



Opioid Sparing Anesthesia

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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

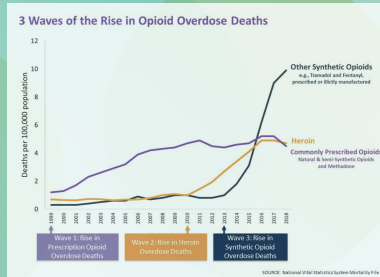
What is opioid sparing anesthesia?

- 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 1998 to 2010.

Drugs	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	12-Year % change from 1998 to 2010
Nonmedical Use of Prescription Drugs*	2,477	3,991	3,849	4,811	6,287	6,451	6,110	6,491	7,090	6,809	6,224	5,953	6,967	181%
Pain Relievers	—	2,621	2,782	3,497	4,377	4,693	4,454	4,618	5,220	5,174	4,747	5,207	5,109	NA
City/County†	—	—	—	—	—	321	334	278	309	338	319	361	361	—
Tranquilizers	655	1,097	1,060	1,358	1,804	1,830	1,616	1,817	1,566	1,432	1,360	1,010	1,360	260%
Stimulants	451	850	764	1,018	1,269	1,310	1,317	1,348	1,361	1,293	994	1,296	1,077	70%
Sedatives*	210	229	175	306	430	294	265	272	345	346	234	270	274	76%
Marijuana and Heroin	11,014	10,438	10,714	12,127	14,584	14,608	14,276	14,626	14,813	14,448	15,283	16,718	17,573	68%
Concaine	1,730	1,552	1,213	1,667	2,020	2,281	2,021	2,297	2,421	2,075	1,855	1,637	1,466	16%
Total	14,412	18,440	18,000	21,042	26,002	26,486	25,181	26,201	26,402	26,002	24,017	22,823	26,440	86%

* Data available from 2002 to 2008 are based on 2008 National Survey on Drug Use and Health Survey Report. A difference-between estimate and 2008 estimate is statistically significant at the 5.0% level. Difference between estimate and 2008 estimate is statistically significant at the 5.0% level.
 † Illicit Drug Use Other than Marijuana/Heroin, Cocaine (including crack), heroin, hallucinogens, inhalants, or prescription-type psychotherapeutics used nonmedically. Illicit Drug Use Other than Marijuana/Heroin, Cocaine (including crack), heroin, hallucinogens, inhalants, or prescription-type psychotherapeutics used nonmedically. The estimates for Nonmedical Use of Psychotherapeutics, Stimulants, and Marijuana/Heroin incorporated in these summary estimates do not include data from the northern-plains states added in 2004 and 2006.
 * Nonmedical use of prescription-type psychotherapeutics includes the nonmedical use of pain relievers, tranquilizers, stimulants, or sedatives and does not include over-the-counter drugs.
 † Estimates of cocaine use, Use of psychotherapeutics, Stimulants, and Marijuana/Heroin in the designated rows include data from nonplanning states added in 2003 and 2006 and are not comparable with estimates presented in NIDA/NIJ reports prior to the 2007 National Findings report. For the 2002 through 2009 survey years, a Research Institute procedure was used to generate estimates comparable with estimates for survey years 2008 and later.
 Source: SAMHSA, Office of Applied Studies, National Survey on Drug Use and Health, 1998–2010.
 www.samhsa.gov/data/2k4/NSDUH/2k4NSDUH2k4Results.pdf (1709 Access date 2/22/2012)

(Manchikanti, 2012)

What is pain?

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

- Complex
- Dynamic
- Emotional

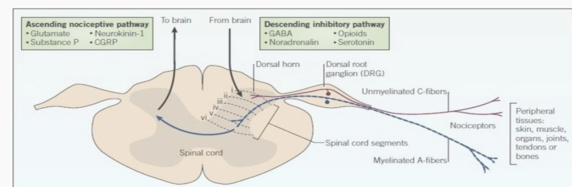
Perception is reality

What is nociception?

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

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

(Answine, 2018, Beloeil, 2019).

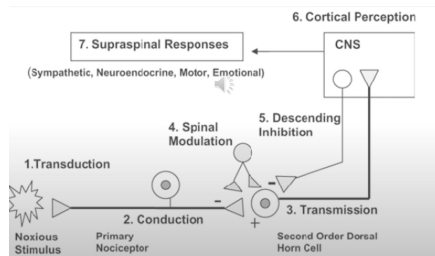


http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2810884/figure/fig1/

(Baribeault, 2020)

Pain Pathway

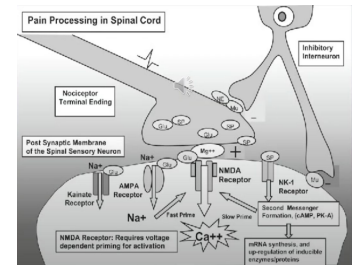
Transduction
Transmission
Modulation
Perception



(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	Mu	Kappa	Delta
	-Analgesia -Euphoria -Low abuse potential -Miosis -Bradycardia -Hypothermia -Urinary retention	-Analgesia -Depression of ventilation -Physical dependence -Constipation (marked)	-Analgesia -Dysphoria -Sedation -Low abuse potential -Miosis -Diuresis	-Analgesia -Depression of ventilation -Physical dependence -Constipation (minimal)

(Kern,2018)

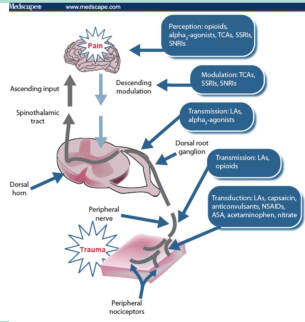
Benefits of OSA

- 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, 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

(Beloeil, 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

(Beloeil, 2019)

OSA medications

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

(Beloeil, 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

OSA Resp

- Use with caution with opioid analgesics
- Avoid with benzodiazepines and other sedatives
- Avoid with alcohol and other CNS depressants
- Avoid with MAOIs
- Avoid with SSRIs
- Avoid with TCAs

Questions: OSA

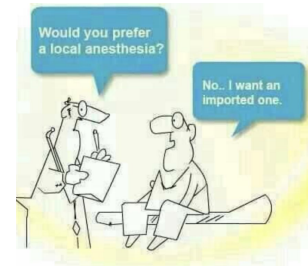
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Regional Anesthesia

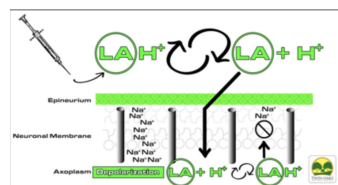
Benefits

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



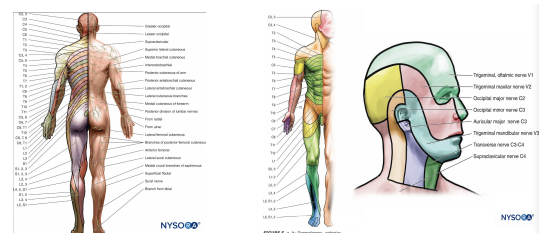
Local anesthetics mechanism of action

- 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



(Kline, 2020)

Dermatomes



(NYSORA, 2020)

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)

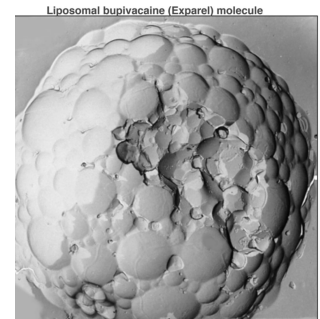
Exparel

Maracaine is encapsulated by 3 layers of microspheres

Delayed release of Maracaine, prolonged duration of block

Onset is roughly 1 hour

Sensory blockade, not motor blockade



(Kline, 2020)

Nerve stimulator basics

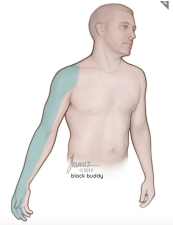
- Purpose is to ensure needle is not placed intraneural
- Stimulator should be set from 0.2 mA to 1mA
- Strong nerve twitch should be lost at less than 0.4 mA



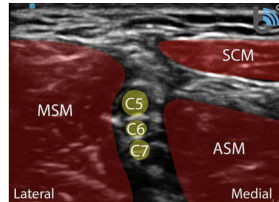
(Kline, 2020)

Upper Extremity Blocks

Interscalene



- Indications: shoulder and upper arm surgery
- Phrenic nerve involvement possible
- Horner's syndrome

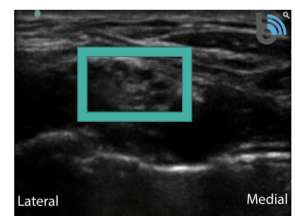


(Molter & Urigel, 2021)

Supraclavicular



- Indications: lower arm surgery
- Decreased risk of phrenic nerve involvement and horner's syndrome

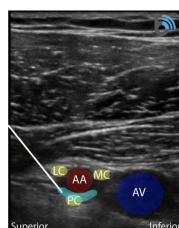


(Molter & Urigel, 2021)

Infracavicular

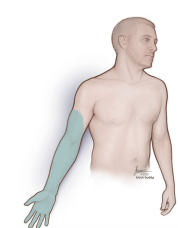


- Indications: lower arm surgery
- Misses intercostalbrachial nerve
- Potential risk of pneumothorax

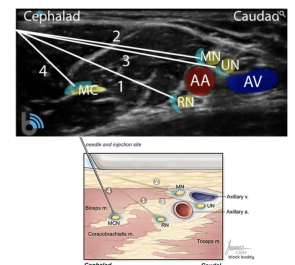


(Molter & Urigel, 2021)

Axillary



- Indications: lower arm surgery

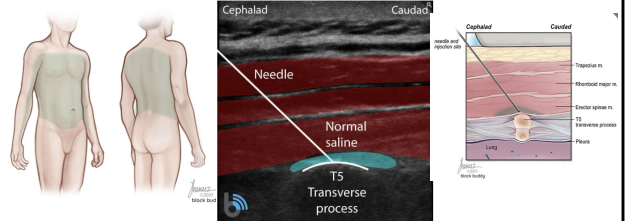


(Molter & Urigel, 2021)

Truncal Blocks

Erector Spinae (ESP)

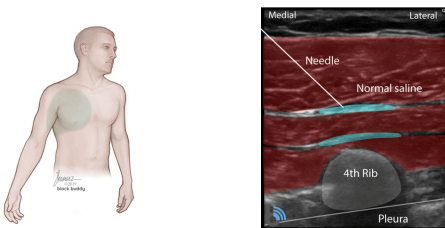
- Indications: large breast surgeries, belly cases
- Somatic and visceral coverage



(Molter & Urigel, 2021)

PECS I and II

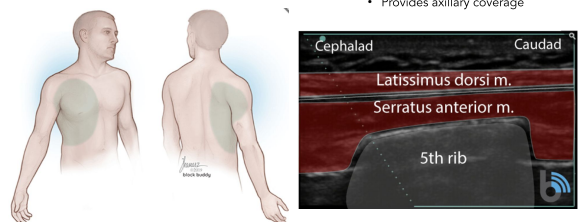
- Indications: breast surgery
- Doesn't reliably cover axilla



(Molter & Urigel, 2021)

Serratus plane

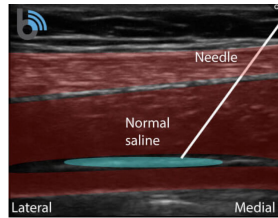
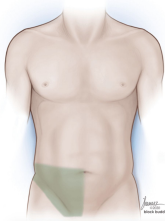
- Indications: breast surgery
- Provides axillary coverage



(Molter & Urigel, 2021)

TAP

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

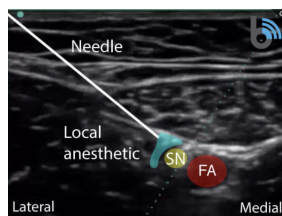
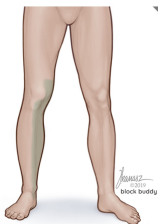


(Molter & Urigel, 2021)

Lower Extremity Blocks

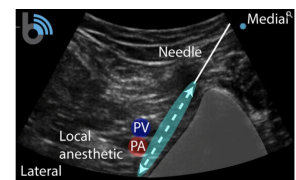
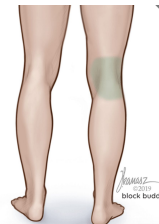
Adductor Canal

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



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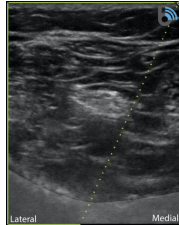
- Indications: adjunct in knee surgery



Popliteal



- Indications: lower leg surgery
- Provides lateral coverage



Questions: Regional Anesthesia

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