

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 similarly effective in decreasing pain to as breastfeeding and oral sucrose in decreasing pain
- Breast feeding (for infants \geq 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 0.5-2.0 mL of Sweet-ease PO to term infants and 0.1-0.42 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 delayed onset of 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

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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 cm²).*
- *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 **forte** 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: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~~30~~ mg/kg/day

PMA > 37 weeks: 7.5-10 mg/kg/dose every 8~~6~~ hours; ~~may increase frequency to every 6 hours;~~ maximum daily dose 40~~30~~ 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

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Commented [BA6]: ≥ 37 weeks: 12.5-15 mg/kg PO every 6 hours

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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 nNo 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 ~~r~~risk of hypotension. Morphine isAlso 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~~S~~ 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)***

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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.

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VERY PAINFUL PROCEDURES

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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 at least 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 ~~that~~ 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.

Non-emergent Intubation

- ~~Begin with a dose of Atropine 0.02 mg/kg IV; slow "push is acceptable~~
- ~~Give fentanyl bolus (2 mcg/kg IV over 5 minutes) and then manually ventilate as needed while waiting for maximal effect~~
- ~~Once sedated, a paralytic (i.e. rocuronium 0.5 mg/kg IV push) may be given for large / near term infants, to reduce the risk of airway trauma. A fellow or attending must be present at the bedside if a non-intubated infant is given a paralytic as emergent intubation may become necessary~~
- ~~Emergent intubations should be performed without waiting for medications to be given~~

ROP Procedures

Laser Surgery

- Fentanyl bolus, repeat as needed based on PIPP score
- Paralytic (~~v~~ecuronium 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~~sticks/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.

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- Consider fentanyl bolus if unsuccessful after the second attempt

Quite 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.
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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

Mildly 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)

References:

1. AAP COMMITTEE ON FETUS AND NEWBORN and SECTION ON ANESTHESIOLOGY AND PAIN MEDICINE. Prevention and Management of Procedural Pain in the Neonate: An Update. *Pediatrics*. 2016;137(2)
2. Stevens B, Johnston C, Petryshen P, Taddio A. Premature Infant Pain Profile: development and initial validation. *The Clinical journal of pain* 1996;12:13-22.
3. Ballantyne M, Stevens B, McAllister M, Dionne K, Jack A. Validation of the premature infant pain profile in the clinical setting. *The Clinical journal of pain* 1999;15:297-303.
4. Corff KE, Seideman R, Venkataraman PS, Lutes L, Yates B. Facilitated tucking: a nonpharmacologic comfort measure for pain in preterm neonates. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG* 1995;24:143-7.
5. Fearon I, Kisilevsky BS, Hains SM, Muir DW, Tranmer J. Swaddling after heel lance: age-specific effects on behavioral recovery in preterm infants. *Journal of developmental and behavioral pediatrics : JDBP* 1997;18:222-32.
6. Eriksson M, Gradin M, Schollin J. Oral glucose and venepuncture reduce blood sampling pain in newborns. *Early human development* 1999;55:211-8.
7. Bucher HU, Moser T, von Siebenthal K, Keel M, Wolf M, Duc G. Sucrose reduces pain reaction to heel lancing in preterm infants: a placebo-controlled, randomized and masked study. *Pediatric research* 1995;38:332-5.
8. Stevens B, Johnston C, Franck L, Petryshen P, Jack A, Foster G. The efficacy of developmentally sensitive interventions and sucrose for relieving procedural pain in very low birth weight neonates. *Nursing research* 1999;48:35-43.
9. Stevens B, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database Syst Rev* 2000:CD001069.
10. Anand KJ. Consensus statement for the prevention and management of pain in the newborn. *Archives of pediatrics & adolescent medicine* 2001;155:173-80.
11. Anand KJ. Clinical importance of pain and stress in preterm neonates. *Biology of the neonate* 1998;73:1-9.
12. Spence K, Henderson-Smart D, New K, Evans C, Whitelaw J, Woolnough R. Evidenced-based clinical practice guideline for management of newborn pain. *Journal of paediatrics and child health* 2010;46:184-92.
13. Durrmeyer X, Vutskits L, Anand KJ, Rimensberger PC. Use of analgesic and sedative drugs in the NICU: integrating clinical trials and laboratory data. *Pediatric research* 2010;67:117-27.
14. Pain assessment and management: Guideline for practice. *National Association of Neonatal Nurses*. (Document 1222) 2001.
15. Stevens B, Yamada J, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database Syst Rev* 2004:CD001069.
16. Codipietro L, Ceccarelli M, Ponzzone A. Breastfeeding or oral sucrose solution in term neonates receiving heel lance: a randomized, controlled trial. *Pediatrics* 2008;122:e716-21.
17. Spasojevic S, Bregun-Doronjski A. A simultaneous comparison of four neonatal pain scales in clinical settings. *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet* 2011;24:590-4.
18. Brummelte S, Grunau RE, Chau V, Poskitt KJ, Brant R, Vinal J, Gover A, Synnes AR, Miller SP. Procedural pain and brain development in premature newborns. *Ann Neurol*. 2012 Mar;71(3):385-96.
19. Gitto E, Pellegrino S, Manfreda M, Aversa S, Trimarchi G, Barberi I, Reiter RJ. Stress response and procedural pain in the preterm newborn: the role of pharmacological and non-pharmacological treatments. *European Journal of Pediatrics*. 2012 Jun;171(6):927-33.
20. Shah PS, Herbozo C, Aliwalas LL, Shah VS. Breastfeeding or breast milk for procedural pain in neonates. *Cochrane Database Syst Rev*. 2012 Dec 12;12:CD004950.
21. Attarian S, Tran LC, Moore A, Stanton G, Meyer E, Moore RP. The neurodevelopmental impact of neonatal morphine administration. *Brain Sci*. 2014 Apr 25;4(2):321-34.
22. Francis, K. What is best practice for providing pain relief during retinopathy of prematurity eye examinations? *Advances in Neonatal Care*. 2016 June; 16(3): 220-228.
23. Ho, L.P., Ho, S.M., Leung, D.Y., So, W.K., Chan, C.W. A feasibility and efficacy randomised controlled trial of swaddling for controlling procedural pain in preterm infants. *Journal of Clinical Nursing*. 2016 25(3-4): 472-482.
24. Zeller, B., Giebe, J. Pain in the neonate: Focus on nonpharmacologic interventions. *Neonatal Network*. 2014 November/December; 33(6): 336-340.