action 30-40 min
- Injectable form exclusively used in anaesthesia
- Transdermal patch available used in cancer or other types of chronic pain
- Dose: 25-75 µg/hr acts for 72 hours
5-Tramadol

• Relieves pain by opioid as well as other mechanisms
• 100 mg IV Tramadol = 100 mg IM morphine
• Dose: 50-100 mg TDS (3 times a day)

• Less respiratory depression, sedation, constipation, urinary retention, ↑ intrabiliary pressure & dependence than morphine

• As effective as pethidine for postoperative pain and as morphine for moderate chronic pain.
Opioids Side Effects

- Nausea and vomiting
- Constipation
- Pruritis
- Irritable movement
- Psychomimetic effects
- Sedation
- Broncho-constriction
- Respiratory Depression

*N.B:* If respiratory depression/sedation develops, the nurse must be familiar with administration of Naloxone, which will reverse the effect. Naloxone is diluted (0.4 mg in 10 mL NS) every 1-2 min until the patient's respiratory status improves and the patient starts to arouse.
C-Adjuvants

Agents used to induce analgesic effect indirectly

- Local anesthetics
- Antidepressants
- Anticonvulsants
- Corticosteroids
- Muscle relaxants
- Anti histamines
4. Choice of Drugs in Treatment of Acute / chronic
4. Choice of Drugs in Treatment of Acute / Chronic Pain