

# PAIN & SEDATION

## CICU Considerations

Jarae Payne MSN, CPNP-AC, CCRN  
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# DISCLOSURES

- None

# OBJECTIVES

- Discuss common analgesic and sedation medications
- Review nonpharmacological pain management measures
- Describe CICU considerations with medication selections
- Identify withdraw symptoms and measurement tools

# MEDICATIONS

Opioids

Benzodiazepines

Dexmedetomidine

Ketamine

Propofol

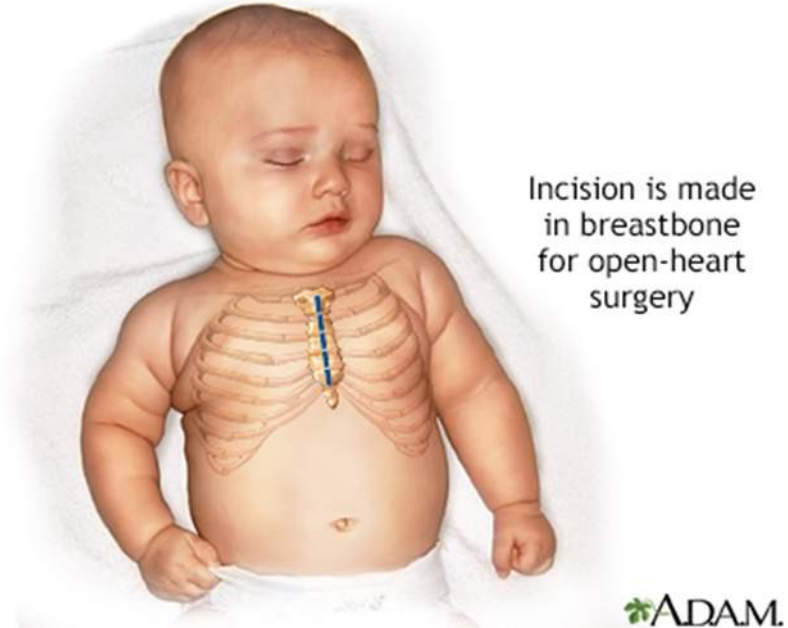
Non-opioid analgesics

# OPIOIDS

## **Analgesic: mu receptor agonist**

- MOA: inhibit nerve impulses to the CNS, binding to opiate receptors
- Moderate to severe pain relief
- Side effects: respiratory depression, cardiovascular instability, gastrointestinal disturbances

*Reversal agent:* Naloxone (Narcan)



# OPIOIDS

## Morphine

- Peak effect 20 minutes
- Duration 2 to 4 hours

## Fentanyl

- Synthetic opioid (70-100x more potent than morphine)
- Onset 30 seconds
- Duration 30 to 45 minutes

## Remifentanyl

- Rapid onset and offset- half life 5 to 10 minutes
- Metabolized by tissue and plasma esterases

## Hydromorphone

- Peak effect 10 to 20 minutes
- Duration 3 to 6 hours
- More potent than morphine, less euphoria

## Methadone

- Long acting
- Peak onset 1 to 2 hours; half life 19 hours
- Treatment or prevention of opioid withdrawal

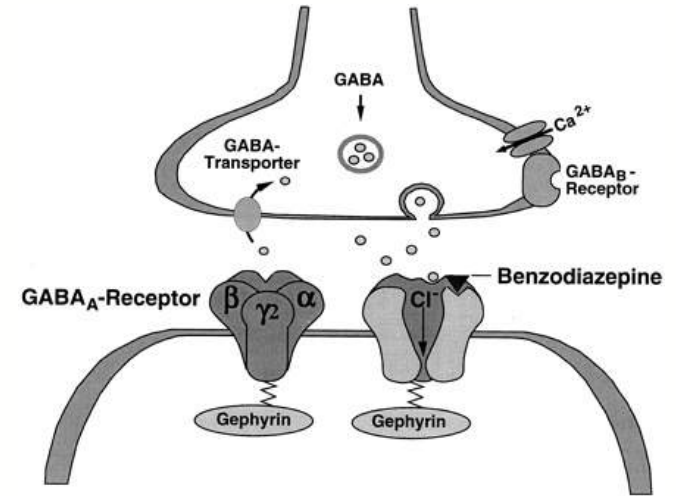


# BENZODIAZEPINES

## Sedation & hypnosis: GABA agonist

Other effects: anxiolysis, amnesia, anticonvulsant, and muscle relaxation

- MOA: bind to GABA receptors on neurons inhibiting CNS activity
- Must be used in combination with analgesics for pain coverage
- Side effects: respiratory depression, cardiovascular instability



*Reversal agent: Flumazenil*



# BENZODIAZEPINES

## Midazolam (Versed)

- Onset 1 to 5 minutes
- Duration 20 to 30 minutes

## Lorazepam (Ativan)

- Onset 10 minutes
- Duration 8 to 12 hours

## Diazepam (Valium)

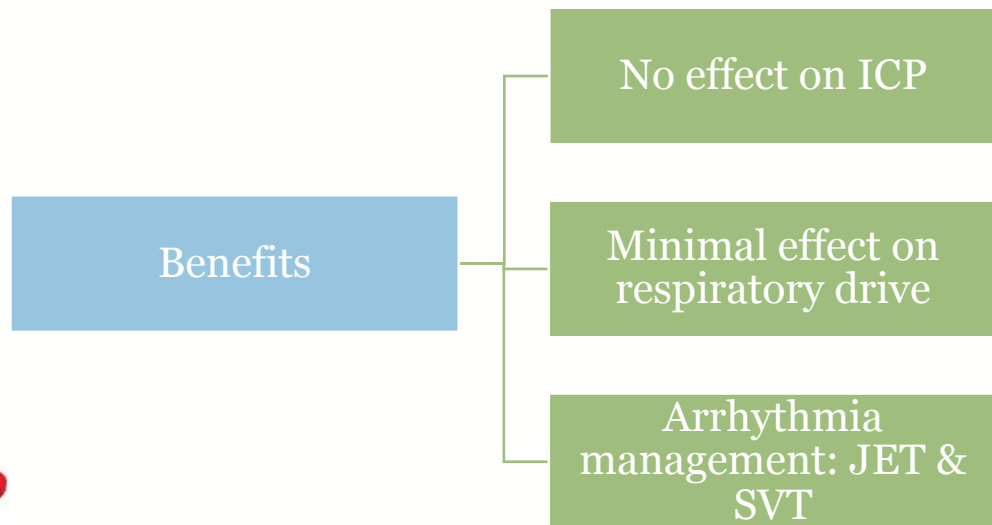
- Onset 4 to 5 minutes
- Long and variable half life, up to 95 hours in neonates

# DEXMEDETOMIDINE (PRECEDEX)

## Sedation: Selective alpha 2 adrenergic receptor agonist

Increases GABA effects

- Continuous infusion: 0.2mcg/kg/hr, starting dose
- Side effects: bradycardia and hypotension



# KETAMINE

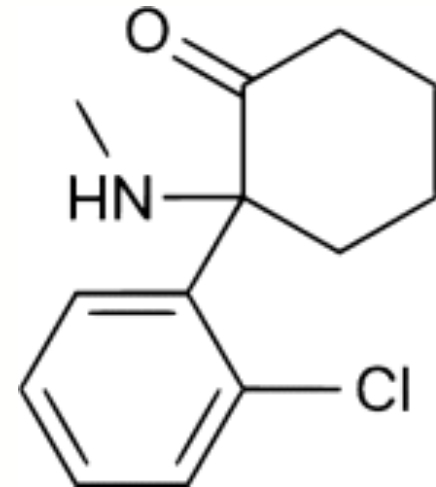
## Sedation and analgesia: NMDA receptor antagonist

Effects: potent analgesia, sedation, amnesia

- Administration continuous or bolus
  - Bolus: onset 1 minute, duration 5 to 10 minutes

Benefits minimal respiratory or cardiovascular effects

- Increase in blood pressure
- Maintain heart rate



# PROPOFOL

## Sedation and hypnosis: GABA agonist

- Fast onset
- Procedural sedation
  - Aid in early tracheal extubation
- Side effects: cardiovascular instability, apnea, PRIS, cerebral vasoconstriction, injection site pain



# BEYOND OPIOIDS

## Acetaminophen (Tylenol)

- Analgesia and antipyretic effects
  - MOA: inhibits prostaglandin production in the cyclooxygenase pathway
- Mild to moderate pain relief
- Administration: PO (enteral), PR (rectal), IV (intravenous)
  - IV preparation postoperative pain management adjunct
- Onset
  - PO: 45 to 60 minutes
  - PR: 3.5 to 4.5 hours
  - IV: 15 minutes
- Considerations: hepatic dysfunction

# BEYOND OPIOIDS

## Ketorolac (Toradol)

- Analgesia and anti-inflammatory
  - MOA: inhibit prostaglandin synthesis in the cyclooxygenase pathway
- Mild to moderate pain relief
- Administration: IV
- Onset: 30 minutes
- Considerations: renal impairment, age, hematologic concerns

| References         | Patient Population (Age Range)                            | Study Design                                                          | No. of Doses/Length of Therapy | Conclusions                                                                                                     |
|--------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Gupta et al (26)   | Children s/p congenital heart surgery (2 d to 18 yr old)  | Prospective, randomized, controlled trial (ketorolac vs no ketorolac) | 36–48 hr                       | Ketorolac group did not have an increased risk of bleeding complications                                        |
| Moffett et al (27) | Infants s/p cardiac surgery (< 6 mo old)                  | Retrospective chart review                                            | 3 d                            | Ketorolac was not associated with adverse hematologic or renal effects                                          |
| Inoue et al (24)   | Children s/p low risk cardiac surgery (5 mo to 18 yr old) | Retrospective cohort study (ketorolac vs no ketorolac)                | Median: five doses             | No difference in increase in SCr between groups<br>Less exposure to opioids in POD0 and POD1 in ketorolac group |
| Dawkins et al (28) | Infants s/p cardiothoracic surgery (< 6 mo old)           | Retrospective case-control chart review (ketorolac vs no ketorolac)   | Mean length of therapy: 3.1 d  | No significant difference in renal or hemorrhagic complications                                                 |
| Aldrink et al (25) | Surgical infants (0–3 mo old)                             | Retrospective chart review                                            | Eight to nine doses            | Bleeding events associated age < 2 wk old and concurrent medications                                            |

# BEYOND OPIOIDS

## Gabapentin (Neurontin)

- Neuropathic pain
- Oral administration
- Side effects: somnolence, dizziness, nausea and visual disturbances
- Benefits:
  - Reduce opioid use
  - Decreased postop nausea & vomiting

# NON-PHARMACOLOGICAL APPROACHES

| Non-Pharmacologic Analgesic Modalities |                                            |
|----------------------------------------|--------------------------------------------|
| Ice/Heat                               | Bubbles, pinwheels                         |
| Pacifiers, breastfeeding               | Swaddle blankets                           |
| Buzzy (vibrating device)               | Video/ Virtual Reality                     |
| Parents (comfort, distracting)         | Child Life Services (comfort, distracting) |

# WITHDRAWAL

## Benzodiazepines & opioids overlap symptoms

- Benzodiazepines: anxiety, tremors, involuntary movements, irritability, perspiration and insomnia
- Opioids: CNS overstimulation, autonomic nervous system & GI signs

## Primary risk factor is duration >5days and dosage

## Assessment tools

- Withdrawal Assessment Tool (WAT-1)
- Sophia Observations Withdrawal Symptoms Scale (SOS)
- Neonatal Abstinence Score (NAS)

# WITHDRAWAL

## RESEARCH

JPPT | Critical Care

### Prolonged Dexmedetomidine Infusion and Drug Withdrawal In Critically Ill Children

Astrid S. Haenecour, MD; Winnie Seto, MSc; Charline M. Urbain, PhD; Derek Stephens, MSc; Peter C. Laussen, MD; and Corrine R. Balit, MD

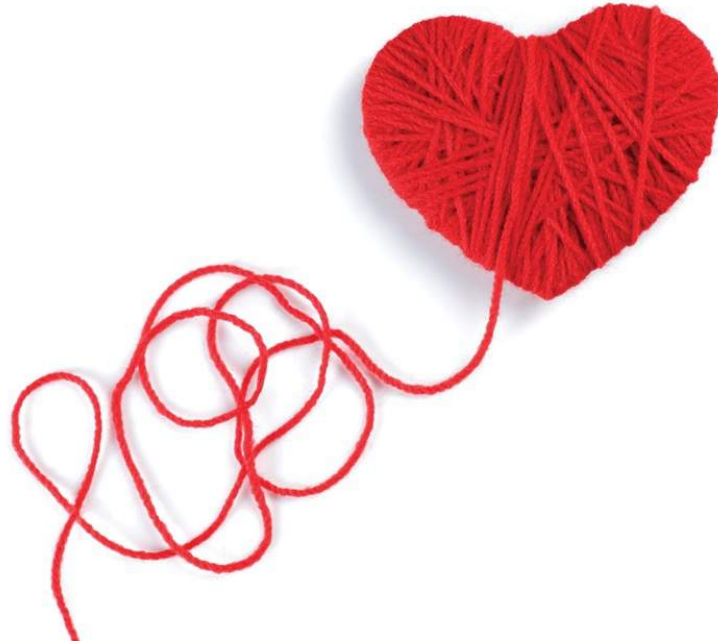
- Withdrawal symptoms occurred >4 days
- Duration of concurrent opioid use was a risk factor
- Clonidine did not reduce presence of withdrawal symptoms
- WAT-1 scoring not validated for Precedex

# WITHDRAWAL

**Table 1** Signs and symptoms of withdrawal

| Opioid       | Benzodiazepine              | $\alpha_2$ -Adrenergic agonist |
|--------------|-----------------------------|--------------------------------|
| Tremors      | Tremors                     | Agitation                      |
| Restlessness | Anxiety                     | Blank staring                  |
| Irritability | Involuntary muscle movement | Decreased communication        |
| Insomnia     | Irritability                | Asymmetric pupils              |
| Vomiting     | Perspiration                | Facial drooping                |
| Diarrhea     | Insomnia                    | Abnormal chewing motions       |
| Fever        | Seizures                    | Rhythmic jerking movements     |
| Perspiration | Hallucinations              | Hypertonicity                  |
| Sneezing     |                             |                                |
| Yawning      |                             |                                |
| Tachycardia  |                             |                                |
| Hypertension |                             |                                |

# THANK YOU



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