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Pain Management

Advanced Care Paramedicine

Module: 08

Section: 12

Scenario 01

- You are dispatched to a local residence for a 35 y/o male with back pain. He is standing in the living room and is in noticeable discomfort. He notes that the pain began while moving some furniture around the living room and is a 10/10.

Introduction

- Many health care professionals would agree that we do not treat pain well
- A lot of stigma surrounding pain
- As paramedics you will encounter acute, chronic, and acute on chronic pain
  - This means you will need to understand pain and pain treatment, regardless of analgesic medications in your scope of practice
  - Understanding is more important than memorizing

Management of Pain in Canada

- Canadian Pain Society:
  - "People living with pain have double the risk of suicide as compared with people without chronic pain"
  - "Only 30% of ordered medication is given, 50% of patients are left in moderate to severe pain after surgery and the situation is not improving"
  - One in five Canadian adults suffer from chronic pain

Why?

- Although your ACP scope of practice will vary in terms of which analgesics you can provide you need to be knowledgeable in pain and pain management for the following reasons:
  - To determine what pain management is within your capabilities
  - How to manage acute and chronic pain calls
    - This call volume will exceed high acuity calls
  - To educate, promote, and advocate for your patients well-being
  - Pain medications can lead to many acute and chronic side effects that you will be required to triage and treat

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Pain Management

PAIN

Pain

- Pain is a common, uncomfortable sensation and emotional experience associated with actual or potential tissue damage.
- It is the physiological response to a noxious stimuli.
  - Pain is complex, with many neurological components. It is still not fully understood.

Pain

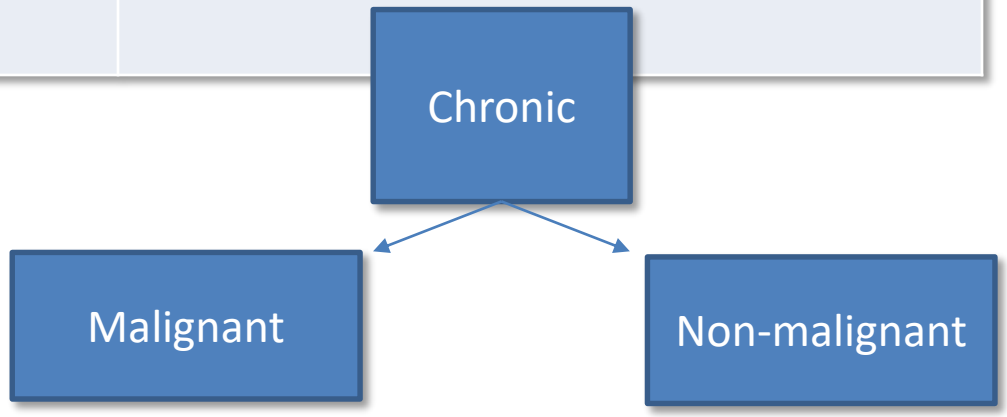
- Classified by:
  - Acute pain
    - Hyperacute
    - Subacute
  - Chronic pain

Pain

- Acute
  - Pain that has been present for less than three months
  - Usually sudden on set and can last from hours to days
    - Hyperacute
      - Pain develops and lasts a very short period of time
    - Subacute
      - Pain that has develops or lasts from an week to a month
- Chronic
  - Pain is persistent, lasting weeks or months or longer, and usually associated with prolonged disease.

Acute vs Chronic Pain

Acute	Chronic
Resolves when injury heals	Continues after injury has healed
Generally lasts no longer than a month, 3 months at most	1-6 months
Protective	Complex, serves no protective function, maladaptive and can erode health and activities of daily living
Many treatments, with good response	Difficult to treat



Types of Pain

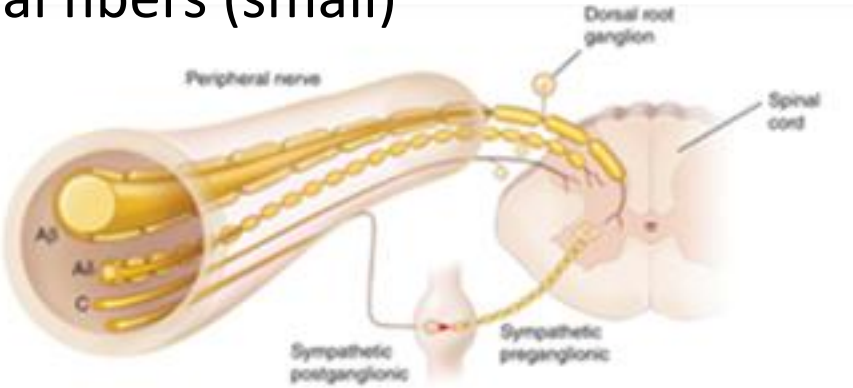
- Nociceptive
  - Visceral
  - Somatic
- Non-nociceptive
  - Neuropathic

Nociceptive Pain

	Visceral	Somatic
	Parietal or visceral	Superficial or deep
Region	Organs of the visceral and parietal cavities	Superficial: skin, subcutaneous tissue and mucous membranes Deep: bones, tendons, connective tissue
Location	Diffuse	Well localized
Description	Visceral: Dull, achy, colicky Parietal: Can be sharp	Sharp, stabbing, throbbing, burning
Examples	Kidney stones, gastroenteritis	Burns, fractures, soft tissue injury

Nociception

- The transmission of pain impulses from the site of injury or tissue damage to the dorsal horn of the spinal cord and brain
  - Mediated by two specialized nerve fibers:
    - Myelinated A-beta (large fibers)
    - Myelinated A-delta (small fibers)
    - Unmyelinated C-polymodal fibers (small)



Nociceptors

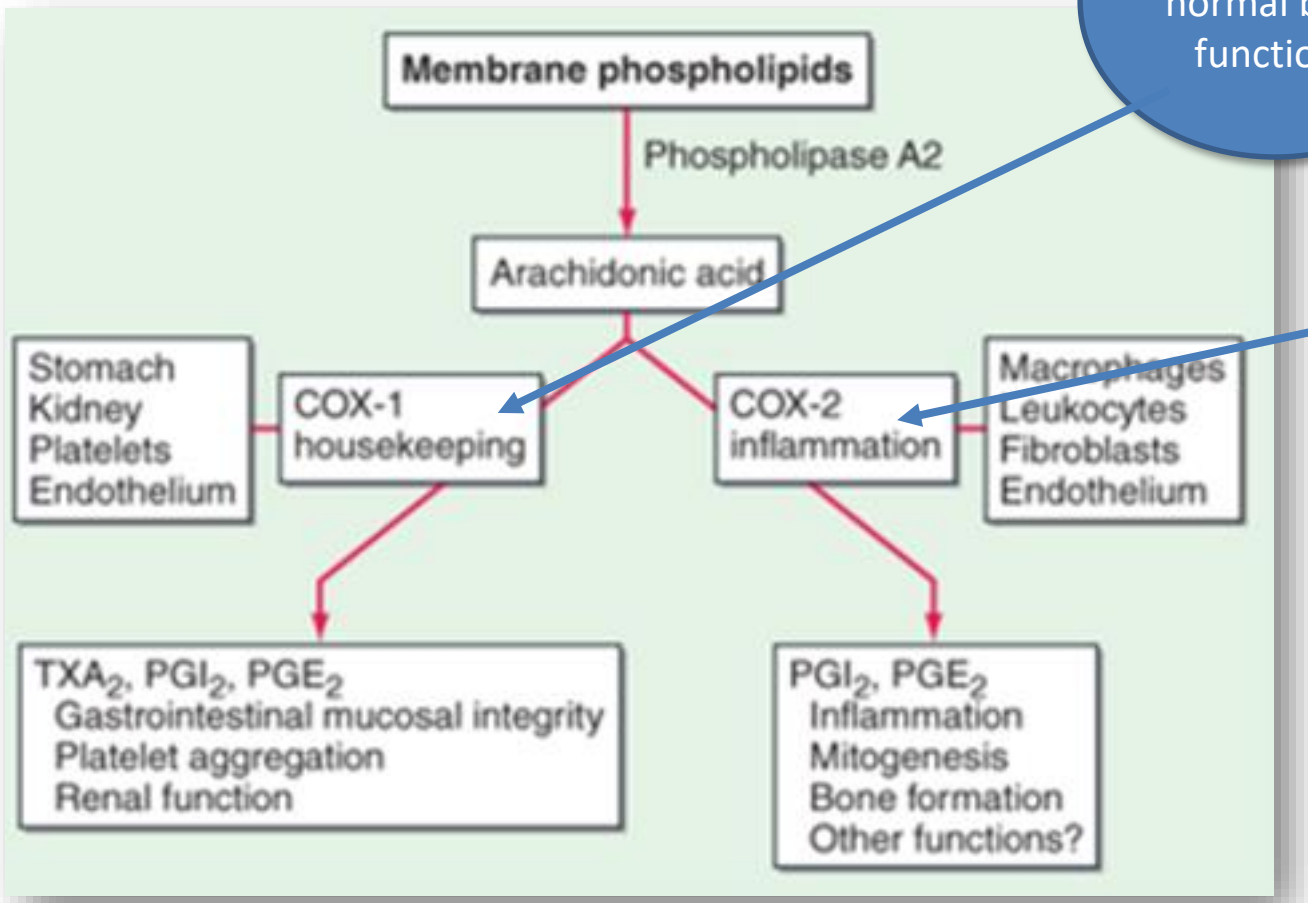
- Peripheral Nociception
  - Different types of cutaneous sensory receptors:
    - **Mechanical nociceptors** respond to strong pressure.
    - **Thermal nociceptors** are activated by skin temperatures above 42°C or by severe cold.
    - **Chemically sensitive nociceptors** respond to various chemicals such as bradykinin, histamine, high acidity, and environmental irritants. Some of these products are released when tissue is damaged, increasing neuronal firing.
    - **Combination nociceptors** that respond to more than one of the previously mentioned

Pathophysiology

- Peripheral nociception
  - Biochemical mediators
    - Bradykinin
    - Prostaglandin
    - Leukotrienes
    - Serotonin
    - Histamine
    - Catecholamine
    - Substance P

Inflammation

- Cyclooxygenase (COX)



Needed for normal body functions

Transient and responds when we hurt ourselves

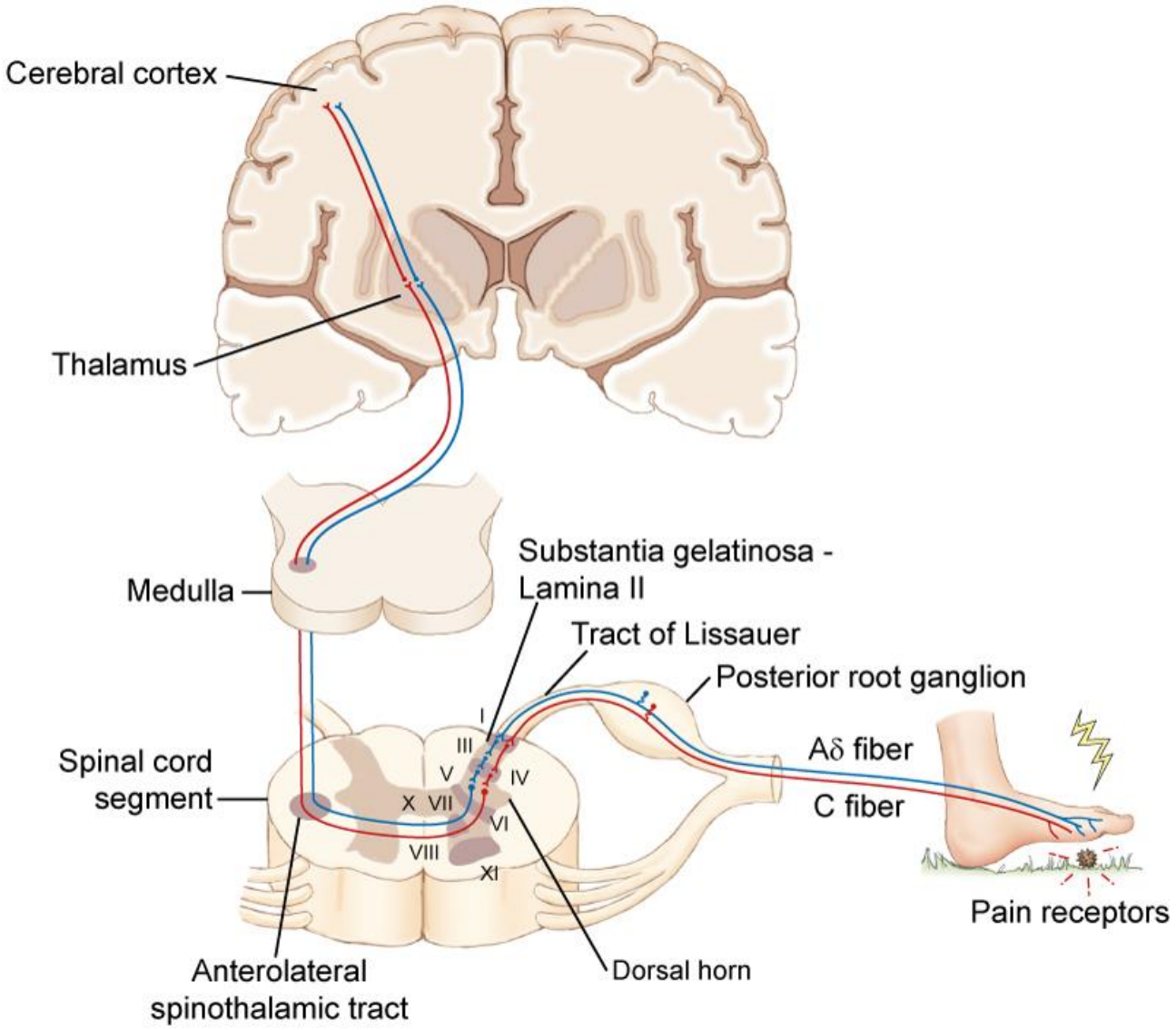
Pathophysiology

- Nociceptors transmit pain impulses along A-delta and C-fibers to the dorsal horn of the spinal cord.
- Spinothalamic tracts reach the thalamus which acts as a relay station
  - Cerebral cortex
    - Limbic system
  - Somatosensory cortex

Pain Modulation

- Descending pain tracts alter pain responses
  - This can lead to pain ceasing or occurring in ascending tracts
  - Serotonin and Norepinephrine neurotransmitters seem to be heavily involved
- Psychological components
  - Why can someone at war be shot at and carry on the fight when another person can suffer from something perceived as less painful?

Pain Pathways



Neuropathic

- In contrast to nociceptive pain, is usually described as burning, electric, heat, tingling or stabbing, numbness.
- Caused by damage to PNS and/or CNS
  - Inflammatory mediators released by injury to the nervous system itself (peripheral and central)
- Characterized by:
  - Chronic Allodynia
    - Pain resulting from a stimulus that ordinarily does not elicit a painful response
  - Chronic Hyperalgesia
    - Increased sensitivity to normally painful stimuli

Neuropathic

- Described as
  - Electric shock, burning, numbness
- Treatments
  - NSAIDs & Opiates are not first line, very little evidence
  - First line treatments
    - Antidepressants
    - Anticonvulsants

Definitions

- Hypoalgesia
  - Diminished response to a normally painful stimulus
- Analgesia
  - Absence of pain in response to stimulation that normally is painful
- Hyperesthesia
  - Increased sensitivity to stimulation, excluding the special senses
- Hypoesthesia
  - Diminished sensitivity to stimulation, excluding the special senses

Definitions

- Dysesthesia
  - An unpleasant abnormal sensation, whether spontaneous or evoked
- Paresthesia
  - An abnormal sensation, whether spontaneous or evoked
- Narcotic
  - Legal term: dependence producing
  - Pharmacological term: sleep inducing

Definitions

- Sensitization
  - "When intense, repeated, or prolonged stimuli are applied to damaged or inflamed tissues, the threshold for activating primary afferent nociceptors is lowered, and the frequency of firing is higher for all stimulus intensities"
    - Harrison's Internal Medicine

Referred Pain

- Pain perceived in a location other than the site of the painful stimulus.
- Thought to be a result of visceral fibers entering into the spinal cord at the same point as other afferent fibers. The brain recognizes this “cross over” stimulation to be pain coming from either area.

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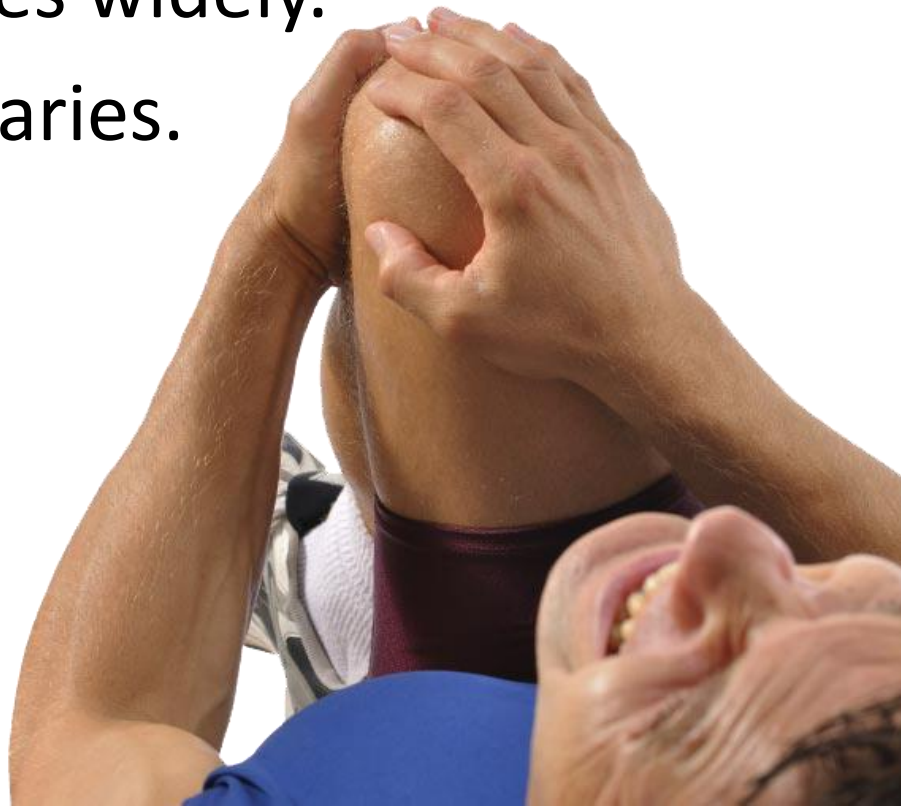
ASSESSMENT

Pain Assessment

- When the chief complaint is pain, the location and related symptoms may assist in the diagnosis of a patient's condition.
- If the pain is related to a diagnosed condition (e.g., trauma, surgery, sickle cell anemia, or cancer), assessment of its character and intensity is necessary for pain control.
- Remember that there may be more than one cause of pain.

Responses to Pain

- Pain is a subjective unpleasant symptom of many conditions and injuries.
- Individual response varies widely.
- Threshold of response varies.
- Tolerance level varies.



Self-Report Pain Rating Scales

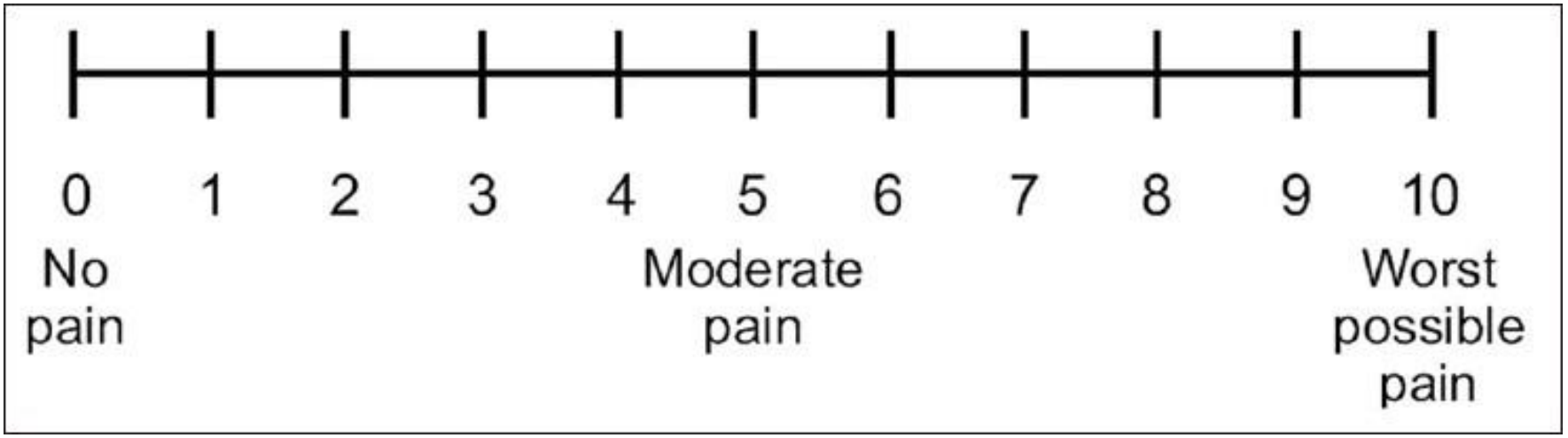
- A variety of scales and instruments have been developed.
- Very few include patient's emotional response.
- Learn patient's customary terminology.
- Consistent use of a particular scale will contribute to consistent interpretation.

Self-Report Pain Rating Scales

- Pain intensity may vary in different sites.
- Pain intensity may vary with routine activities such as moving, coughing, or deep breathing.
- Link pain intensity reported with location and activity.
- Reassess regularly, even after problem is solved.

Self-Report Pain Rating Scales

- 10 point scale
- “On a scale of 0 to 10, with 10 being the worst pain you have every felt, how would you describe your pain?”

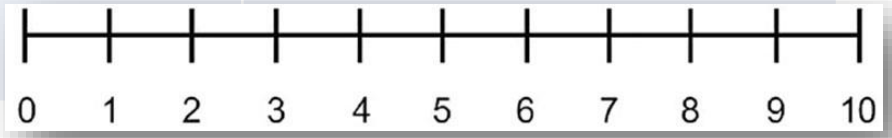


Assessing Pain Behaviors

- Guarded, protective behavior, hands over painful area, distorted posture, irritability
- Facial mask of pain: distorted expression
- Vocalizations: groaning, crying, or talkative patient becomes quiet
- Body movements such as head rocking, pacing, inability to keep hands still

Assessing Pain Behaviors

Scale	Descriptive	Activity Tolerance Scale
• No Pain (0 – 1)	• Alert • Smiling	• No pain
• Mild Pain (1 – 2)	• No Humour • Serious, Flat Affect	• Can be ignored
• Moderate Pain (2 – 4)	• Furrowed brow • Pursed Lips • Breath holding	• Interferes with tasks
• Severe Pain (5 – 6)	• Wrinkled nose • Raised upper lip • Rapid breathing	• Interferes with concentration
• Very Severe Pain (6 – 8)	• Slow blink • Open mouth	• Interferes with basic needs
• Excruciating Pain (8 – 10)	• Eyes closed • Moaning • Crying	• Bed rest required

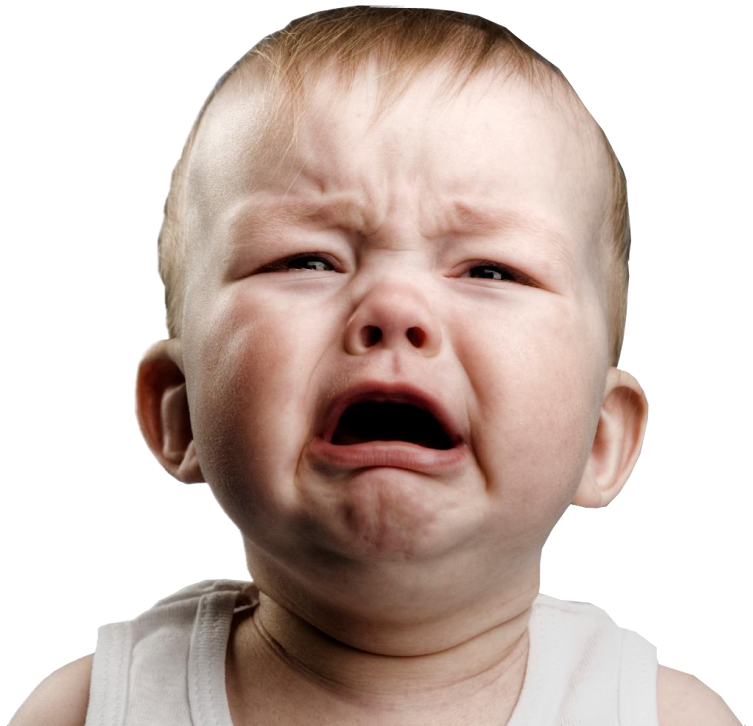


Assessing Pain Behaviors

- Changes in vital signs
- Pallor and diaphoresis
- Pupil dilation
- Dry mouth
- Decreased attention span, greater confusion

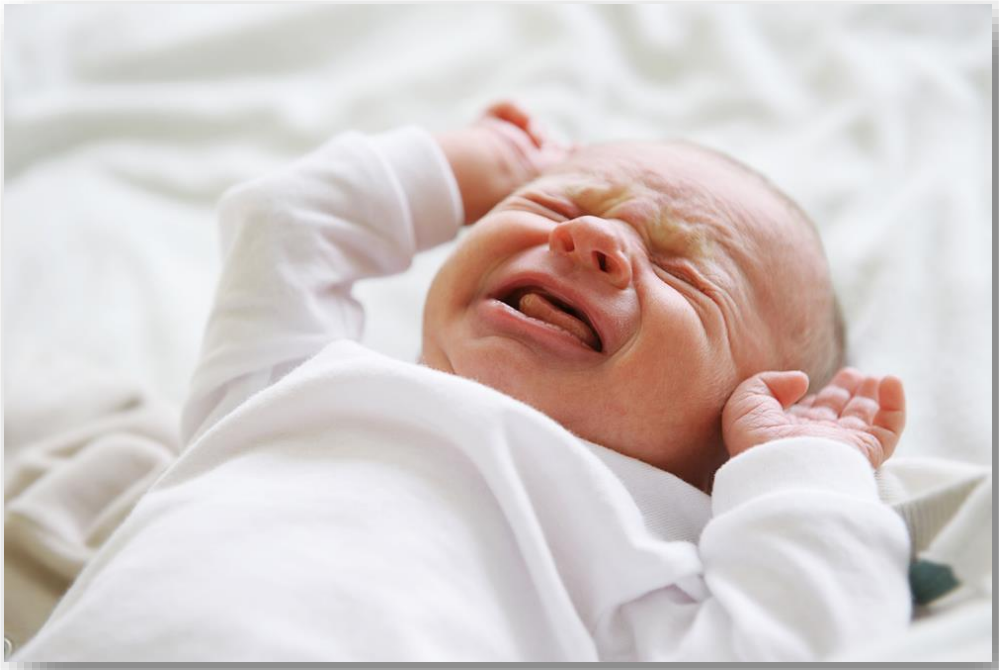
Newborn and Infants

- Higher pulse and respiratory rate than adults
- Lower blood pressure than adults
- Less able to modify pain impulses
- The newborn's pulse rate is more variable than that of older infants with activities such as feeding, sleeping, and waking.



Pain Assessment
Neonate and Infants

- Premature Infant Pain Profile (PIPP)
  - Gestational age
  - Behavioral state
  - Heart rate
  - Oxygen saturation
  - Brow bulge
  - Eye squeeze
  - Nasolabial furrow



Children

- The heart rates of children are more variable than those of adults and react with wider swings related to exercise, fever, or stress.
- The usual respiratory rates for children vary with age.
- Rates decrease with age, with a greater variation in the first 2 years of life and without significant gender difference.

Pain Assessment Children

- History and physical examination will provide much information about child's pain.
- Wong/Baker Faces Rating Scale is an example of faces rating scales reliable for children.
  - The child must choose the face that best represents amount of pain.

Pain Assessment Children

- Pain Assessment Scale for children can vary depending on age:
  - FLACC (Face, Legs, Cry, Consolability) for 0 – 3 y/o
  - Wong-Baker Faces Pain Scale for 4 – 12 y/o

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FLACC Scale

	0	1	2
FACE	No particular expression or smile, **eye contact and interest in surroundings**	Occasional grimace or frown, withdrawn, disinterested, **worried look to face, eyebrows lowered, eyes partially closed, cheeks raised, mouth pursed**	Frequent to constant frown, clenched jaw, quivering chin, **deep furrows on forehead, eyes closed, mouth opened, deep lines around nose/lips**
LEGS	Normal position or relaxed	Uneasy, restless, tense, **increased tone, rigidity, intermittent flexion/ extension of limbs**	Kicking or legs drawn up, **hypertonicity, exaggerated flexion/ extension of limbs, tremors**
ACTIVITY	Lying quietly, normal position, moves easily **and freely**	Squirming, shifting back and forth, tense, **hesitant to move, guarding, pressure on body part**	Arched, rigid, or jerking, **fixed position, rocking, side to side head movement, rubbing of body part**
CRY	No cry or **moan** (awake or asleep)	Moans or whimpers, **occasional cries, sighs,** occasional complaint	Crying steadily, screams, sobs, moans, **grunts**, frequent complaints
CONSOLABILITY	**Calm**, content, relaxed, does not require consoling	Reassured by occasional touching, hugging, or talking to, distractible	Difficult to console or comfort

Pain Assessment Children

- History and physical examination will provide much information about child's pain.
- *Wong/Baker Faces Rating Scale* is an example of faces rating scales reliable for children.
  - The child must choose the face that best represents amount of pain.

Pregnant Women

- During pregnancy, some women may experience pain due to several physiologic processes
  - Back pain
  - Cramping or pressure
  - Epigastric pain
  - Round ligament pain
  - Pressure on the bladder

Pregnant Women

- The process of labor involves significant pain and stress for the majority of women.
- Laboring women may describe their pain as sharp, cramping, aching, throbbing, stabbing, shooting, heavy, and exhaustive.
- Childbirth training does not result in significantly different perceptions of pain.

Pregnant Women

- Labor pain may be related to:
  - Dilatation of the cervix
  - Stretching of the lower uterine segment
  - Pressure on adjacent structures
  - Hypoxia of the uterine muscle cells during contractions
- During delivery, additional pain is caused by:
  - Pressure of the fetal head against of the pelvic floor, vagina, and perineum

Older Adults

- No evidence exists that older adults have a diminished perception of pain.
- Many do have chronic health conditions associated with pain.
- May not report any pain

Pain Assessment Older Adults

- Self-report pain scales should be used with older adults.
- When a self-report pain rating scale cannot be used, observe for pain behaviors.
- Cognitive impairment may complicate the pain assessment of older adults.

Red Flags

- Lower back pain (very common complaint), rule out:
  - AAA
  - Cauda equina syndrome
  - Malignancy
  - Sciatica
  - Infection of indwelling catheter
  - Osteoporosis
  - Corticosteroid use
- Symptoms to watch for
  - Tearing, ripping pain, radiation from back down legs with feeling of needing to make bowel movement
  - Pain worse at night
  - Numbness
  - Bowel and bladder disturbances (cauda equina)

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Pain Management

TREATING PAIN

How do we treat pain?

- Not well
  - Room for improvement
  - Room for further research
  - Room for further new therapies
- Acute better than chronic

Non-pharmacological Pain Management (NPPM)

- Proper immobilization
- RICE
- Therapeutic communication and distraction techniques
- Providing child with a comforting item may help reduce stress

Principles of Pain Management

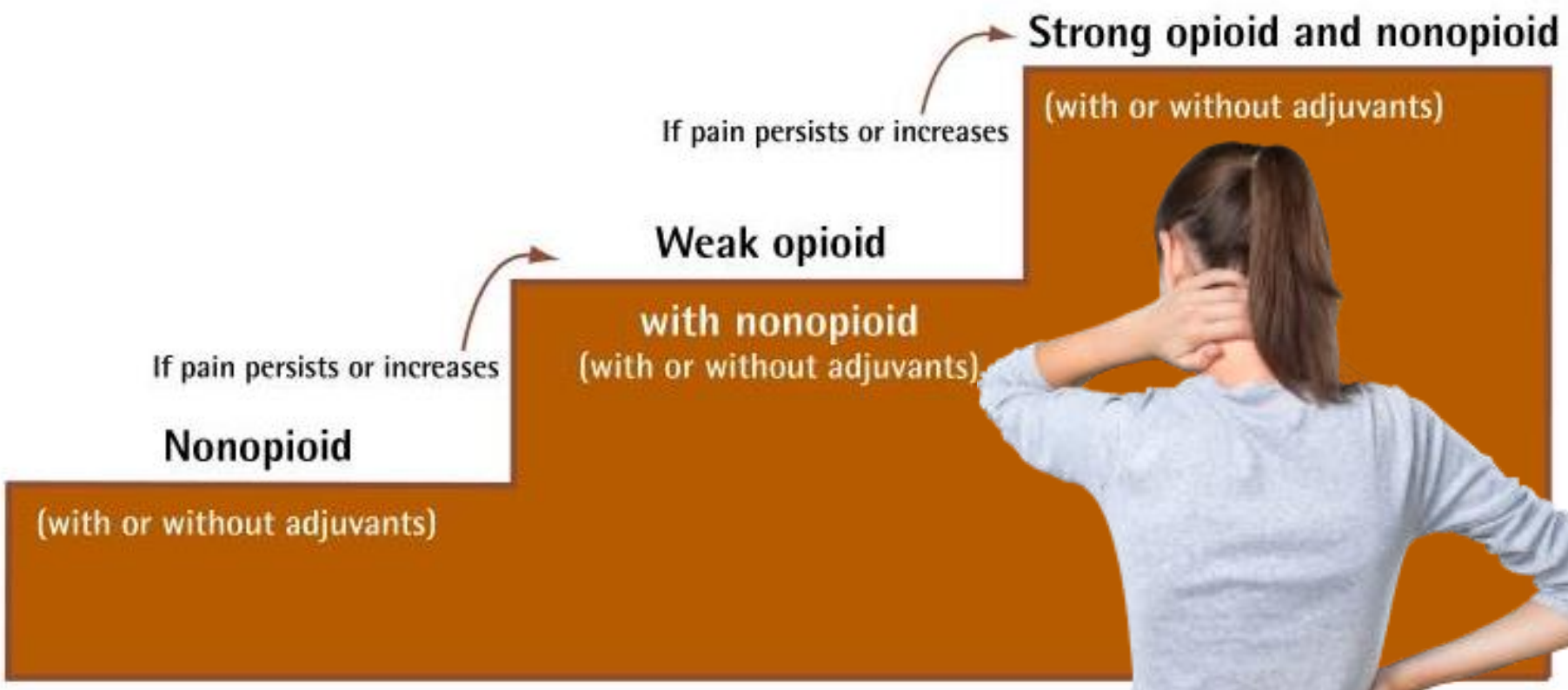
- There are 5 guiding principles for its application which makes it a useful tool for teaching due to its simplicity may be summarized as:
  1. ‘By mouth’
  2. ‘By the clock’
  3. ‘By the ladder’
  4. ‘For the individual’
  5. ‘Attention to detail’

Pain Ladder

Mild Pain
<3 out of 10 on NRS

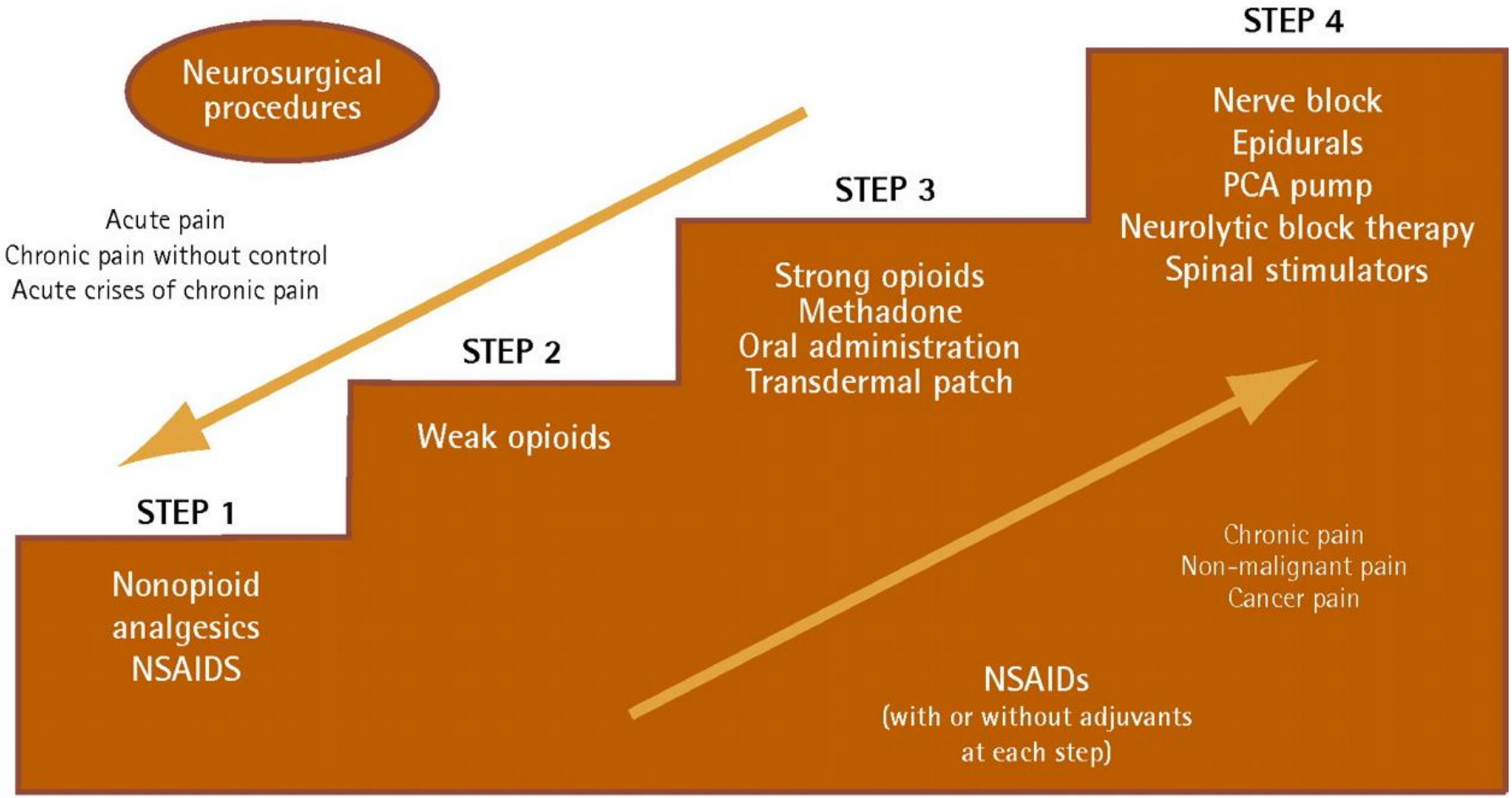
Moderate Pain
3-6 out of 10 on NRS

Severe Pain
>6 out of 10 on NRS



Adapted from the World Health Organization.[1]

Pain Ladder


Neurosurgical procedures
Acute pain
Chronic pain without control
Acute crises of chronic pain
STEP 1
Nonopioid analgesics
NSAIDS
STEP 2
Weak opioids
STEP 3
Strong opioids
Methadone
Oral administration
Transdermal patch
STEP 4
Nerve block
Epidurals
PCA pump
Neurolytic block therapy
Spinal stimulators
Chronic pain
Non-malignant pain
Cancer pain
NSAIDs
(with or without adjuvants at each step)

Medications

PCP Scope

- Non-narcotic Analgesics
  - NSAID
    - Ibuprofen
    - Ketorolac (Toradol)
  - Analgesics
    - Acetaminophen
    - Nitrous Oxide (N_2O)

ACP Scope

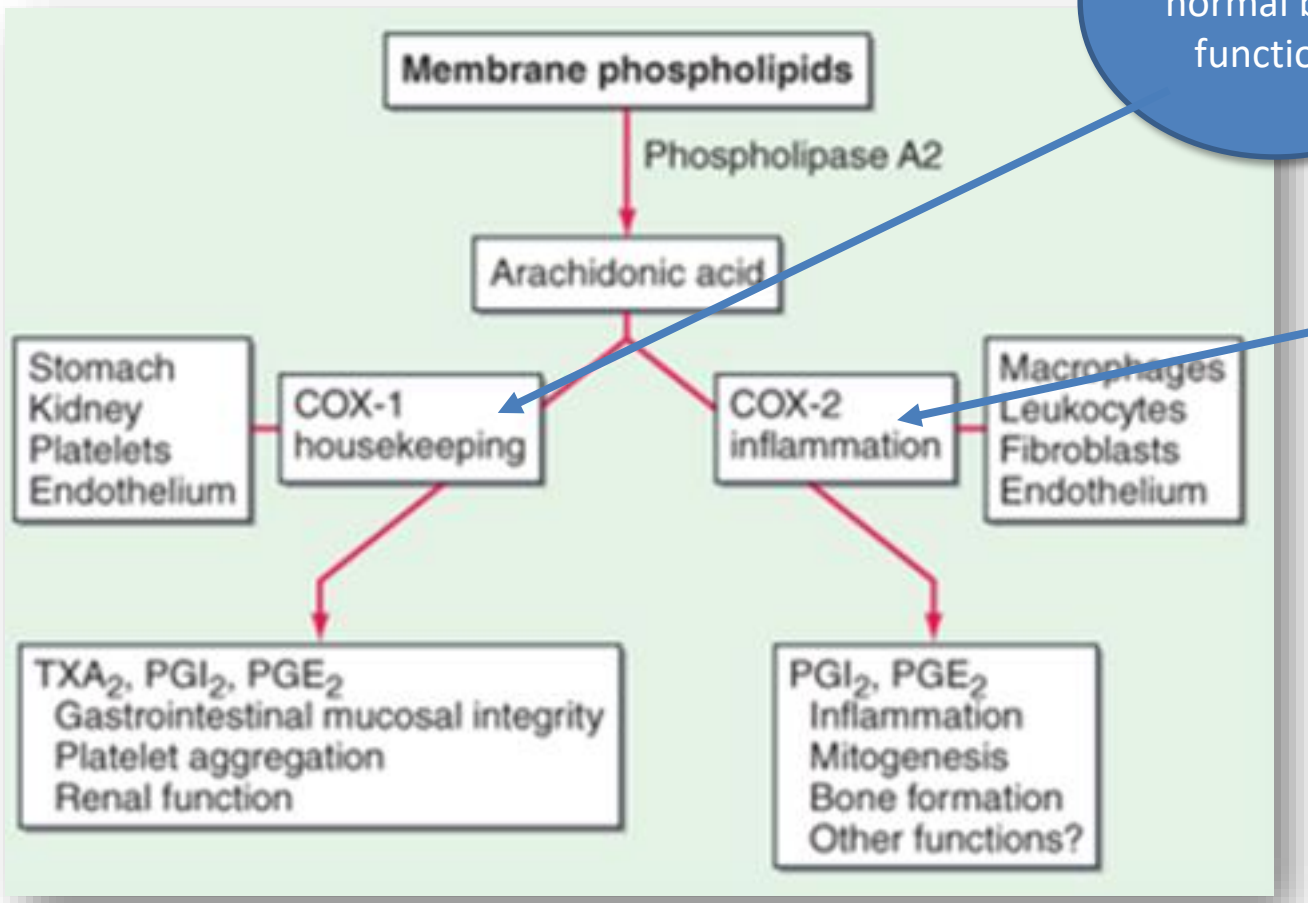
- Narcotic Analgesics
  - Morphine
  - Fentanyl
- Hydromorphone

Non-Steroidal Anti-Inflammatory Drugs (NSAID)

- Reduces the production of prostaglandins by inhibiting the COX (COX-1 and COX-2) enzymes.
- As a result reduces inflammation, pain, and fever.
- Since the prostaglandins that protect the stomach and promote blood clotting also are reduced, NSAIDs that block both COX-1 and COX-2 can cause ulcers in the stomach and intestines, and increase the risk of bleeding.

Inflammation

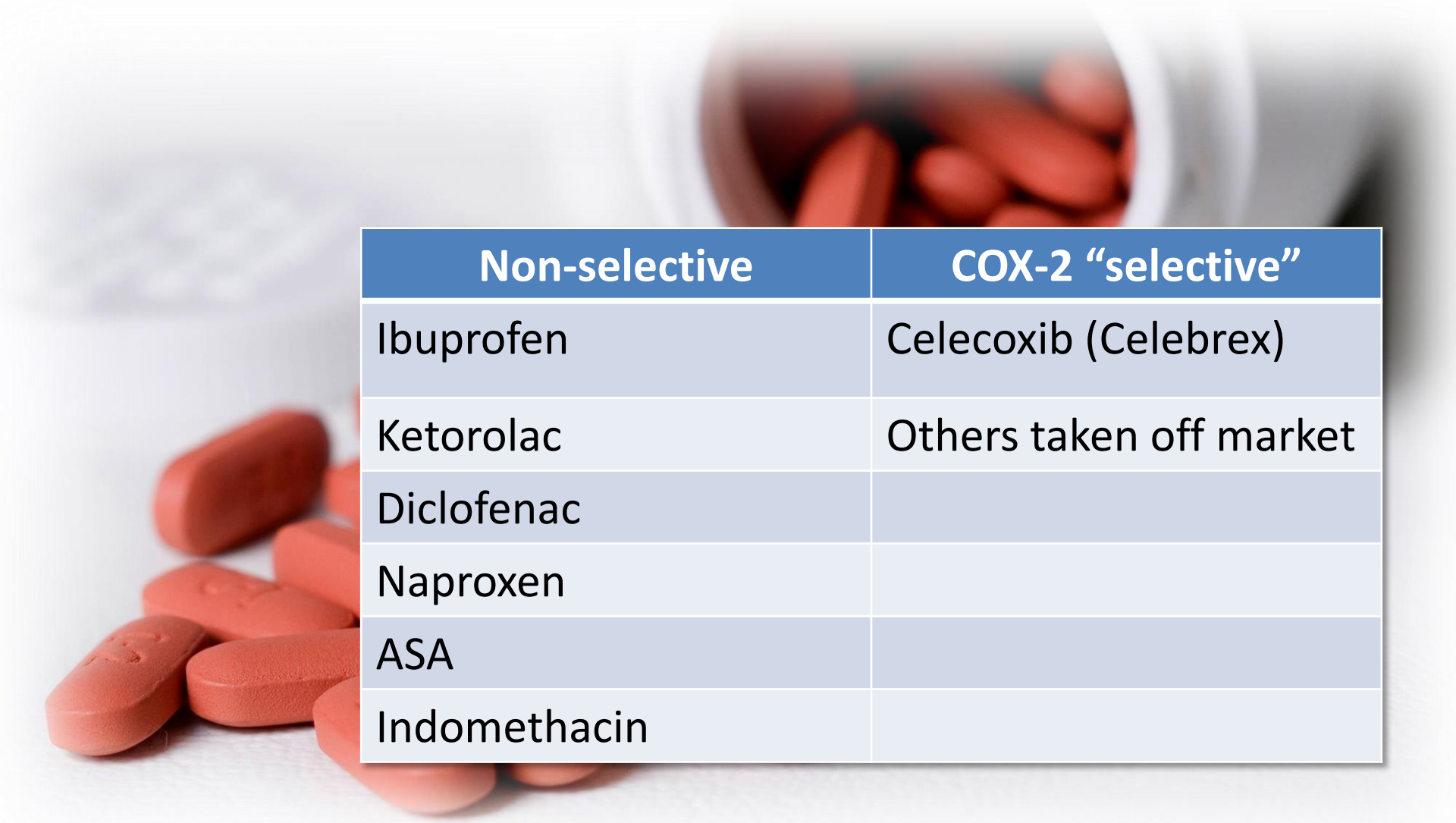
- Cyclooxygenase (COX)



Needed for normal body functions

Transient and responds when we hurt ourselves

Inflammation



Non-selective	COX-2 “selective”
Ibuprofen	Celecoxib (Celebrex)
Ketorolac	Others taken off market
Diclofenac	
Naproxen	
ASA	
Indomethacin	

Ibuprofen

Classification	• Non-Steroidal Anti-Inflammatory Drug (NSAID)
Mechanism of Action	• Decreases inflammation, pain and fever though inhibition of cyclooxygenase activity and prostaglandin synthesis
Indications	• Treatment of mild pain • Reduction in fever • Anti-inflammatory

Ibuprofen

Contraindications	• Hypersensitivity to NSAIDs/salicylates • Age < 6 months or > 65 • Peptic ulcer disease or History of GI bleed • ASA induced asthma • Late pregnancy (3rd trimester) • CVA or TBI in previous 24 hours • Major burns • Renal failure or solitary kidney

Dosage	• Adult
	  • 200 - 600 mg PO q 6 – 8 h
	• Pediatric (> 6 months)
	  • 7.5 mg/kg PO 6 – 8 h

Ketorolac (Toradol)

Classification	• Non-Steroidal Anti-Inflammatory Drug (NSAID)
Mechanism of Action	• Decreases inflammation, pain and fever though inhibition of cyclooxygenase activity and prostaglandin synthesis

Indications	• Treatment of moderate to severe pain
	  • Major burns
	  • Cancer related pain
	  • MSK Neck or Back pain
	  • Renal Colic

Ketorolac (Toradol)

Contraindications	• Hypersensitivity to NSAIDs/salicylates • Age < 16 or > 65 • Peptic ulcer disease or History of GI bleed • ASA induced asthma • Late pregnancy (3rd trimester) • CVA or TBI in previous 24 hours • Major burns • Renal failure or solitary kidney

Dosage	• Adults
	  • 30 - 60 mg IM/IV q 4 – 6 h max 120 mg/day
	• Pediatrics >6 months
	  • 0.5 mg/kg IM/IV q 4 – 6 h, max 30 mg/dose and 0.5 mg/kg/day

NSAIDs (Ibuprofen and Ketoralac)

Side Effects	• N/V/D
	• Heartburn
	• Dyspepsia
	• Edema
	• Severe side effects
	  • GI ulceration
	  • GI bleeding
	  • Increase liver enzymes, which can lead to complications
	  • Kidney issues – increase BP – induce heart failure
	  • Exacerbate cardiovascular disease
	  • Bronchospasm in asthmatics

Why is Ketorolac Special?

- Predominantly given via parenteral routes
  - Only NSAID to be given by parenteral route
  - Thus used for more significant pain than PO NSAID
    - Short term use
- Another parenteral option other than opiates
  - When used with an opioid, it may decrease the opioid requirement by 25 – 50%
- Toxicities similar to other NSAIDs

Acetaminophen (Tylenol)

Classification	• Analgesic, Anti-Pyretic
Mechanism of Action	• Inhibits prostaglandin synthesis which produces analgesic effect • Acts on hypothalamic heat regulating system
Indications	• Treatment of mild pain • Reduction of fever (due to infection)

Acetaminophen (Tylenol)

Contraindications	• Hypersensitivity • Liver disease • Major burns

Dosage	• Adult
	  • 500 – 1000 mg q 4 – 6 h prn PO
	• Pediatric
	  • 10 - 15 mg/kg q 4 - 6 h prn PO

Medications

- Do not be lulled into a false sense of security
  - "I can't believe we carry Tylenol and ibuprofen on the ambulance, a patient can easily go buy that stuff"
  - "Why are there so many contraindications with these over-the-counter drugs"

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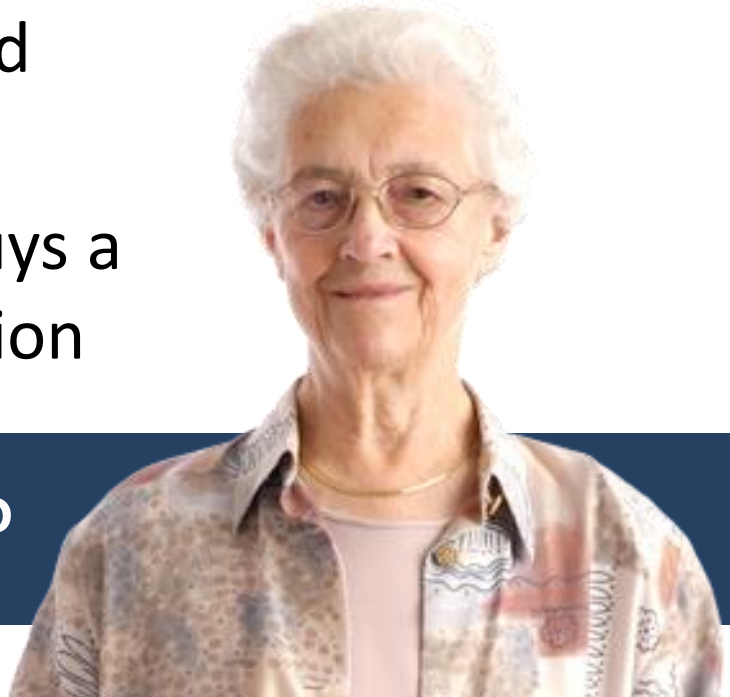
Acetaminophen vs Ibuprofen

	Acetaminophen	NSAIDs
Anti-inflammatory	No	Yes
Analgesic	Yes	Yes
Anti-pyretic	Yes	Yes
Side effects	Very few, sometimes people get a rash, some nausea	Many
Issues in people with?	Liver problems, alcoholism	Liver, kidney, GI, Heart problems
Drug interactions	Few	More than a few… BP meds, lithium

Acetaminophen

- Consider the following situation:
  - You respond for a 68 y/o F with chronic arthritis that is taking 3 - 4 extra strength Tylenol a day because “My doctor said I can’t take those NSAID things because of my heart and stomach ulcer”
  - Patient develops a cold and buys a off the shelf anti-cold medication



So what is the big deal?

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Products containing Acetaminophen

Nitrous Oxide (Nitronox)

Classification	• Analgesic Gas
Mechanism of Action	• Blended mixture of 50% O_2 and 50% N_2O that has potent analgesic effects • CNS depressant with analgesic properties • Effects last only 2 - 5 minutes after administration ceases
Indications	• Acute pain associated with MSK injury, ACS, Renal colic, perinatal, burns and ABD pain • Temporary relief of mild to moderate pain from painful procedures (splinting, etc) • Acute anxiety

Nitrous Oxide (Nitronox)

Contraindications	• Patients that cannot comprehend verbal instructions or who are intoxicated
	• Gas trapping conditions
	  • Possible bowel obstruction
	  • Air embolism
	  • Pneumothorax
	  • Middle ear infection
	  • Decompression sickness
	• COPD or signs of respiratory distress including SaO_2 < 90%
	• Head injury
	• Altered mental status

Dosage	• Adults • Self-administered

Nitrous Oxide (Nitronox)

- Requires special delivery system
  - Nitrous oxide/oxygen cylinder
  - Nitrous oxide/oxygen mask and tubing
  - Administration valve

Opiates

- Opiates are a common prehospital medication used to treat moderate to severe pain.
- These medications reduce sensory transmission in pain pathways at the level of the dorsal root ganglion and spinal cord dorsal horn, which diminishes the effects of a painful stimulus.
- Medications that fall within this class include:
  - Morphine
  - Fentanyl (Sublimaze)
  - Hydromorphone (Dilaudid)

Opiate Receptors

- Endogenous/Exogenous opiates at

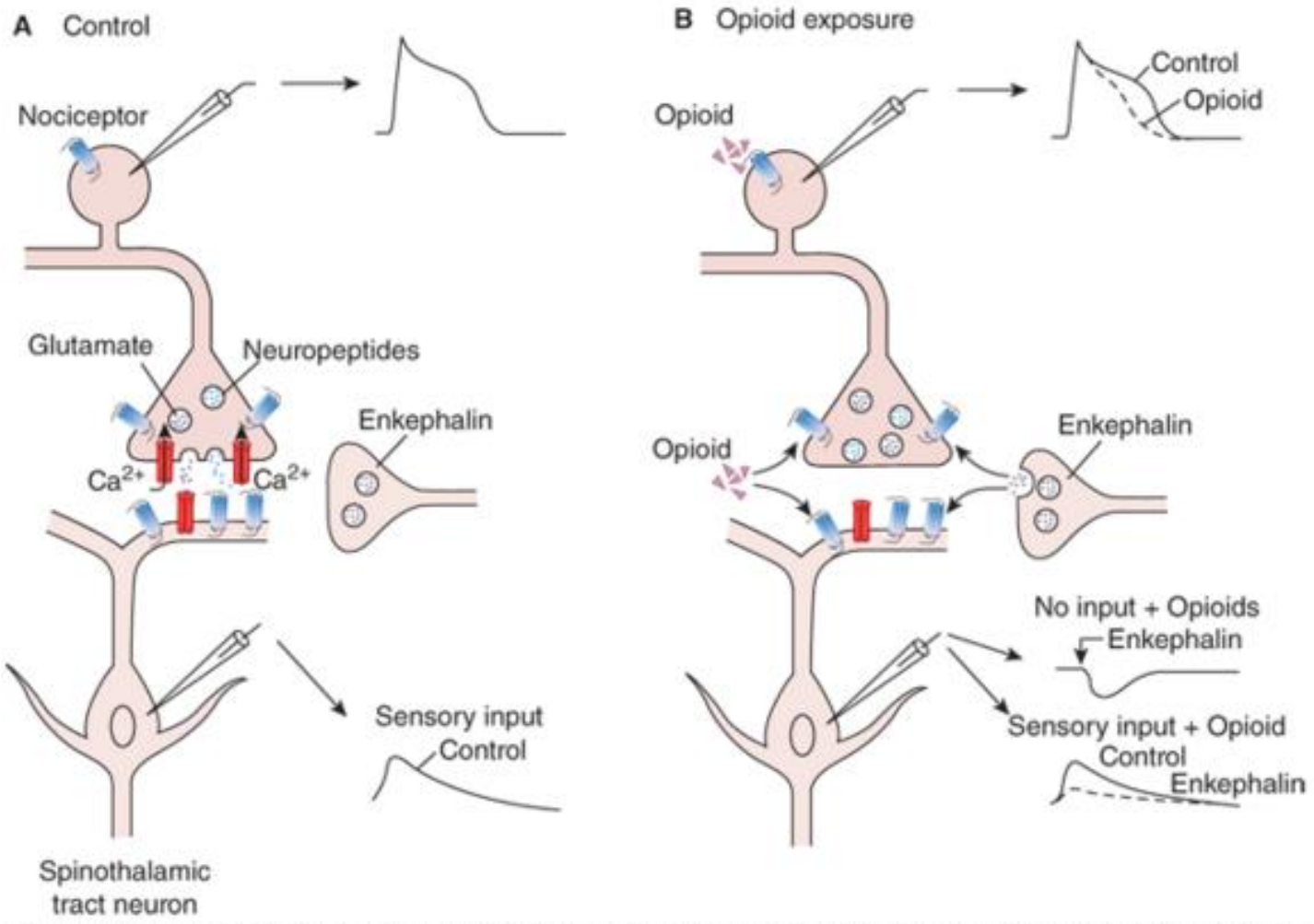
Receptor	Endogenous Chemical mediator
Mu	Endomorphin
Kappa	Enkephalin
Delta	Dynorphin

Receptor	Exogenous Drug
Mu	Heroin, morphine, codeine
Kappa	Buprenoprhine
Delta	Diphenorphine

Nalaxone is an antagonist for all Receptor subtypes

Acute vs chronic

Pathophysiology: Receptor



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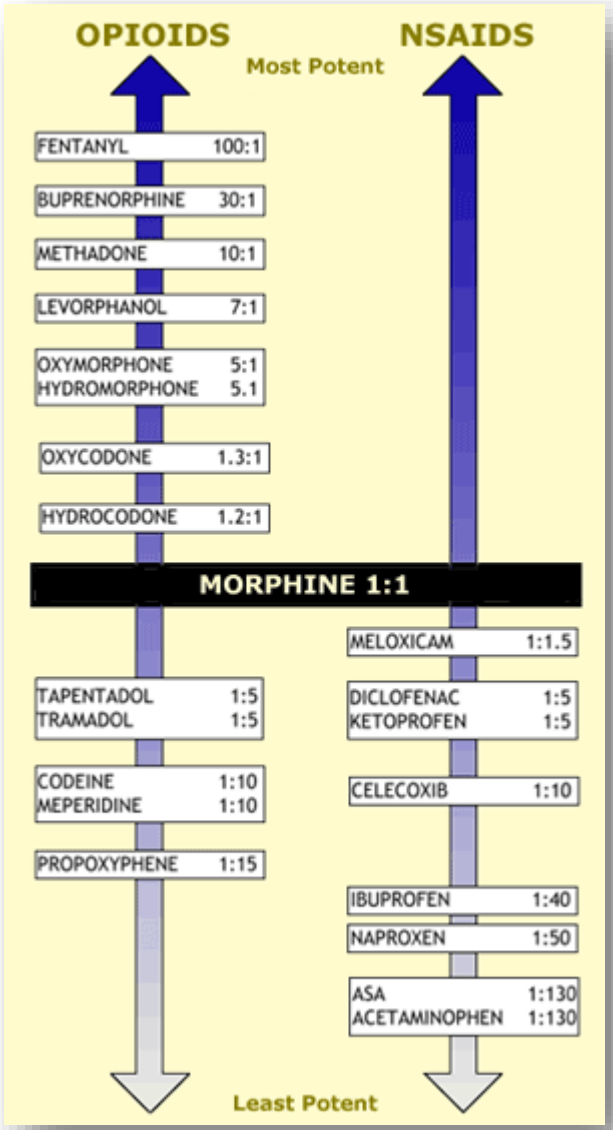
Opiate potency



Drug	Parenteral Dosage (mg)	Enteral Dosage (mg)
Morphine	10	30
Codeine	130	200
Oxycodone	15	30
Hydromorphone	1.5	7.5
Methadone	10	300
Meperidine	75	300
Fentanyl	0.1	---

Opiates

- Side Effects:
  - Sedation
  - Nausea and vomiting
  - Constipation
  - Respiratory depression
  - Delirium
  - Dry mouth
- Tolerance will develop to all the above side effects
  - Except Constipation

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Pain Management

	Hyperacute	Acute	Subacute	Chronic
Mild	*Ex: Starting IV* • NPPM	*Ex: Sprained Ankle* • NPPM • Ibuprofen +/- Acetaminophen	*Ex: Back Strain* • NPPM • Ibuprofen +/- Acetaminophen	*Ex: Arthritis* • NPPM • Ibuprofen +/- Acetaminophen
Moderate	*Ex: Splinting #* • Narcotic	*Ex: ABD Pain* • Narcotic +/- Non-narcotic	*Ex: Shingles* • NPPM • Encourage pt to take their own analgesic medications	*Ex: Crohn's* • NPPM • Encourage pt to take their own analgesic medications
Severe	*Ex: Cardioversion* • Narcotic	*Ex: Renal Colic* • Narcotic +/- NSAID	*Ex: Back pain* • Narcotic	*Ex: Palliative pt* • Narcotic

Scenario 02

- During an interfacility transfer you and your PCP partner are transferring an 88 y/o pt with a fractured hip. She was given 10 mg total of IV morphine earlier by the sending facility and was given another 10 mg prior to transport for comfort.
- The patient was resting initially but is now awake and muttering “I won’t let Chuck Norris take me” and seems to be getting quite agitated.

Scenario 03

- You respond to a 18 y/o F patient living at a university residence who recently had dental surgery and was prescribed codeine for the pain
  - "My pain has gone from a 10 to an 11, this stupid drug has not done a thing"