Newborn Critical Care Center (NCCC) Clinical Guidelines

Procedural Pain Guidelines

A. Goals of Pain Management in Neonates

- To assess and manage pain appropriately and provide humane care
- To reduce the cumulative effects of untreated pain on the developing brain while taking into consideration the possible long-term neurodevelopmental effects of narcotic analgesia
- To reduce the number of painful procedures to which the infant is exposed
- To use a stepwise approach to provide neonatal analgesia when a painful process is necessary

B. Pain Assessment Tool

Premature Infant Pain Profile (PIPP)

- Surgical/post-operative pain assessments should be made every 3 hours for 48 hours post-operatively or every 4 hours while on a continuous opioid infusion and 30 minutes after any intervention for pain to document resolution.
- If there is on-going or recurrent pain due to surgery, disease, or therapy, more frequent assessments may be necessary.
- The presence of pain should be presumed in all situations usually considered to cause pain in adults and children even in the absence of behavioral or physiologic signs.

C. Pain Reducing Measures

1. Comfort Measures

Non-pharmacologic methods of pain reduction should be used whenever a procedure is deemed painful to any degree (see list of procedures below). These can be used singularly or in conjunction with each other. These comfort measures include:

- Facilitated tucking (swaddling) or containment holding if unable to be swaddled
- Non-nutritive sucking (pacifier), with dips of maternal milk, it is similar to breastfeeding and oral sucrose
- Breast feeding (for infants ≥ 34 weeks who are not NPO)
- Skin to skin contact, encourage parental involvement
- Pacifier dipped in 0.2 mL of Sweet-ease (24% sucrose) or breast milk; can also give 2 mL of Sweet-ease PO to term infants and 2 mL of Sweet-ease PO to preterm infants (do not give by NG as is not effective)
    - Infants on full feeds may have repeated Sweet-ease doses but limit to <10 per day.
    - Sweet-ease should be given 2 minutes prior to initiation of procedure (for optimal effect), peak onset of action is 2 minutes with efficacy from 5-10 minutes
    - Ask for a second caregiver to help contain the infant and keep the pacifier in place and re-dip in Sweet-ease throughout procedure

Environmental modifications: avoid loud noise, bright or continuous light, frequent handling, and thermal stress to improve the infant's overall stability and reduce stress and discomfort.

Non-pharmacologic pain control measures should be used in conjunction with pharmacologic measures whenever possible.

2. Topical Anesthetics

Lidocaine Cream (L.M.X. 4)

Dose: 0.5-2 grams under an occlusive dressing (1cm x 1cm area equals ~ 1 gram of L.M.X.4)

- For use only in infants ≥ 37 weeks post conceptual age
- L.M.X.4 must be applied to the site of the painful stimulus *at least 30 minutes* prior to the procedure; duration of effect is up to 60 minutes after cream removal.
- *The maximum total area than can be covered with L.M.X.4 at one time for children less than 5 kg is 10 square cm (100 cm^2).*
- *Can cause erythema at application site.*

3. Pharmacologic Measures

Medications that reduce pain should be used for any procedure that is expected to cause more than mild pain.

a. Tylenol (acetaminophen):

ORAL

- Oral dosing is preferred over rectal dosing, given the variability of absorption through rectal mucosa and therefore potential under-medication of pain

  DOSE:

  PMA < 32 weeks: 12.5 - 15 mg/kg PO every 12 hours

  PMA ≥ 32 weeks and < 37 weeks: 12 - 15mg/kg PO every 8 hours

  PMA > 37 weeks: 12.5-15 mg/kg PO every 6 hours

- Avoid repeat dosing for more than 48-72 hours
- Limit use for circumcisions or minor post-op, unless discussed with fellow or attending

INTRAVENOUS

- Intravenous dosing is indicated for treatment of mild to moderate pain and fever; treatment of moderate to severe pain when combined with opioid analgesia

  DOSE:

  PMA 28 - 32 weeks: 7.5 mg/kg/dose every 12 hours; may increase frequency to every 8 hours; maximum daily dose: 22.5 mg/kg/day

  PMA 33 - 36 weeks: 7.5-10 mg/kg/dose every 8 hours; may increase frequency to every 6 hours; maximum daily dose 40 mg/kg/day

  PMA > 37 weeks: 10 mg/kg/dose every 6 hours~~;~~ maximum daily dose 40 mg/kg/day

- EPIC only allows 24 hours of scheduled IV dosing, will need to renew daily. Dosing >48-72 hours is not recommended.
- Limit use to post-operative pain, unless discussed with fellow or attending
- Do not use acetaminophen in combination with **barbiturates** as this may increase the metabolism of acetaminophen and diminish the effects. There is also an increased the risk of liver damage or increased production of nitric oxide which may contribute to the likelihood of significant methemoglobinemia.

b. Fentanyl

This has a faster onset of action, shorter duration of effect, and possibly less inhibition of GI motility than morphine. However, there is the risk of chest wall rigidity (4-9%), even with small doses infused slowly.

Dosing guidelines:

Single Dosing:

1. Start at 1-2 mcg/kg IV (IM if no IV access), may require up to 5 mcg/kg
2. Infuse over at least 5 minutes to avoid chest wall rigidity
3. Wait for the maximal effect *before starting* the procedure (usually 3-5 minutes if IV, 7-15 minutes if IM, once dose is complete)
4. Re-dose every 30 minutes during the procedure, as needed, based on the PIPP score and clinical assessment

Continuous infusion:

1. First bolus dose with 1-3 mcg/kg to reach a steady state, then start infusion at 1-3 mcg/kg/hour
2. Titrate up by 1 mcg/kg/hour as needed based on PIPP score and clinical assessment
3. ***If the child is already on a continuous fentanyl infusion, extra dosing prior to the procedure is still necessary*.** If the infusion is less than 5 mcg/kg/hour, a dose of 2 mcg/kg for the procedure may be sufficient. If the infusion is 5-10 mcg/kg/hour than a dose of half the hourly dose may be sufficient.

c. Morphine

In contrast to fentanyl, morphine has no risk of chest wall rigidity. However, like fentanyl, can cause respiratory depression. Also, Morphine may cause histamine release of unknown significance in CLD and the risk of hypotension. Morphine is associated with an increased risk of apoptosis in microglial cells leading to long term changes in behavior, brain function, and spatial recognition memory following exposure. Morphine has a slower onset of action compared to fentanyl, and requires advanced planning for procedure.

Dosing guidelines:

Single Dosing:

1. Start with 0.05-0.1 mg/kg per dose IV (or IM if no IV access); may require up to 0.2 mg/kg. Infuse over 5 minutes per nursing protocol, can also be "slow" IV push.
2. Wait for the maximal effect *before starting* the procedure (20 minutes if IV, 30-60 minutes if IM). Repeat every 2-4 hours, as needed.

Continuous infusion:

1. Give a loading dose of 0.05 – 0.1 mg/kg over 1 hour followed by 0.01 mg/kg/hour
2. May need to titrate up to a maximum of 0.03 mg/kg/hour based on PIPP score and clinical assessment

- ***Naloxone should be readily available to reverse adverse effects of narcotic medications*** *(Recommended Naloxone Dose 0.1 mg/kg IV push)*

D. Specific Guidelines by Procedure

For all procedures utilize comfort measures as much as possible including swaddling, breastfeeding, skin to skin pacifier dipped in MBM or oral sucrose with non-nutritive sucking.

VERY PAINFUL PROCEDURES

Chest Tube Insertion

- Fentanyl bolus prior to procedure
- Consider local injection of lidocaine (2-5 mg/kg)
- Consider a continuous infusion or scheduled doses of fentanyl for 72 hours after procedure

Circumcision

- See separate circumcision guideline

Bedside Surgical Procedures *(Central line placement, Penrose drain placement, pleurocentesis, etc.)*

- Fentanyl bolus prior to and repeated as needed throughout the case and/or continuous drip based on invasiveness of procedure, PIPP score and clinical assessment
- If needed, administration of a paralytic drug (pancuronium or vecuronium), should be given *after* fentanyl takes effect
- Ensure enough time is allowed for medications to take effect before procedure is started
- Continuous infusion or scheduled doses of fentanyl for at least 72 hours

If more invasive surgical procedures, such as or laparotomy, are to be done at the bedside, an anesthesiologist should be present to manage pain and sedation throughout the procedure. If anesthesia is not available provide bolus dose of Fentanyl ~5 mcg/kg followed by intermittent doses or continuous infusion. Discuss need for paralytic drug with pediatric surgeon.

ROP Procedures

Laser Surgery

- Fentanyl bolus, repeat as needed based on PIPP score
- Paralytic (vecuronium or pancuronium, possibly rocuronium if short procedure)
- Intubation

Post-operatively, give fentanyl boluses and / or acetaminophen as needed, based on PIPP for 24 hours.

Avastin Therapy

- Pre-medicate with sucrose and repeat as needed

Peripheral Arterial Line Placement

- Fentanyl bolus prior to procedure, consider repeating as needed for multiple punctures/prolonged procedure

Peripheral Arterial Blood Draw

- Arterial blood draws should only be used if arterial blood is required for an ABG or if a large volume of blood is required and venipuncture is not an option.
- Consider fentanyl bolus if unsuccessful after the second attempt

Painful Procedures

Percutaneous Catheterization

- Consider Fentanyl bolus prior to procedure, repeat as needed based on PIPP score
- Consider placing a PICC within the first week of life in infants who are likely to require long-term central access, to reduce number of IVs required and unsuccessful PICC attempts, and thereby reduce pain exposure.

Peripheral IV Starts

- Limit attempts to 2-3 per person, if possible
- Give fentanyl after 2-3 attempts, give IM if necessary

Ventricular Tap

- L.M.X.4
- Consider fentanyl bolus prior to procedure

Lumbar Puncture

- L.M.X.4
- Consider fentanyl bolus prior to procedure

Immunizations and Other IM Injections

- Comfort measures, including oral sucrose

Heel Sticks

- Warm heel adequately
- Reduce the number of blood draws, including CBGs (confer with MD if necessary)

Urinary Bladder Catheterization

- Comfort measures, including oral sucrose

Potentially Painful Procedures	
Chest Tube Removal	Ostomy Care
Central Line Removal	ROP Exam
Dressing Changes	Subcutaneous Reservoir Tap
Endotracheal Suctioning	Venipuncture
OG/NG Tube Placement	Adhesive / Tape Removal
Echocardiogram	

- Utilize as many comfort measures as possible
- Non-nutritive sucking (pacifier) with MBM should be emphasized first, then consider oral sucrose, particularly for ROP exams
- Avoid excessive endotracheal suctioning (i.e. RT and RN duplicating procedure unnecessarily)

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Reviewed November 2019 – Lee / Brown RPh / Bauserman