

Opioid Sparing Anesthesia

2/6/2021

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I have no actual or potential conflict of interest in relation to this presentation.

Objectives

- Define opioid sparing anesthesia
- Discuss pathophysiology of pain
- Discuss benefits of opioid sparing anesthesia
- Discuss medication regimens
- Brief overview of regional anesthesia

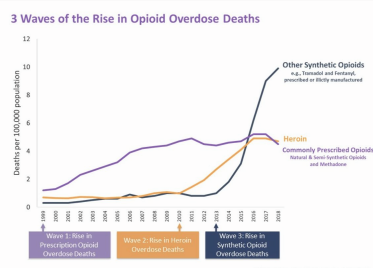
What is opioid sparing anesthesia?

- Goal of opioid sparing anesthesia (OSA) is to reduce negative impact of intraoperative opioid on patients' postoperative outcomes as well as the reduce negative effects of nociception effects intraoperatively.
- OSA is achieved through multimodal anesthesia
 - Balanced technique of different analgesics
 - Regional anesthesia
 - Reduction of adverse effects of each analgesic

(Beloeil, 2019)

Opioid Epidemic

- 1999-2018 450,000 people died from opioid overdose; prescribed and illicit
- CDC describes 3 waves of the opioid epidemic
 - Prescription opioids
 - Rise in heroin
 - Other synthetic opioids
- Perioperative opioids have been associated with the opioid crisis
- Specifically for Crow Wing county, from 1999-2018, death rate from overdose was 9.7%



(Beloeil, 2019, 2012 CDC, 2020, Manchikanti et al.,)

Table 1. Types of illicit drug use in the past month among persons aged 12 or older: Numbers in thousands, from 1999 to 2010.

| Drug | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 10-Year % change from 1999 to 2010 |
|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------------|
| Nonmedical Use of Psychotropic ^a | 2,477 ^b (1.7%) | 3,043 ^b (1.8%) | 3,849 ^b (1.7%) | 4,811 ^b (2.7%) | 6,287 ^b (2.7%) | 6,481 ^b (2.7%) | 6,493 ^b (2.7%) | 7,093 ^b (2.9%) | 6,860 ^b (2.8%) | 6,234 ^b (2.7%) | 6,967 ^b (2.8%) | 6,967 ^b (2.7%) | 181% |
| Pain Relievers | — | 2,621 ^b (1.2%) | 2,382 ^b (1.2%) | 3,497 ^b (1.6%) | 4,377 ^b (1.9%) | 4,484 ^b (1.9%) | 4,636 ^b (1.9%) | 5,220 ^b (2.1%) | 5,174 ^b (2.1%) | 4,747 ^b (2.0%) | 5,257 ^b (2.2%) | 5,100 ^b (2.0%) | NA |
| Crack/Cocaine ^c | — | — | — | — | 325 ^b (0.1%) | 334 ^b (0.1%) | 376 ^b (0.1%) | 369 ^b (0.1%) | 439 ^b (0.1%) | 439 ^b (0.1%) | 439 ^b (0.1%) | 439 ^b (0.1%) | NA |
| Transmogrifiers | 615 ^b (0.3%) | 1,097 ^b (0.5%) | 1,000 ^b (0.4%) | 1,358 ^b (0.6%) | 1,804 ^b (0.8%) | 1,830 ^b (0.8%) | 1,817 ^b (0.8%) | 1,796 ^b (0.7%) | 1,833 ^b (0.7%) | 1,800 ^b (0.7%) | 2,035 ^b (0.9%) | 2,100 ^b (0.9%) | 236% |
| Stimulants | 475 ^b (0.2%) | 930 ^b (0.4%) | 788 ^b (0.3%) | 1,014 ^b (0.5%) | 1,301 ^b (0.6%) | 1,310 ^b (0.6%) | 1,387 ^b (0.6%) | 1,580 ^b (0.6%) | 1,603 ^b (0.7%) | 1,603 ^b (0.7%) | 1,804 ^b (0.8%) | 1,804 ^b (0.8%) | 70% |
| Sedatives ^d | 310 ^b (0.1%) | 220 ^b (0.1%) | 177 ^b (0.1%) | 366 ^b (0.1%) | 430 ^b (0.2%) | 284 ^b (0.1%) | 261 ^b (0.1%) | 272 ^b (0.1%) | 365 ^b (0.1%) | 364 ^b (0.1%) | 234 ^b (0.1%) | 270 ^b (0.1%) | 78% |
| Marijuana and Heroin ^e | 11,016 ^b (5.0%) | 10,408 ^b (4.7%) | 10,714 ^b (4.8%) | 12,122 ^b (5.4%) | 14,584 ^b (6.5%) | 14,604 ^b (6.5%) | 14,626 ^b (6.5%) | 14,813 ^b (6.6%) | 14,448 ^b (6.4%) | 15,203 ^b (6.6%) | 16,718 ^b (7.5%) | 17,573 ^b (7.8%) | 88% |
| Cocaine | 1,730 ^b (0.8%) | 1,552 ^b (0.7%) | 1,213 ^b (0.5%) | 1,667 ^b (0.7%) | 2,020 ^b (0.9%) | 2,281 ^b (1.0%) | 2,297 ^b (1.0%) | 2,423 ^b (1.0%) | 2,405 ^b (1.0%) | 1,855 ^b (0.8%) | 1,627 ^b (0.7%) | 1,646 ^b (0.7%) | -16% |
| TOTAL ILLICIT ^f | 12,815 ^b (5.8%) | 12,249 ^b (5.5%) | 12,027 ^b (5.3%) | 13,684 ^b (6.0%) | 16,126 ^b (7.1%) | 16,426 ^b (7.2%) | 16,426 ^b (7.2%) | 17,207 ^b (7.3%) | 16,817 ^b (7.2%) | 16,077 ^b (7.0%) | 17,813 ^b (7.8%) | 17,813 ^b (7.8%) | 60% |

^aNon-steroidal anti-inflammatory drugs (NSAIDs) are included in the nonmedical use of psychotropic drugs category.

^bA difference between estimate and 2008 estimate is statistically significant at the 0.05 level. Difference between estimate and 2008 estimate is statistically significant at the 0.01 level.

^cCrack Cocaine includes crack cocaine (including crack), heroin, buprenorphine, suboxone, or prescription-type buprenorphine and suboxone.

^dOther Drugs include cocaine (including crack), heroin, buprenorphine, suboxone, or prescription-type buprenorphine and suboxone. The estimates for Nonmedical Use of Psychotropic Drugs, Stimulants, and Marijuana/Heroin are based on three separate estimates and do not include data from the nonmedical use of psychotropic drugs.

^eHeroin and Marijuana are included in the nonmedical use of psychotropic drugs category.

^fEstimates of Marijuana and Cocaine are based on three separate estimates and do not include data from nonmedical use of psychotropic drugs.

^gEstimates of Marijuana and Cocaine are based on three separate estimates and do not include data from nonmedical use of psychotropic drugs.

^hEstimates of Marijuana and Cocaine are based on three separate estimates and do not include data from nonmedical use of psychotropic drugs.

ⁱEstimates of Marijuana and Cocaine are based on three separate estimates and do not include data from nonmedical use of psychotropic drugs.

^jEstimates of Marijuana and Cocaine are based on three separate estimates and do not include data from nonmedical use of psychotropic drugs.

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(Manchikanti, 2012)

What is pain? What is nociception?

Pain- Conscious, unpleasant perception of noxious stimulus potential or actual tissue damage

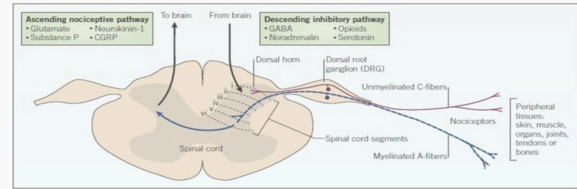
- Complex
- Dynamic
- Emotional

Perception is reality

Nociception- nervous system response to noxious stimulation of receptors by mediators

- Inflammatory Mediators: serotonin, norepinephrine, enkephalin, histamine, and peptides

(Answine, 2018, Beloeil, 2019).

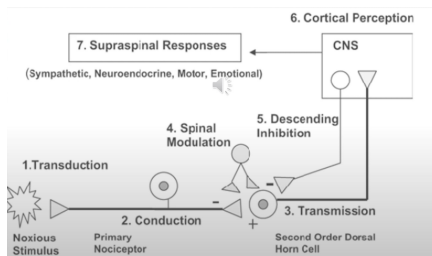


Pain pathways: the review

(Baribeault, 2020)

Pain Pathway

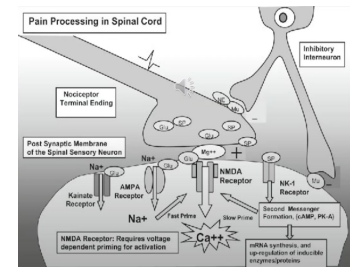
Transduction
Transmission
Modulation
Perception



(Answine, 2018, Baribeault, 2020)

Receptor overview

- Sodium Channels
- NMDA receptor
 - Magnesium and glutamate
- AMPA
 - glutamate
- Mu
- Calcium
 - Role in pain transmission is to support the initiation of an action potential



(Answine, 2018, Baribeault, 2020)

Opioid mechanism of action

Opioid receptors located primarily in the brain and spinal cord regions

- transmission and modulation of pain.

Primarily act on mu, kappa and delta

- Enhance outflow in the descending pathways
- Directly inhibit transmission at the dorsal horn
- Also interact with peripheral opioid receptors

| Effect | Mu ₁ | Mu ₂ | Kappa | Delta |
|--------|--|--|---|---|
| | <ul style="list-style-type: none"> -Analgesia -Euphoria -Low abuse potential -Miosis -Bradycardia -Hypothermia -Urinary retention | <ul style="list-style-type: none"> -Analgesia -Depression of ventilation -Physical dependence -Constipation (marked) | <ul style="list-style-type: none"> -Analgesia -Dysphoria -Sedation -Low abuse potential -Miosis -Diuresis | <ul style="list-style-type: none"> -Analgesia -Depression of ventilation -Physical dependence -Constipation (minimal) |

(Kern, 2018)

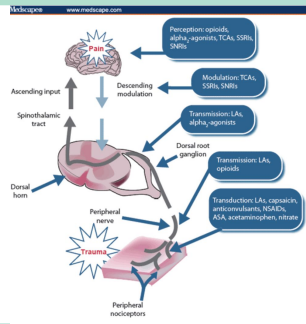
Benefits of OSA

- Elimination of opioids or reduction of opioid use results in a reduction of adverse effects.
 - Adverse effects such as, respiratory depression, airway obstruction, hyperalgesia, opioid tolerance, addiction, dependence, PONV, puritis, constipation and ileus, urinary retention, immune retention
- Supports hemodynamic stability
- Aids in post operative pain management
- Reduces wind up pain pathway activation

(Baribeault, 2020)

Medications used in OSA

NMDA antagonists (lidocaine, ketamine, magnesium sulfate)
Sodium channel blockers (Local anesthetics (LA))
Anti-inflammatory drugs (NSAID, dexamethasone, LA)
Alpha-2 agonists (dexmedetomidine, clonidine)



(Medscape, 2020)

OSA medications

- **Lidocaine:** blocks sodium channels
 - inhibits actions by peripheral neurons that are excited by nociceptive stimuli.
 - Blocks NMDA receptors.
 - Anti-inflammatory
 - **Ketamine:** antagonizes NMDA receptors.
 - Prevents post-operative hyperalgesia.
 - CV stability
 - Increased secretions
- Subhypnotic dosing reduces risk of emergence delirium
- Risk factors for delirium: increased age, female, >2mg/kg, psychiatric hx

(Beloel, 2019)

OSA medications

Magnesium Sulfate:
antagonizes NMDA receptors.
CV stability
Bronchodilator
Reduce post operative shivering

Anti-inflammatories:
(glucocorticoid) reduce pro-inflammatory genes and increase anti-inflammatory
reduces PONV
(Acetaminophen) cox 3 inhibitor, provides anti-inflammatory effects
Analgesia

(Beloel, 2019)

OSA medications

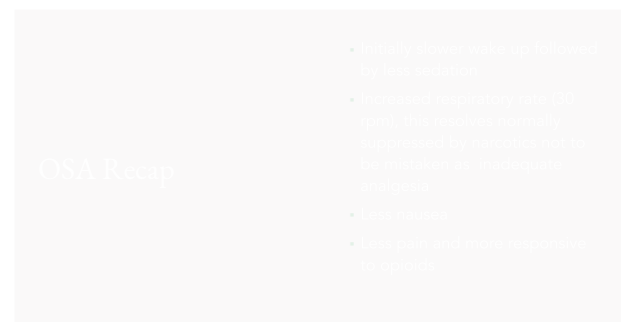
- **Esmolol-** selective beta 1 blocker
 - appears to reduce hyperalgesia however studies not fully delineated
- **Dexmedetomidine:** alpha 2a agonist
 - sedation, hypnosis, anxiolysis
 - sympatholysis
 - reduce shivering
 - inhibits substance P
 - Analgesia
 - No respiratory depression
- **Lyrica and neuronitn (gabapentinoids)-** reduces release of calcium and excitatory mediators

(Beloel, 2019)

Opioids

Oxycodone: binds to mu receptors
Immediate action (10-15 mins), peak 0.5-1 hr, duration 3-6 hrs

• **Tramadol:** binds to mu receptor, inhibits NE and serotonin re-uptake
Avoid with patients with seizure history (increased risk with SSRI, SNRI, TCAs, MAOIs)
Onset 45min-1hr, duration 6 hours
Avoid with breastfeeding moms and children



Questions: OSA

References

Answine, J. (2018). A Basic Review of Pain Pathways and Analgesia: Pain and the Brain. *Anesthesiology News*

Baribeault, T. (2020). Introduction to Opioid-Free Anesthesia. Presentation

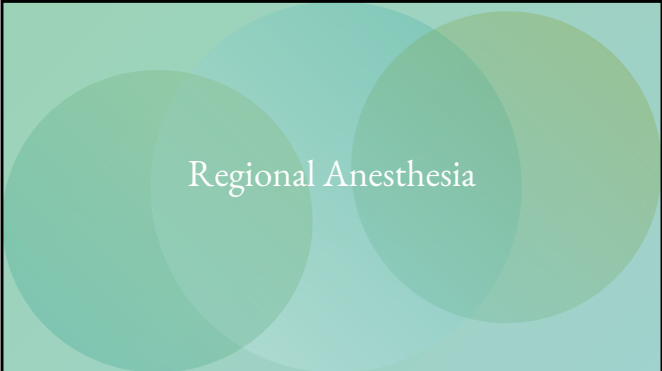
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Manchikanti, L., Helm II, S., Fellows, B., Janata, J. W., Pampati, V., Grider, J. S., & Boswell, M. V. (2012). Opioid Epidemic in the United States. *Pain Physician*, 15.

Medscape (2020). Acute Pain Management in the Opioid-Tolerant Individual. Retrieved from: <https://www.medscape.org/viewarticle/581948>

The background of the slide features three large, overlapping circles in various shades of teal and green. The circles are semi-transparent, creating a layered effect. The text 'Regional Anesthesia' is centered in the middle of the slide in a white, serif font.

Regional Anesthesia

Benefits

- Improved pain management
- Decreased opioid use
- Reduced stress response
- Potential decrease in cancer spread
- Increased patient satisfaction

A cartoon illustration of two doctors in white coats. The doctor on the left is holding a clipboard and pen, asking a question. The doctor on the right is sitting down, looking thoughtful. Speech bubbles contain their dialogue.

Local anesthetics mechanism of action

- Voltage gated sodium channel
 - Channel is maintained by ability to maintain a sodium gradient
- Non-ionized form of the local is allowed to pass through the membrane
 - Once inside the cell, the local ionizes and subsequently de-activates sodium channel by slowing the rate of depolarization
- Keys to local function: hydrophobicity, protein binding and pKa

The diagram shows a cross-section of a cell membrane separating the Epithelium (top) from the Neuronal Membrane (bottom). In the Epithelium, a syringe injects local anesthetic (LA). The LA is shown in two states: a non-ionized form (LAH+) and an ionized form (LA + H+). The non-ionized form passes through the Neuronal Membrane, which contains voltage-gated sodium channels (Na+). Once inside the cell, the LA ionizes (LAH+ + H+), and the ionized form binds to the sodium channel, blocking it and preventing the flow of Na+ ions. This process is labeled as 'Depolarization'.

(Kline, 2020)

[illegible]

LA Classes

Ester

- Quickly metabolized in the blood
- Higher risk for allergic reaction due to PABA metabolites

Amides

- Metabolized by the liver

| | Classification | Potency | Onset | Duration after Infiltration (min) | Maximum Single Dose for Infiltration (adult, mg) |
|---------------|----------------|---------|-------|-----------------------------------|--|
| Esters | | | | | |
| | Procaine | 1 | Slow | 45-60 | 500 |
| | Chlorprocaine | 4 | Rapid | 30-45 | 600 |
| | Tetracaine | 16 | Slow | 60-180 | 100 (topical) |
| Amides | | | | | |
| | Lidocaine | 1 | Rapid | 60-120 | 300 |
| | Mepivacaine | 1 | Slow | 90-180 | 300 |
| | Bupivacaine | 4 | Slow | 240-480 | 175 |
| | Etidocaine | 4 | Slow | 240-480 | 300 |
| | Prilocaine | 1 | Slow | 60-120 | 400 |
| | Ropivacaine | 4 | Slow | 240-480 | 200 |

(Kern, 2018)

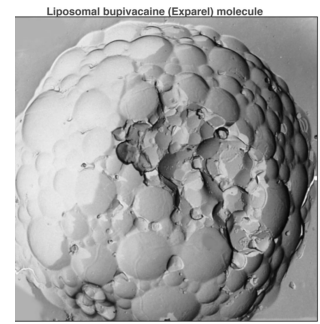
Exparel

Marcaine is encapsulated by 3 layers of microspheres

Delayed release of Marcaine, prolonged duration of block

Onset is roughly 1 hour

Sensory blockade, not motor blockade



(Kline, 2020)

Nerve stimulator basics

- Purpose is to ensure needle is not placed intraneural
- Stimulator should be set from 0.2 mA to 1mA
- Strong nerve twitch should be lost at less than 0.4 mA

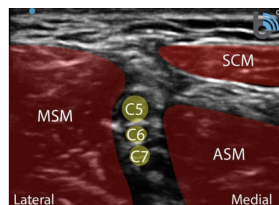
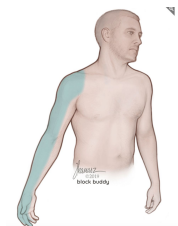


(Kline, 2020)

Upper Extremity Blocks

Interscalene

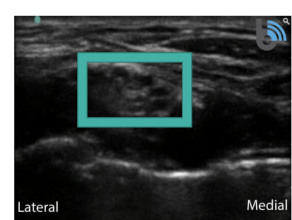
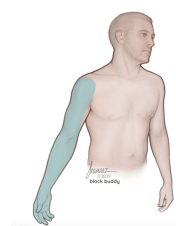
- Indications: shoulder and upper arm surgery
- Phrenic nerve involvement possible
- Horners syndrome



(Molter & Urigel, 2021)

Supraclavicular

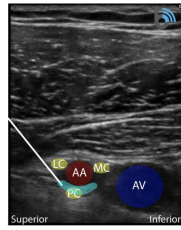
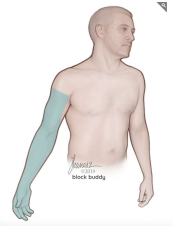
- Indications: lower arm surgery
- Decreased risk of phrenic nerve involvement and horns syndrome



(Molter & Urigel, 2021)

Infraclavicular

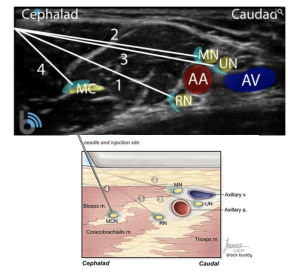
- Indications: lower arm surgery
- Misses intercostalbrachial nerve
- Potential risk of pneumothorax



(Molter & Urigel, 2021)

Axillary

- Indications: lower arm surgery

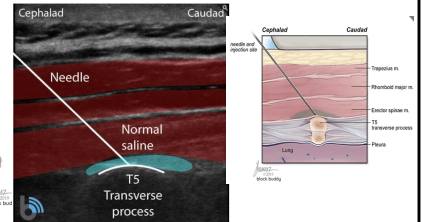
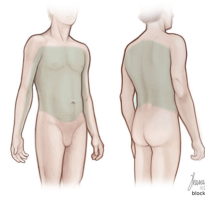


(Molter & Urigel, 2021)

Truncal Blocks

Erector Spinae (ESP)

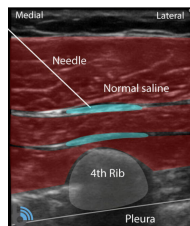
- Indications: large breast surgeries, belly cases
- Somatic and visceral coverage



(Molter & Urigel, 2021)

PECS I and II

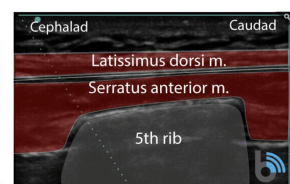
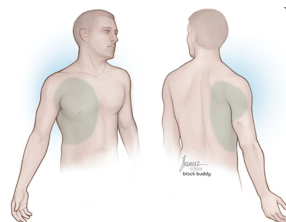
- Indications: breast surgery
- Doesn't reliably cover axilla



(Molter & Urigel, 2021)

Serratus plane

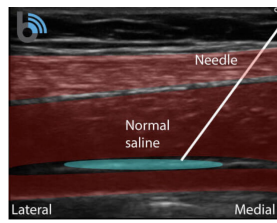
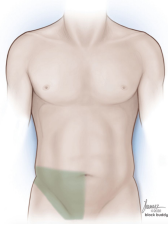
- Indications: breast surgery
- Provides axillary coverage



(Molter & Urigel, 2021)

TAP

- Indications: abdominal surgery, c-sections
- Generally done bilaterally

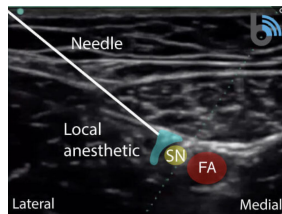
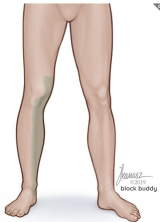


(Molter & Urigel, 2021)

Lower Extremity Blocks

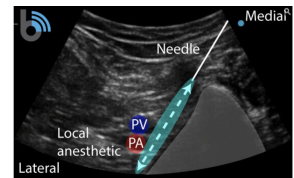
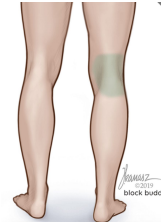
Adductor Canal

- Indications: adjunct with other blocks
- Covers medial aspect of leg



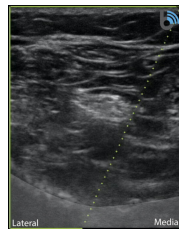
IPACK

- Indications: adjunct in knee surgery



Popliteal

- Indications: lower leg surgery
- Provides lateral coverage



Questions: Regional Anesthesia

References

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