Pain Management and Sedation

INTRODUCTION and DEFINITION: Pain is defined as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage or perceived in terms of such damage." From 24 weeks post-conceptional age, all neurotransmitters and receptors associated with pain modulation are present and responsive; thus, **the fetus and newborn can feel pain**. Premature infants and term infants <6 months old may have immature inhibitory pathways and thus experience greater discomfort because they are unable to "gate" painful sensations. Physiologic maturity at different gestational ages affects pharmacokinetics of analgesic drugs. Although it may not be feasible to eliminate all pain, the goal should be to reduce it to the lowest level possible.

PHYSIOLOGICAL EFFECTS OF PAIN: Pain can cause immediate adverse physiologic effects including:

- -Tachycardia
- - ↑ O_2 consumption
- - ↓ cerebrovascular autoregulation
- -Temperature changes
- -Reduced tidal volume
- -Prolonged catabolism
- -Release of catecholamines, cortisol, endorphins
- -Blood pressure changes (↑ or ↓)
- -Hypoxemia
- -↑ intracranial pressure
- -Pallor, flushing
- -Abnormal respirations
- -State changes
- -Pupillary dilatation

For any potentially painful interventions, pain management or analgesia should be considered as either:

- **-Moderate analgesia** ("conscious sedation"): drug-induced depression during which patients cannot be easily aroused but respond to light tactile stimuli. Spontaneous breathing, airway patency and cardiovascular function are usually maintained.
- **-Deep sedation**: drug-induced depression during which patients cannot be easily aroused but respond to repeated or painful stimuli. Patients may require assistance for breathing and airway patency, but cardiovascular function is usually maintained.

PAIN ASSESSMENT is typically done using scoring tools such as the **Neonatal Infant Pain Scale (NIPS) (Table 1),** which uses behavioral cues and two physiological variables. Infants are scored on a 1-10 point scale, in coordination with clinical nursing judgment. A low pain scale score does not necessarily indicate pain medication is not warranted. Daily examinations by housestaff should also assess the level of pain and discomfort and the adequacy of pain control.

GUIDELINES FOR PAIN MANAGEMENT:

A. To prevent or minimize pain:

- -Reduce number of needle punctures by drawing blood tests at one time if feasible.
- -Use indwelling venous or arterial catheters when appropriate.
- -Avoid invasive monitoring when possible.
- -Select most competent staff to perform invasive procedures.
- -Use minimal amount of tape and remove tape gently.
- -Ensure proper premedication before invasive procedures.

-Use appropriate equipment (smallest gauge needle, automatic heel lancet, *etc.*)

Table 1. Neonatal Infant Pain Scale (NIPS)

Variable	Finding	Points
Facial expression	Relaxed (Restful face, neutral expression)	0
	Grimace (Tight facial muscles, furrowed brow, chin, jaw)	1
Cry	No cry (Quiet, not crying)	0
	Whimper (Mild moaning, intermittent)	1
	Vigorous crying (Loud scream, shrill, continuous). If infant is intubated, score silent cry based on facial movement.	2
Breathing pattern	Relaxed (Usual pattern for this infant)	0
	Change in breathing (Irregular, faster than usual, gagging, breath holding)	1
Arms	Relaxed (No muscular rigidity, occasional random movements of arms)	0
	Flexed/extended (Tense, straight arms, rigid and/or rapid extension, flexion)	1
Legs	Relaxed (No muscular rigidity, occasional random leg movements)	0
	Flexed/Extended (Tense, straight legs, rigid and/or rapid extension, flexion)	1
State of Arousal	Sleeping/Awake (Quiet, peaceful, sleeping or alert and settled)	0
	Fussy (Alert, restless and thrashing)	1
Heart Rate	Within 10% of baseline	0
	11-20% of baseline	1
	>20% of baseline	2
O_2 Saturation	No additional O_2 needed to maintain O_2 saturation	0
	Additional O_2 required to maintain O_2 saturation	1

B. Treatment guidelines: Assess each infant on an individual basis. Using the NIPS, the nurse and the medical team determine a pain score and the appropriate intervention for pain management, as suggested by the **guidelines shown in Table 2.**

MONITORING: Respiratory depression and/or arrest may occur with narcotic agents as well as with barbiturates, midazolam, diazepam and lorazepam, particularly when these agents are given in **combination**. Careful and appropriate monitoring of infants receiving these agents is essential, especially when the patients are not receiving mechanical ventilation.

Table 2. Guidelines for Pain Management

Pain Score	Guidelines for Intervention
0-3 Mild	Non Pharmacologic (primary method) -Pacifiers, sucrose, hand-to-mouth, non-nutritive sucking -Whiskey nipple* -Swaddling, nesting, holding -Position changes, correct positioning for procedures -Decrease environmental stimuli (light, noise, abrupt movements) -Decreased handling with rest periods between procedures -Comfort measures noted to be effective with individual neonate -Soothing vocalizations, recorded intrauterine sounds Pharmacologic -Acetaminophen (Tylenol™)
4-6 Moderate	Non Pharmacologic -See above Pharmacologic: (primary method) -Narcotic bolus
7-10 Severe	Pharmacologic: (primary method) -Narcotic intermittent bolus -Consider narcotic drip

*Whiskey nipple: 1/5 dilution of bourbon in D5W; ~3 cc/kg dripped into a cotton filled nipple (as pacifier)

PHARMACOLOGIC MANAGEMENT OF PAIN Analgesics are the mainstay of pharmacologic treatment of pain. Sedative, hypnotic and anxiolytic drugs do not provide analgesia**. Muscle relaxants (paralytic agents) do not provide analgesia** and pain is difficult to assess in patients receiving neuromuscular blockade Pharmacological agents commonly used in the ICN to reduce or prevent pain include:

-Mild analgesia: Acetaminophen (Tylenol™) also has antipyretic properties. Usual dose is 15 mg/kg PO or PR q6-8h (not to exceed 75 mg/kg/d).

-Local Anesthesia: Lidocaine (Xylocaine™). Use 0.5-1% solution **without epinephrine.** To avoid toxicity, total dose must be <0.5 mL cc/kg of 1% solution.

-Narcotic analgesia:

- **Morphine** can be used for analgesia, sedation and opiate withdrawal. Usual dose is 0.1 (0.05-0.2) mg/kg q2-4 h prn IV, IM, or SC.
- **Fentanyl** is used for analgesia, sedation and anesthesia.
  - -Dose for analgesia or sedation: 1-2 mcg/kg q4-6 prn IV (slowly) or SC, or as continuous IV infusion: 2 mcg/kg/h.
  - -Dose for anesthesia: 10-50 mcg/kg IV over 2 to 10 min. (Titrate to effect).
- **Meperidine** is not recommended for use in newborns.
- **Methadone** can be used for treatment of post-operative pain but has no advantages over morphine or fentanyl.

-Adjunctive Drugs (*e.g.*, diazepam, midazolam, lorazepam, chloral hydrate) are useful for sedation when pain is adequately managed.

SPECIFIC SITUATIONS for which analgesia or sedation is recommended and suggested agent:

-Circumcision: EMLA (eutectic mixture of local anesthetics: lidocaine-prilocaine) topically 1h prior to procedure, or dorsal penile block (1% lidocaine) immediately before procedure.

-Lumbar puncture (analgesia when feasible): EMLA prior to procedure, **or** morphine (0.05 – 0.1 mg/kg IV) at least 5 min prior to procedure.

-Nasal CPAP: Lidocaine jelly to nostrils q6h

-Non-emergent endotracheal intubation: Morphine (0.05 – 0.1 mg/kg IV) at least 5 min prior to intubation.

-Mechanical ventilation: Typical sedation involves one of the following:

- •Morphine 0.05 - 0.1 mg/kg IV q 4-6h, **or** continuous infusion of 0.01-0.025 mg/kg/h. Titrate dose to lowest that achieves analgesic/sedative effect.
- •Fentanyl 1-3 mcg/kg IV q1-2 h, **or** continuous infusion of 1-5 mcg/kg/hr. Titrate dose to lowest that achieves analgesic/sedative effect.
- •Phenobarbital is useful for long-term ventilation at 2.5 mg/kg IV or PO q12-24 h.

-Chest tube thoracostomy: Morphine 0.05-0.1 mg/kg IV. Attempt to give at least 5 min prior to chest tube insertion. Unless it is a dire emergency, use local infiltration with 1% lidocaine.

-Venipuncture or minor procedures (IV catheter placement) may be painful, especially if difficult to accomplish. Therefore, consider giving morphine 0.05 - 0.1 mg/kg IV at least 5 min prior to procedure.

-CT or MRI scanning: Sedation is often unnecessary, especially if infant has been fed just before scan, is well-bundled, and efforts are made to minimize sound of scanning. Otherwise, use pentobarbital (Nembutal™) 1.5-3.0 mg/kg IV immediately before placing in scanner.

-Post-operative pain:

- •**Major surgery** (*e.g.*, thoracotomy, abdominal laparotomy): Morphine 0.1-0.2 mg/kg q3-4h IV prn for at least 24h after the operation. Discuss subsequent pain medication with Neonatology Fellow and with Surgeons.
- •**Minor Surgery** (*e.g.*, hernia repair, pyloromyotomy): Acetominophen is usually adequate. Discuss with Fellow and with Surgeons.

-Withdrawal of life support: The major aim is to relieve suffering as much as possible. Discuss this with Neonatology Fellow and/or Attending. In many cases it is appropriate to give relatively large doses of narcotics to alleviate suffering. In these circumstances, morphine almost never causes apnea.

WEANING OF OPIATE ANALGESICS (morphine, fentanyl) should be done if the agents have been given routinely for more than 3 d. Method of weaning depends upon length of opiate therapy:

1. Short term therapy (<1 week): Initially reduce dose by 20%. Then reduce dose by 10% (of original dose) q6-8h. Discontinue drug as tolerated.

2. Long term therapy (>1 week): Reduce dose by 20% over first 24h. Then reduce dose by 10% (of original dose) q12h as tolerated. Drug can usually be discontinued when it is at about 20% of original dose, although subsequent small doses may be needed.