



Around the Block with Post-Op Pain Management

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Objectives

- Participants are able to identify key components of accurately caring for patients with an epidural, peripheral nerve catheter, and/or status post a spinal block.
- Participants are able to identify 3 potential adjuvants/multimodal options for the treatment of post-operative pain.
- Participants are able to identify mechanism of action, indications, appropriate dosing, and potential side effects of ketamine and lidocaine infusions.

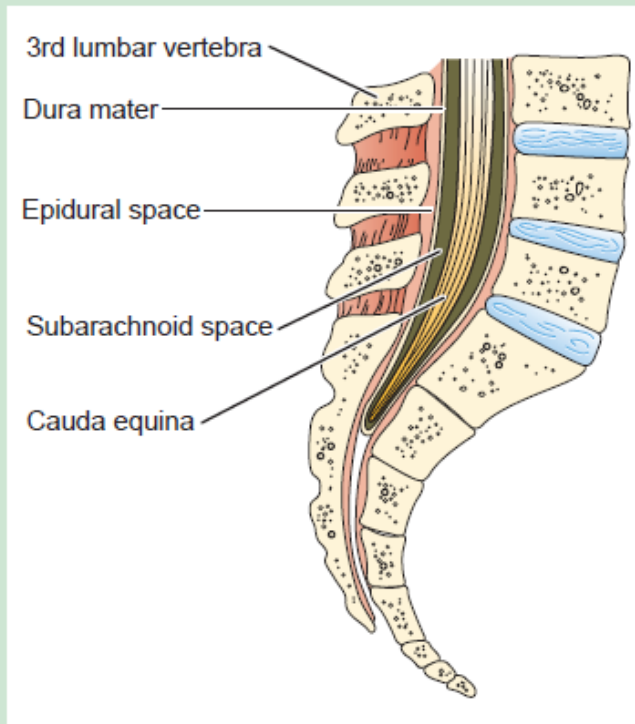


Epidural Catheters

WHAT IS AN EPIDURAL?

- Epidural space is the empty area posterior to the spinal cord.
- Medications administered to the epidural space absorb into the CSF for effect.
- Either a single injection or an indwelling catheter can be used to dose the epidural space.

Picturing the epidural space





Why Use An Epidural?

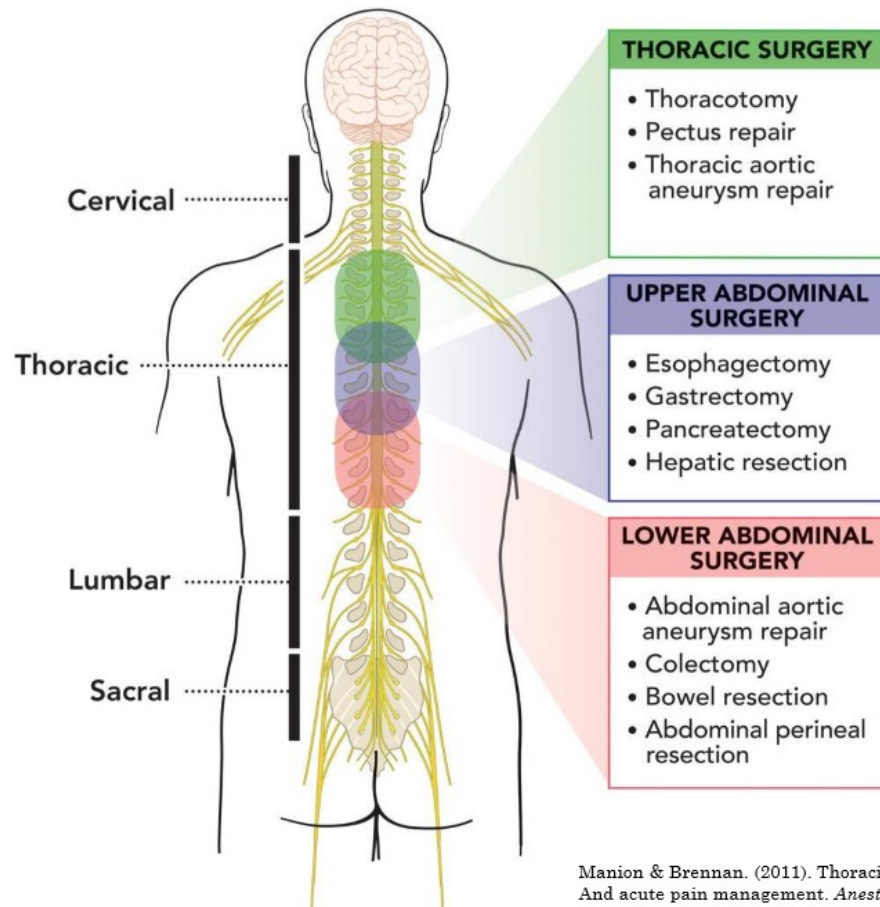
- An epidural is placed for the purpose of pain management.
- Allows the patient to receive an effective dose of medication while minimizing side effects.
- This means:
 - ✓ Limited systemic opioid effects
 - ✓ Less sedation
 - ✓ Patient is more likely to ambulate earlier
 - ✓ Patient is able to cough and deep breath more effectively



Where Is It And When Is Commonly Used?

- May be placed in the thoracic, lumbar or caudal regions
- Provide pain management for patients with medical, surgical or traumatic needs
- The placement of an epidural catheter procedure is done by anesthesia
- A signed informed consent must be completed
- Some examples include
 - Thoracic surgery
 - Rib fractures
 - Chest tubes
 - Abdominal surgery
 - Lower extremity amputation
 - Lower extremity orthopedic surgery

Placement



Manion & Brennan. (2011). Thoracic epidural analgesia And acute pain management. *Anesthesiology*, 115(1), 18.

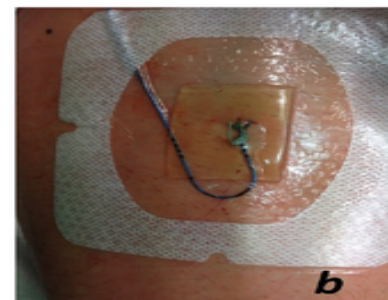
Epidural Dressings

A dressing is used for visualization of the site

- Assess for blood, oozing, or tenderness and document
- *A small amount of blood at the site is common*



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Now medication can be delivered...

Various medications may be infused via the epidural catheter, usually local analgesics and opioids. To provide a synergistic effects, the combination of these is utilized.

Local Anesthetic	Opioid	Additive
<i>Bupivacaine 0.0625</i>	Hydromorphone 10 mcg/ml	Clonidine 1 mcg/ml
Bupivacaine 0.125%	Hydromorphone 25 mcg/ml	
<i>Bupivacaine 0.25%</i>	Hydromorphone 50 mcg/ml	
Ropivacaine 0.2%	Fentanyl 2 mcg/ml	

Managing Pain Via Epidural: Continuous Infusion

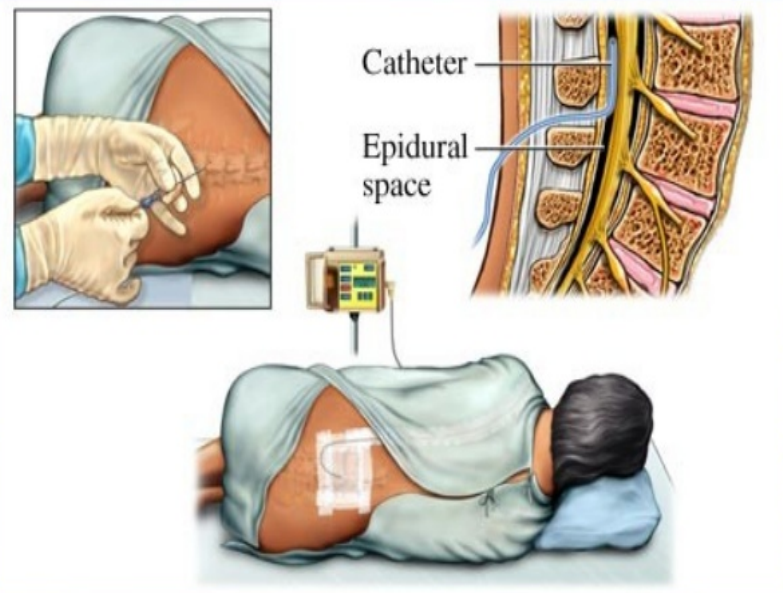
Provider Orders for continuous epidural infusion will include:

- Continuous rate
- PCEA (*optional*)
 - ☐ Patient bolus
 - ☐ Bolus frequency
 - ☐ 4 hour lockout



CADD Pump, W.Molasky

Continous Epidural



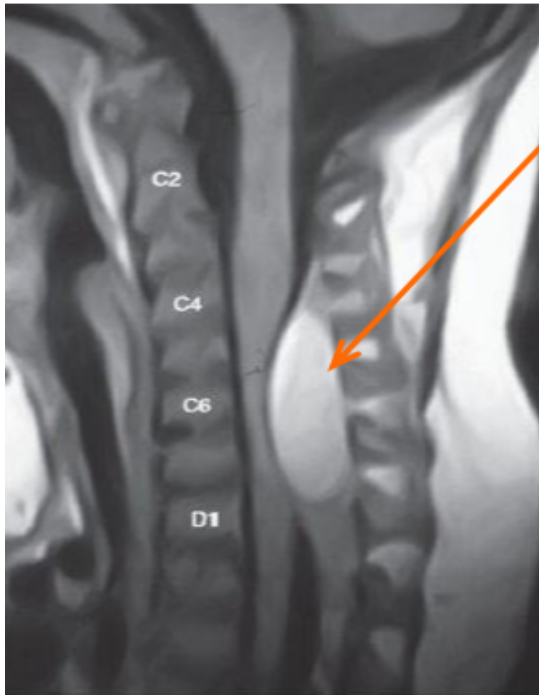
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Epidural Catheter - Anti-Coagulant Considerations

- Only SQ heparin and aspirin may be given to patients with an epidural catheter
- Use of a heparin infusion should be discussed by the primary team/anesthesia
- ***Use of ANY other anticoagulant is contraindicated for patients with epidural catheters due to the risk of an epidural hematoma***
- SQ heparin and heparin infusions will be stopped prior to epidural removal

EPIDURAL HEMATOMA



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- Cervical epidural hematoma (from trauma) with spinal cord compression
- Confirmed by MRI
- Corrected via emergency neurosurgery for evacuation of hematoma
- Reduce risk by:
 - Place/remove epidural with normal platelet count and coagulation (INR)
 - Heparin (SQ or IV) as ONLY approved anticoagulant while epidural in place
 - Close patient assessment while epidural in place



Peripheral Nerve (Regional) Catheters

Why Use A Peripheral Nerve (Regional) Catheter?

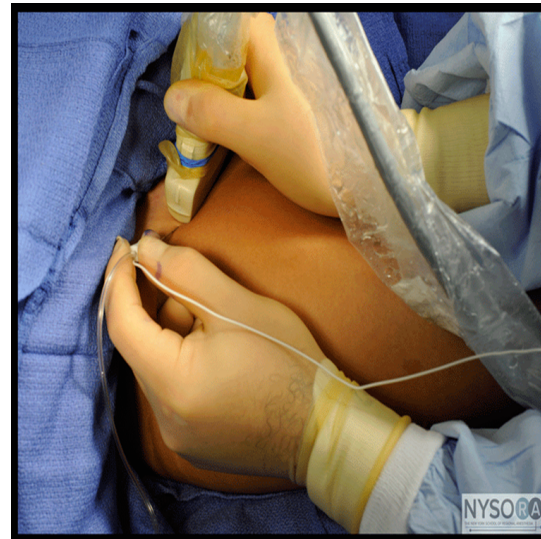
- Placed for the purpose of pain management.
 - Regional anesthesia during surgery
 - Post-operative management of pain
 - Management of pain in non-surgical patients
- Benefits
 - Reduction in use of general anesthesia
 - Part of multimodal approach for pain management
 - May lessen opioid consumption and side effects
 - Decreased incidence of myocardial ischemia events , respiratory depression, and DVT formation



Regional Catheter, W.Molasky

Placing The Catheter

- The peripheral nerve catheter is placed beside the nerve using ultrasound.
- Catheter placement is based on the where the pain is located or anticipated.
- The placement of a peripheral nerve (regional) catheter procedure is done by the anesthesiologist.
- A signed informed consent must be completed.



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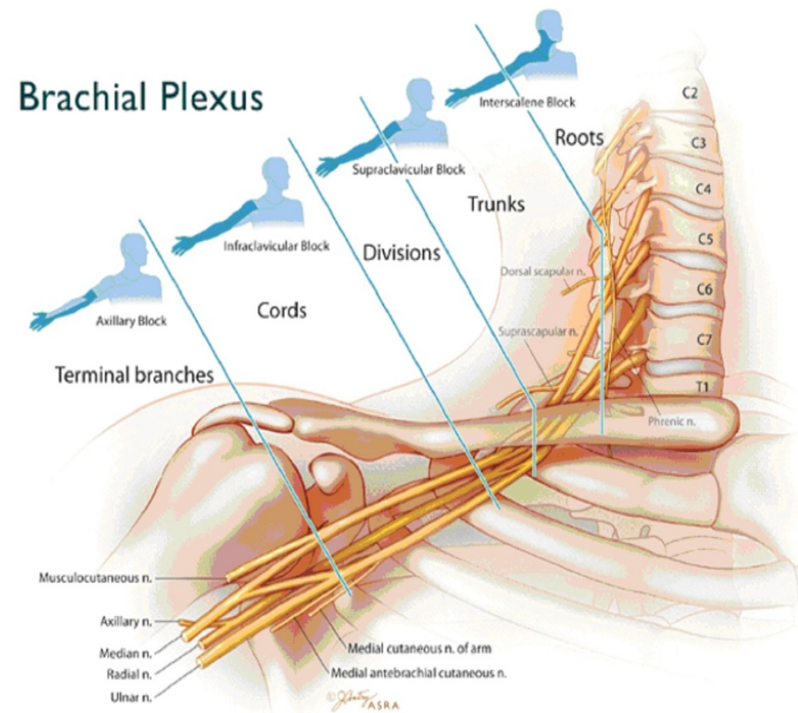
When is a peripheral nerve catheter used?

- Upper Extremity
 - Rotator cuff surgery
 - Elbow surgery
 - Finger amputation
 - Humerus surgery
 - Trauma
- Lower Extremity
 - Hip fracture
 - Lower extremity amputation
 - Total knee and ankle arthroplasty
 - External fixator
 - Trauma



Upper Extremity Nerve Catheters

- Upper extremity
 - Interscalene
 - Supraclavicular
 - Infraclavicular
- Patients with interscalene catheters should have head elevated at least 30 degrees due to potential phrenic nerve involvement

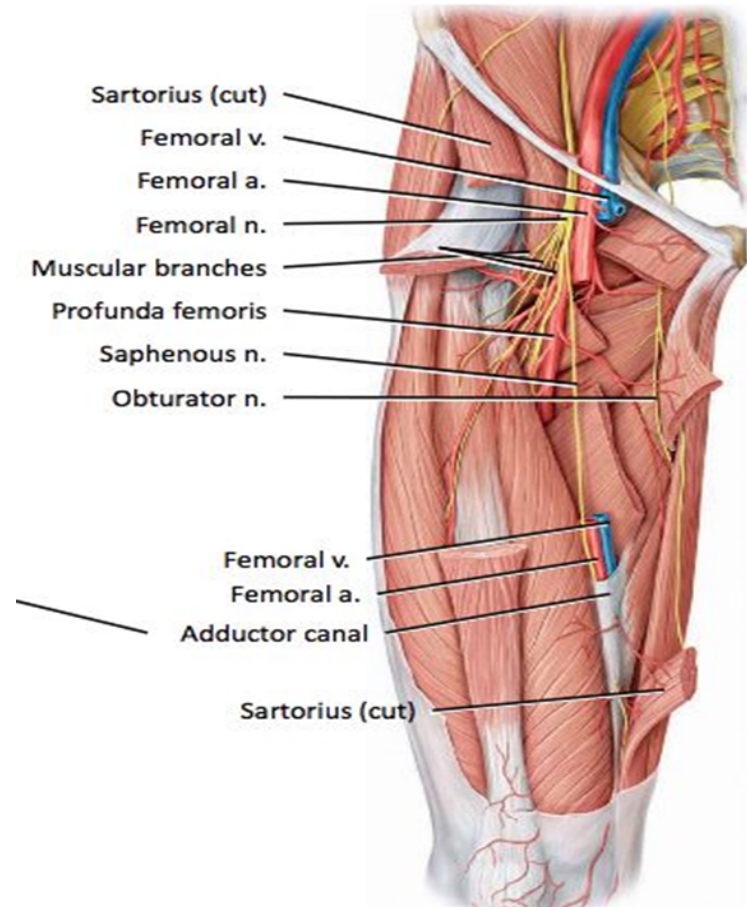


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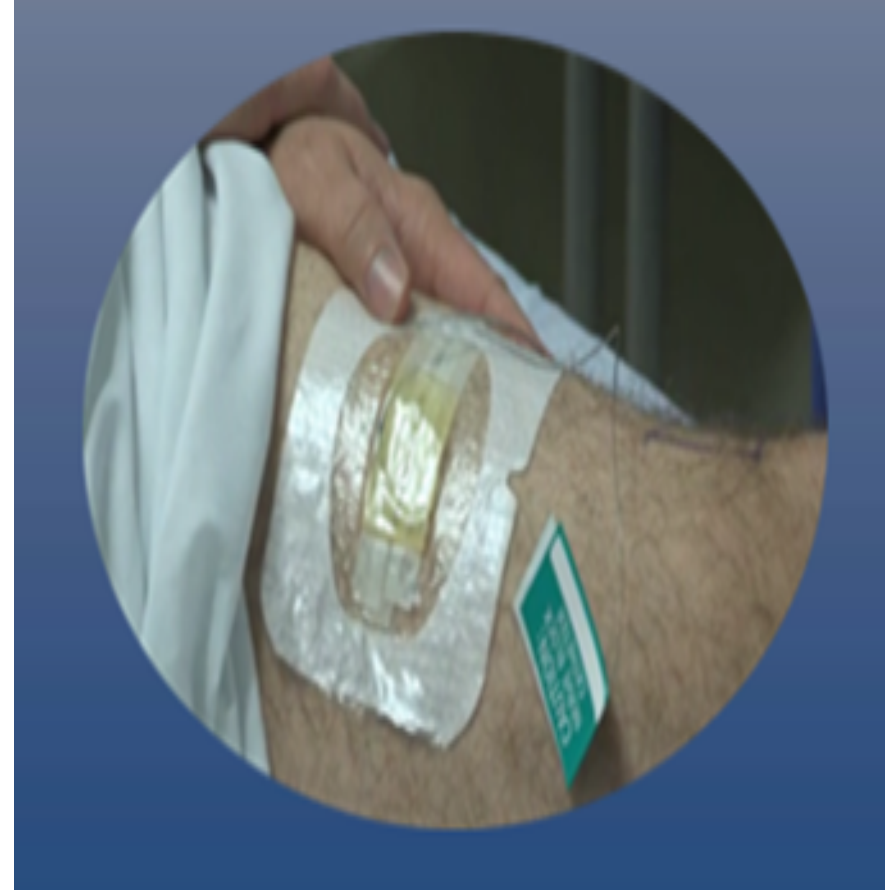
Lower Extremity Nerve Catheters

- Lower extremities
 - Femoral
 - Sciatic
 - Saphenous
 - Adductor canal
 - Popliteal



Catheter Site

- When the peripheral nerve catheter is placed it is bolused by the anesthesiologist and a dressing is applied.
- Assess the site for catheter presence, intact connections, blood, oozing, or tenderness and document your findings.



Peripheral Nerve Catheter, W.Molasky



Medications for Infusion. . .

The ONLY medication to be given via a **peripheral nerve catheter** is a local anesthetic.

Remember:

- All Peripheral Nerve (Regional) infusions include only medications that are preservative free.
- Preservatives would cause damage to the nerves.

Bupivacaine 0.125%

Or

Ropivacaine 0.2%



Administration of Medication

- Continuous Infusion
 - CADD (or equivalent) pump
 - On-Q pump
- Patient Controlled Bolus Dosing with A Continuous Infusion (PCRA)
 - Continuous rate plus a patient administered bolus dose option
- Continuous Infusion with Clinician Bolus
 - Continuous rate plus subsequent bolus doses provided per MD order
- Bolus Dosing without A Continuous Infusion (rare)



Infusion Devices



On-Q Pump

www.halyardhealth.com



CADD Solis Pump

www.smiths-medical.com



Peripheral Nerve Catheters and Anticoagulants

- Anticoagulants may be administered when a peripheral nerve (regional) catheter is in place.
- The placement of some catheters does limit the use of anticoagulants.
 - Sciatic
 - Lumbar plexus
- Check with provider if unsure

Remember.....

- Patients will require additional medications for pain
 - The peripheral nerve (regional) catheter is **part** of multi-modal therapy



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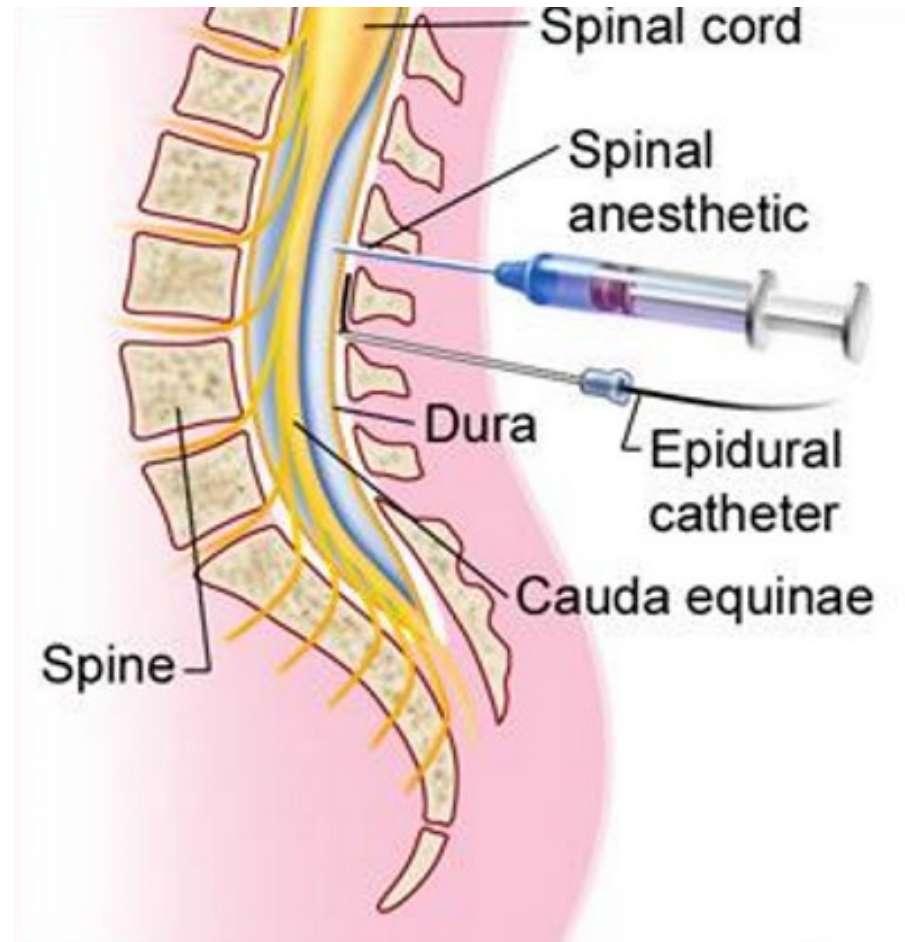
Spinal Blocks



Intrathecal (Spinal) Analgesia

- Administration of analgesic(s) into the subarachnoid space (called the intrathecal space in the caudal area of the spine)
 - Single injection
 - Relatively brief pain control
 - Indications: postoperative pain, procedural pain, and labor pain
 - Long-term administration
 - Extended pain control
 - Provided by an implanted intrathecal catheter and implanted refillable infusion device
 - Indications: chronic cancer pain and chronic nonmalignant pain

Spinal Anatomy





Assessment of the patient with a block



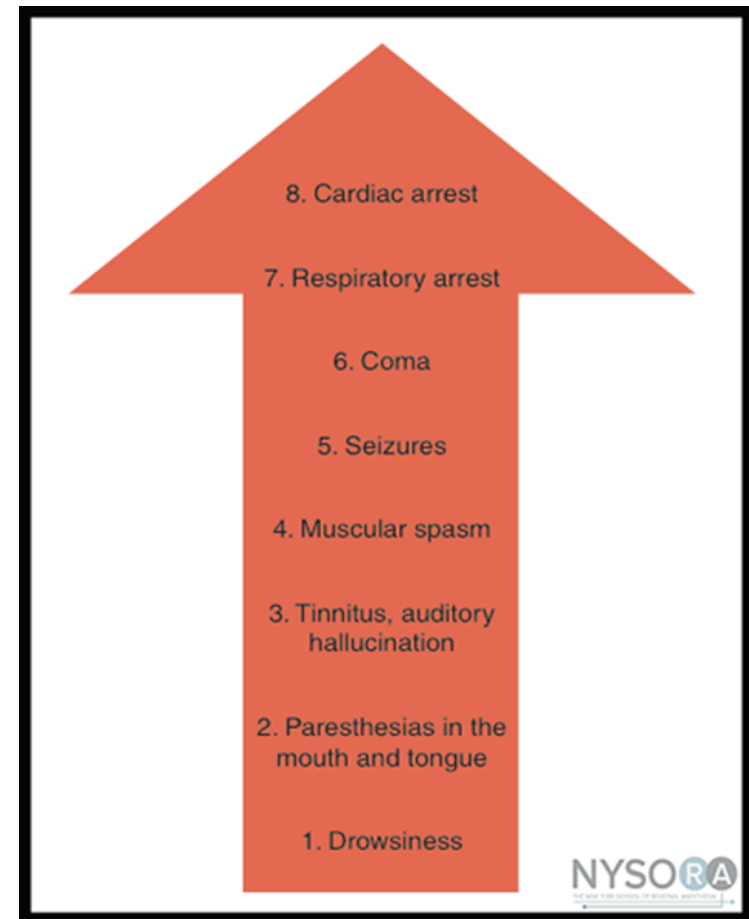
PATIENT ASSESSMENT OVERVIEW

- General
- Vital signs, Pain
- Mental status, Sedation
- Motor/sensory assessment
- Adverse Effects
- Abnormal vital signs (BP, RR)
- Nausea/vomiting
- Pruritus
- Local anesthetic toxicity



LOCAL ANESTHETIC TOXICITY

- Signs and symptoms are dose-dependent and may include:
 - Agitation (early sign)
 - Ringing of ears (early sign)
 - Metallic taste and/or lip numbness (early sign)
 - Twitching
 - Slow speech
 - Visual disturbances
 - Sedation
 - Seizure (late sign; rare)
 - Dysrhythmias/cardiovascular failure (late sign; rare)





What Do I Do If I Suspect My Patient Has Anesthetic Toxicity?

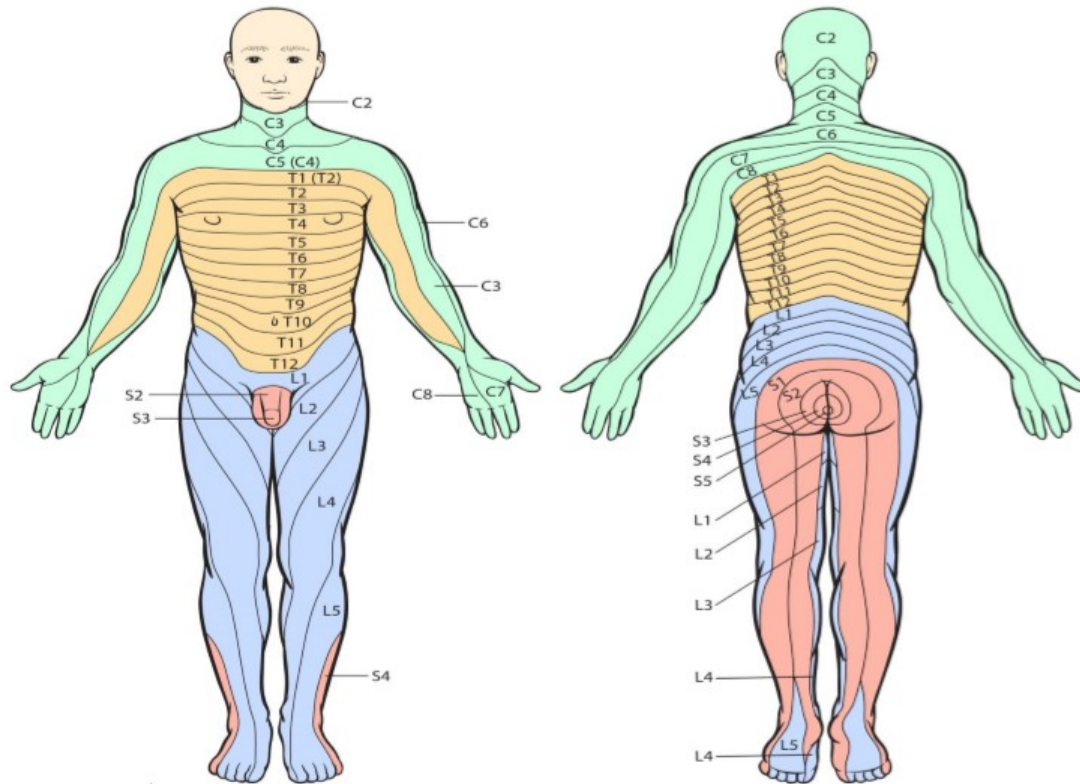


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Checking Levels

SENSORY ASSESSMENT—DERMATOMES





MONITORING SEDATION—RASS

RASS	RASS Description
+4 Combative	Violent, danger to staff
+3 Very Agitated	Pulls or removes tube(s) or catheters
+2 Agitated	Frequent non-purposeful movement, fights ventilator
+1 Restless	Anxious, apprehensive, but not aggressive
0 Alert & calm	Alert and calm
-1 Drowsy	Awakens to voice (eye opening/contact) >10 sec
-2 Light Sedation	Briefly awakens to voice (eye opening/contact <10 sec
-3 Moderate Sedation	Movement or eye opening to voice. No eye contact
-4 Deep Sedation	No response to voice, but movement or eye opening to physical stimulation
-5 Unarousable	No response to voice or physical stimulation



Acceptable sedation levels





EPIDURAL SIDE EFFECTS: OPIOID- RELATED

Side effects	Typical Treatment Options
Nausea	<ul style="list-style-type: none">• Ondansetron (Zofran) IV PRN• Scopolamine patch• Promethazine (Phenergan) IV PRN
Pruritus	<ul style="list-style-type: none">• Naloxone 0.25 mcg/kg/hr infusion (titrate for effect up to max of 1.0 mcg/kg/hr)• Nalbuphine (Nubain) IV PRN• Diphenhydramine PO/IV (infrequently used)
Sedation	<ul style="list-style-type: none">• Decrease or turn off epidural infusion• Removal of opioid from solution• Identify other possible sedating medications



EPIDURAL SIDE EFFECTS: LOCAL ANESTHETIC-RELATED

Side Effect	Typical Treatment Options
Hypotension	<ul style="list-style-type: none">• IVF and/or pressors as appropriate• Reduction in continuous/bolus settings• Change solution to remove LA
Numbness	<ul style="list-style-type: none">• No treatment necessary if appropriate to epidural placement and coverage.• Reduction in settings if coverage excessive.
Urinary retention	<ul style="list-style-type: none">• Urinary catheter for <u>all</u> epidurals below T10• <u>May</u> be needed for epidurals above T10
Motor weakness/block	<ul style="list-style-type: none">• Reduction in continuous/bolus settings• Change solution to remove LA
LA Toxicity	<ul style="list-style-type: none">• Stop solution until symptoms resolve• Reduce settings or remove LA from solution



EPIDURAL SIDE EFFECTS: CATHETER-RELATED

Issue	Notes/Treatment
Infection	<ul style="list-style-type: none">• Epidural abscess is rare but potentially life-threatening; requires early detection and treatment.• Inflammation that involves a collection of pus between dura and spine.
Epidural Hematoma	<ul style="list-style-type: none">• Bleeding into epidural space as a result of catheter placement, erosion and/or anticoagulant use.• Can compress sensory and/or motor nerves resulting in potentially irreversible numbness, tingling and motor deficits of the lower extremities.
Dural Puncture, Headache CSF leakage	<ul style="list-style-type: none">• CSF leakage from the intrathecal space may occur when epidural catheter needle punctures the dura.• Patient may complain of constant, throbbing occipital headache, tinnitus, diplopia and/or photophobia.• Treatment includes a darkened, quiet environment; bedrest, hydration. If persists, autologous blood patch may be placed by the anesthesiologist.



PATIENT/FAMILY EDUCATION

- Ongoing patient and family education is critical during every encounter with the patient to ensure safe, effective pain management using epidural medications.
- Topics may include:
 - Use of equipment of PCEA pump/button
 - Side effects and actions to address
 - Use of non-opioid and non-pharmacologic pain interventions to address pain
 - Patient/family goals and desires for pain management
 - Expected progression during post-surgical care



WHEN TO CALL THE PROVIDER

- Oversedation (RASS <-1) and/or mental status changes
- Respiratory depression (RR<10, hypercarbia)
- Catheter concerns: tubing disconnect/break, dislodgement
- New or worsening medication/epidural side effects
- Motor blockade/weakness



Multimodal Pain Management

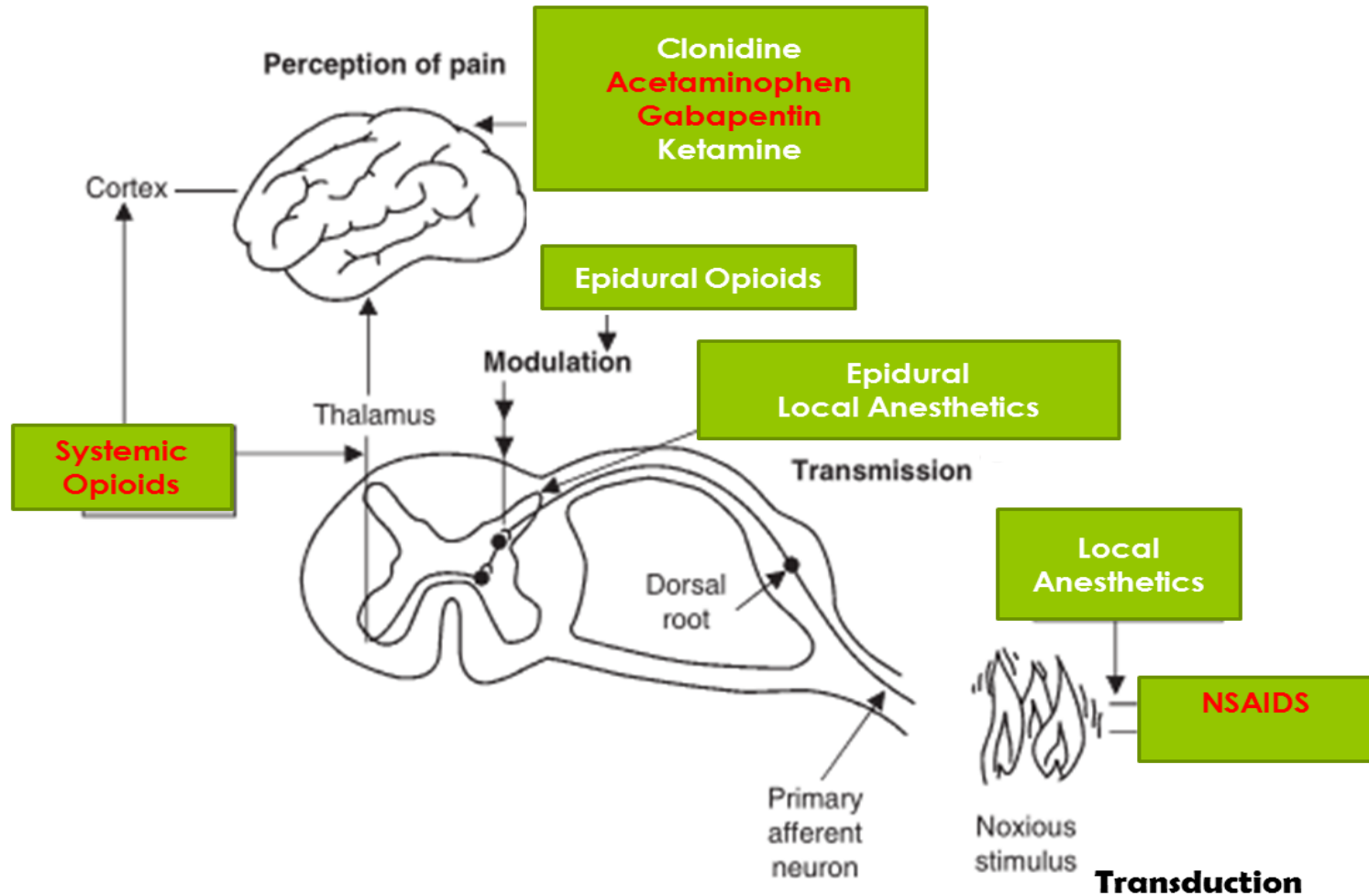


Multimodal Pain Management

The Key to addressing patients' pain needs is to utilize strategies with complementary mechanisms of action to work synergistically to lower analgesic doses, shorten duration of therapy, and lessen drug toxicity.



Pain Transmission & Multi-modal Therapy





Multimodal Pain Management Key Points

- Use of various pharmacologic and non-pharmacologic interventions
- Goal of reducing individual medication doses, adverse effects, and providing greater pain relief
- Using medications with differing mechanisms of action to impact pain signal pathways
- Use of Around the Clock and Patient Controlled Analgesia when possible



Traditional Analgesics

- Local anesthetic agents
 - Block conduction of nerve impulses
 - IV, nerve block, epidural
- Acetaminophen
 - Inhibits prostaglandin synthesis centrally
- NSAIDs
 - Inhibit prostaglandin production peripherally and centrally
- Opioids
 - Multiple sites of action (brain, periphery, spine)



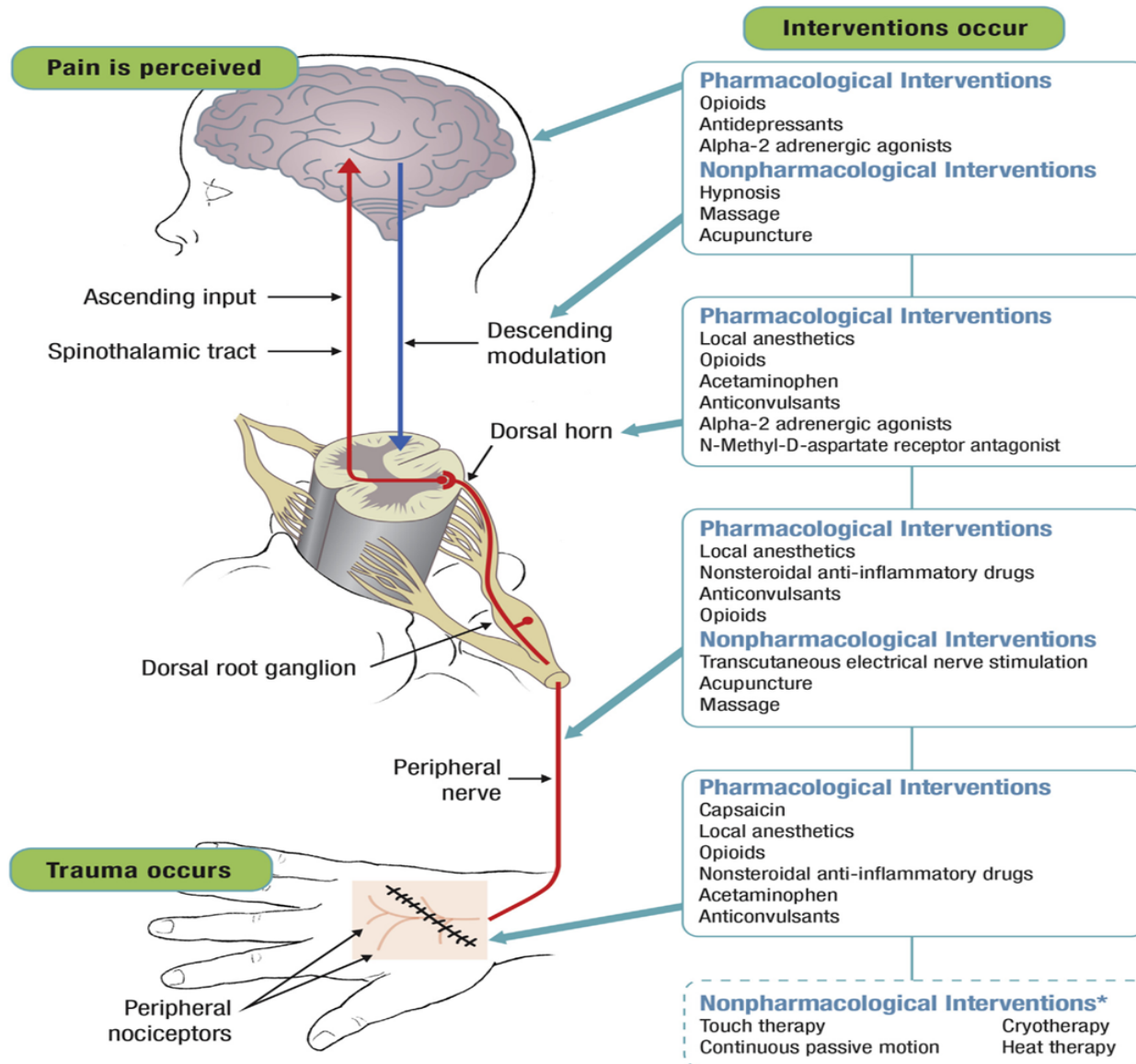
Nontraditional Analgesics

- Anticonvulsants
 - Inhibit high-frequency neuronal firing
- NMDA-receptor antagonists
 - Inhibit glutamate activation
- Alpha-2 adrenergic agonists
 - Inhibit release of substance P
- Antidepressants
 - Inhibit reuptake of serotonin and norepinephrine



Non-pharmacological Interventions

- Heat/cold
- Repositioning
- Stress management
- Television
- Music
- Distraction
- Breathing techniques
- Social support
- Education
- TENS
 - Stimulates A-beta nerve fibers
- Cognitive behavioral therapies
 - Such as relaxation methods, guided imagery, hypnosis



Manworren, R., (2015), Multimodal pain management and the future of a personalized approach to pain. *AORN Journal*, 101 (3) 307-318.



Ketamine Infusions for Pain



Mechanism of Action

- Ketamine is an N-methyl-D-aspartate (NMDA) receptor antagonist and is proven to alleviate hyperalgesic pain when given IV.
 - Hyperalgesia is excessive response to painful stimulus caused by damaged nociceptors in the body's soft tissue.
 - The (NMDA) receptor plays a significant role in wind-up and spinal hypersensitivity and is involved in the occurrence of hyperalgesia.
 - Ketamine inhibits the binding of excitatory amino acids to the NMDA receptor, thus blocking the transmission of painful stimuli.

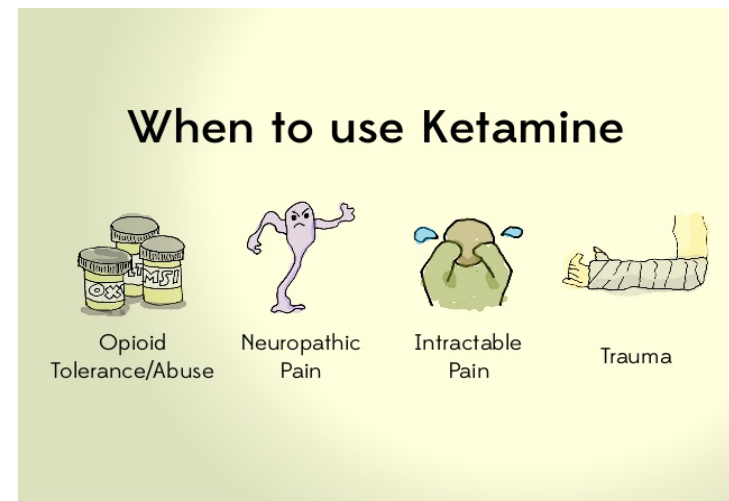


Mechanism of Action

- Drug class – general anesthetic
- Dissociative anesthesia
 - In large doses
 - Reduces pain in smaller doses
- Wide margin of safety
- CSA Schedule 3
- It can reduce opioid tolerance and decrease the amount of post-operative opioids used for analgesia.
- Inhibits the reuptake of dopamine and serotonin and elevates circulating epinephrine and norepinephrine levels.

Indications

- Adult and pediatric patients
- Acute or chronic pain
 - Oncology, sickle cell, burns, extensive trauma, complex regional pain syndrome (CRPS)
- Most effective in opioid tolerant patients
- Ketamine for pain considered off-label use
 - FDA
 - Insurance companies





Dosing

- One time infusion (over 30 mins)
 - 0.25-0.5 mg/kg every 6 hours as needed for pain control.
 - The lower dose is typically selected and increased based upon response.
- Continuous infusion
 - **Adults** a rate of 0.1 – 0.35 mg/kg/hour
 - 0.25 mg/kg/hour being the typical starting dose
 - **Pediatrics** a rate of 2-5 mcg/kg/min
 - 1-2mcg/kg/min being the typical starting dose
 - May be titrated up and down based upon clinical response
 - Increases in the infusion rate can be initiated every 8 - 12 hours
- The standard drip concentration 2mg/ml (500mg/250ml)
- Quick onset
 - IV within 30 secs
 - Max effect in 60 mins
- Duration of IV Ketamine: Up to 60 minutes
- Half-Life of Ketamine: 2 to 3 hours

Side Effects

- Sedation
 - Analgesia
 - Hallucinations
 - Anxiety
 - Vivid Dreams
 - Increased HR and/or BP
 - Decreased RR
 - Double vision
 - Increased ICP
 - Vomiting
 - Increased salivation
- Reportable Conditions
 - RASS ≤ -2 or ≥ 2
 - Bothersome hallucinations or vivid dreams, aggressive behavior
 - Sustained hypertension
 - $>20\%$ increase
 - Increased or uncontrolled pain

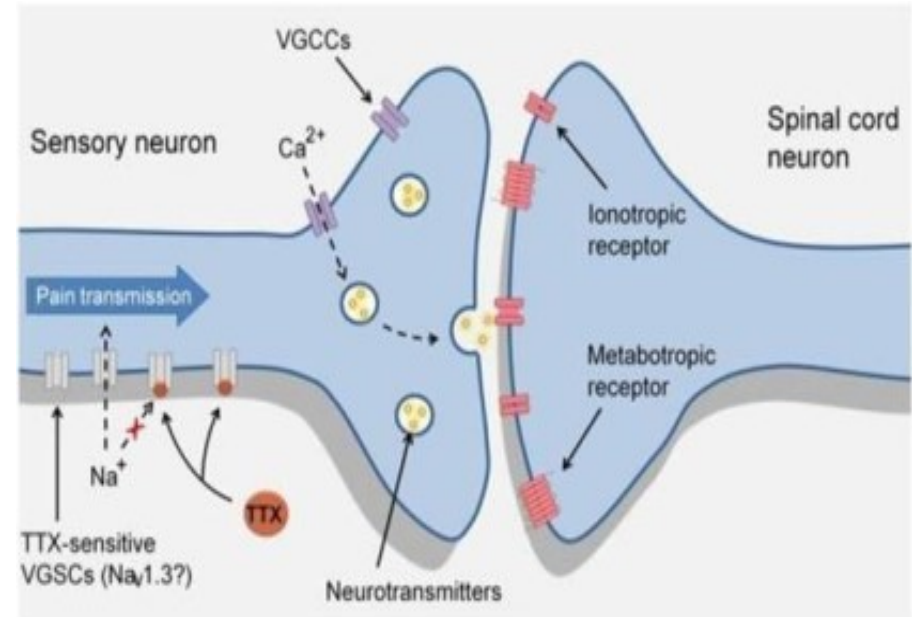




Lidocaine Infusions for Pain

Mechanism of Action

- Suppresses active sodium channels of nerves at the site of injury & along the nerve pathway
- Metabolized in liver
- Excreted by kidneys
- *Low doses do not impact normal nerves or cardiac function*





Indications

- Neuropathic pain
- Nociceptive pain
- Inflammatory pain
- Perioperative pain
- Chronic pain
- Refractory pain
- Amide local anesthetic
 - Historically used at higher doses for cardiac issues
 - ***At lower doses, Improves analgesia and reduces opioid use***
- Multi-modal
 - **Not** a first line pain treatment option



Dosing

- Standard concentration:
 - 2 gm/250 ml
- The infusion rate may be titrated based upon clinical response.
 - Usual dosing range is 0.5-1.25 mg/kg/hr.
 - Can go higher
- Initial dosing:
 - 0.5 mg/kg/hr (based on actual body weight)
 - Decreased initial dosing (0.25 mg/kg/hr)
 - Patients twice ideal body weight
 - Liver disease (LFTS > 1.5 ULN)
 - Renal disease (CrCl 30-50 mL/min)



Side Effects

- Lidocaine Toxicity

Serum Level	Signs/Symptoms of Toxicity
4-8 mcg/ml	Numbness & tingling of fingers, toes or mouth; metallic taste; tinnitus; lightheadedness /dizziness
8-12 mcg/ml	Severe dizziness; decreased hearing; tremors
> 12 mcg/ml	Seizures; loss of consciousness

- Reportable Conditions

- Sedation (RASS -2 to -5)
- Hyperactivity (RASS +2 to +5)
- Increased or unrelieved pain
- Signs and symptoms of lidocaine toxicity



References

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- Sawhney, M. (2012). Epidural analgesia: What nurses need to know. *Nursing2012*; August: 36-41.
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Kranke, P., Jokinen, J., Pace, L., et al. Continuous intravenous perioperative lidocaine infusion for postoperative pain and recovery. *The Cochrane Collaboration*. 2015; 7:1-175.

Chen, L. & Malek, T. Follow me down the k-hole: Ketamine and its modern applications. *Critical Care Nursing Quarterly*; 38(2): 211-216.



QUESTIONS?

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Case Studies



CASE #1

- 52 year old female
- In PACU status post ExLap with large tumor debulking
- Has thoracic epidural
- Epidural solution running with PCEA
 - B1/8H10@5/2/30/40 (Bupivacaine 0.125%+Hydromorphone 10mcg/ml@ 5ml/hr continuous, 2ml pt bolus q30mins, 40ml 4 hour lockout)
- Rating pain to incision site 9/10

What would you do?



- Check levels to see if pt's incision being covered at all.
- Ask pt/check pump to see if she has been utilizing her PCEA function appropriately. Is she awake enough to even use it?
- If pt using PCEA with no relief, call provider to see if solution or rate can be increased, a bolus administered, or if catheter might need to be tested.
- Prior to just administering prn opioids, try to troubleshoot EP or at least determine if you think it is potentially not working.
- If no levels or relief from PCEA, notify anesthesiologist if you think the epidural is not working properly.



CASE #2

- 64 year old male
- In PACU waking up from L lobectomy with chest tube in place
- Has thoracic epidural
- Epidural solution B1/16H10 (Bupivacaine 0.0625% Hydromorphone 10mcg/ml)
 - running with a continuous rate of 5ml/hr as ordered
- States pain is ok, but reports pain is the worst when taking deep breaths, so he tries not to

What would you do?



- One of the main benefits to utilizing epidurals vs. opioids alone is that pts are able to cough and deep breath more effectively.
- Troubleshoot catheter: does pt have levels? If not, page provider to ensure epidural is working.
- How's the pt's BP? If good, could recommend increasing EP solution rate or local anesthetic concentration (currently running at lowest- bupivacaine 0.0625%).
- Could recommend adding on PCEA function if pt able to participate.
- Sometimes chest tubes cause a referred shoulder blade area pain that the epidural won't cover (too high). In these situations other adjuvants need to be added on (i.e. Tylenol, Lidoderm patch, etc.).



CASE #3

- 70 year old female
- Status post colectomy
- Has thoracic epidural
- Solution ordered and running (Bupivacaine 0.0625% Hydromorphone 10mcg/ml)
 - B1/16H10@5/2/30/40
- Arrived to PACU with RASS -1
- Has now progressed to RASS -2, has received no further medications/opioids

What would you do?



- RASS -2 is a reportable condition, stop infusion and contact provider.
- Provider may write to decrease solution rate, pause epidural until pt more awake and then restart at a decreased rate, or remove opioid(H10) from epidural all together.
- In older pts
 - Spinal stenosis can lead to:
 - a reduced latency time
 - higher dermatome level achieved
 - increased blockade density
 - Reduced nerve myelination can lead to:
 - greater diffusion of local anesthetic
 - wider nerve block extension

Therefore, a reduced dosage of local anesthetic is recommended