It’s Just a Poke (Prick), Right?
Needle Pain Management in Pediatrics

Stefan J. Friedrichsdorf, MD, FAAP
Medical Director, Department of Pain Medicine, Palliative Care & Integrative Medicine
Children’s Hospitals and Clinics of Minnesota, Minneapolis/St. Paul, MN
Associate Professor of Pediatrics, University of Minnesota Medical School
stefan.friedrichsdorf@childrensMN.org  Twitter: @NoNeedlessPain

FUN FACTS Minneapolis, Minnesota:
• City of 10 Lakes (& 187 parks!); 3.5 million people in metro
• Snowy winter; groovy spring, summer & fall
• Minnesota home to 19 Fortune 500 companies, more than any other state
• America’s most literate city
• Biggest shopping mall in US
• Most theater seats after New York City
• Children’s Minnesota: 10th largest in US, 385 beds, 50% ICU
• Our department: 33.6 FTE

Minneapolis / St. Paul (Minnesota)
Learning Objectives

- Identify myths and misconceptions around needle pain prevention ["attitude"]
- Appreciate high incidence and importance of preventing needle pain ["knowledge"]
- Evaluate the four “non-negotiable” components of needle pain management and design implementation plan for your own clinical environment ["skill"]

What are children most afraid of when coming to see a doctor?

What argument might colleagues voice against effective needle pain strategies, such as
(1) topical anesthesia
(2) sucrose (0-12 months)
(3) positioning,
(4) distraction
for all children undergoing vaccinations, injections, IV access or lab draws?
Don't have enough staff for pediatric pain control...?

Funny, how there is always enough staff to restrain a child.

Needle Pain: A Call for Action

- Needle procedures (incl. vaccine injections) performed in childhood are a substantial source of distress
  - By age 2: 14-20 vaccine injections in US
  - Children get behind in vaccination schedule

- Needle fear was the primary reason for immunization non-compliance for 7% and 8% of parents and children, respectively
  

- It is estimated that up to 25% of adults have a fear of needles (with most fears developing in childhood)
  

- Untreated needle pain can have long-term consequences including
  
  

  - preprocedural anxiety
  - hyperalgesia
  - needle fears
  - avoidance of health care (including nonadherence with vaccination schedules

Procedural Pain: A Call for Action
Procedural Pain in the Neonate


- Exposure to severe pain on NICU, without adequate treatment, has negative long-term consequences
  - ↑ morbidity (hypoxia, coagulopathy, respiratory incoordination, increased intracranial pressure)
  - ↑ risk of IVH

Pain in the Neonate: Why bother?


Procedural pain: A Call for Action


Procedural pain: A Call for Action

Pain ratings at 4-6 months routine vaccination higher for circumcised versus uncircumcised boys:


- 42 boys received DPT and 18 also received HIB. After DPT, median visual analogue scores by an observer were higher in the circumcised group (40 vs 26 mm, p = 0.03). After HIB, circumcised infants had higher behavioral pain scores (8 vs 6, p = 0.01) and cried longer (53 vs 19 s, p = 0.02). Thus neonatal circumcision may affect pain response several months after the event. Taddio A, Goldbach M, Ipp M, Simons R, Koren G. Effect of neonatal circumcision on pain response during vaccination in boys. Lancet. 1995;345(8945):291-2.


- Children (5-10 yrs) perceive their parents as worried, when they reassure (e.g. “it’s okay”) - whereas distraction is associated with increased child coping. McMurtry CM, Chambers CT, McGrath PJ, Agninis A. “Don’t worry” consequences for children’s perceptions of parental reassurance and distraction during painful medical procedures. Pain. 2010 Jul;150(1):52-8.


Guidelines...


Pain outcomes in a US children's hospital: a prospective cross-sectional survey

In past 24 hrs, what was cause of worst pain?

- **40% Needle poke**
- 34% Trauma/injury/other medical
- 10% Surgery
- 8% Procedure
- 4% Acute illness/infection
- 3% Treatment for known disease


http://vimeo.com/106286508

“Non-Negotiable”

- Topical Anesthesia
- 0-12 months: Sucrose
- Positioning
- Distraction (Integrative “non-pharmacological” therapies)

Develop Plan B (or deferral process)

- Child life, psychology
- Nitrous gas sedation
- Consider moderate-deep sedation, if excellent analgesia cannot be achieved
- other approaches

Watch videos at childrensMN.org/comfortpromise.

4 steps to make needles less painful

1. Numb the skin
2. Sugar water or breastfeeding for babies
3. Comfort positioning
4. Distraction

Watch videos at childrensMN.org/comfortpromise.
Avoid Finger Pokes & Heel Lance

- Venepuncture versus heel lance? Venepuncture, when performed by a skilled phlebotomist, appears to be the method of choice for blood sampling in term neonates. The use of a sweet tasting solution further reduces the pain Shah VS, Ohlsson A. Venepuncture versus heel lance for blood sampling in term neonates. Cochrane Database Syst Rev 2011; (10): CD001452.

- Finger-Prick? In order to avoid pain of finger pricking, one straightforward approach developed some years ago was to obtain the blood drop at other sites. Heinemann L. Finger pricking and pain: a never ending story. Journal of diabetes science and technology 2008; 2(5): 919-21.


“Non-negotiable” Components of Needle Pain Prevention in Children

1. Numbing
2. Sucrose
3. Positioning
4. Distraction

http://vimeo.com/106286508

Topical Local Anesthetics


  Topical anesthetics considered safe for children of all ages. However, administration of excessive doses and/or prolonged application times can lead to serious adverse effects, including irregular heartbeat, seizures and difficulty breathing. Taddio A, Obsthaler E, Jones L, Guzzo V, Yuki M, Goullouz B, et al. Reducing the pain of childhood vaccination: an evidence-based clinical practice guideline. CMAJ: Canadian Medical Association journal 2010 Dec 14;182(18):E843-55.

- insufficient evidence for or against use of skin-cooling techniques (vapocoolants, ice, cool/cold packs) to reduce pain at time of injection.
**EMLA versus LMX**

- EMLA Cream (lidocaine 2.5% and prilocaine 2.5%) vs Ela-Max LMX 4% Lidocaine Topical Anesthetic Cream
  
  

- 4% Lidocaine: 30 minutes application as effective as 60 minutes

- EMLA application for preventing pain during IV insertion in Children

- Analgesia duration:
  - EMLA 1-2 hours vs. LMX 1 hour

- Skin time:
  - EMLA 4 hours vs. LMX 2 hours

**Success of venipuncture or venous cannulation in children**

- 388 children (255 with EMLA, 133 without).
  

- 86% percent of in the EMLA group

- 76.7 % in the no EMLA group

**Ametop gel (4% amethocaine [tetracaine])**


- EMLA and amethocaine gel comparable efficacy for procedural pain relief in children, but EMLA requires longer application time (60 vs 30 minutes)
EMLA and Neonates


Application of Cream

- Consider Cellophane (transparent film dressing [e.g. Tegaderm] might hurt at time of removal)

Needle pokes without the pain?

J-Tip in the Emergency Room (CBS 4 Morning News)
J-Tip (Lidocaine)

- J-tip: single-use, disposable, carbon-dioxide-powered, needle-less lidocaine injector
- Adults: More pain than s.c. lidocaine


Needle pokes without the pain?

J-Tips at Children’s of MN

“Non-negotiable” Components of Needle Pain Prevention in Children

2. Sucrose

3. Positioning

4. Distraction

http://vimeo.com/106286508
Sucrose for Children 0-12 months

- Reduces pain (PIPP, VAS) and cry during painful procedure, such as venipuncture
  - Role of endogenous opioids - naloxone blunts effect
    - Effective dose (24%): 0.05 - 0.5 mL (~ 0.012 - 0.12 g)
    - Administration 2 minutes prior to mild - moderately painful procedure
    - Duration ~ 4 min

- Breastfeeding
  - Effective in term infants (superior to sweetening agents)
  - Ineffective in preterm infants?

Breastfeeding

Effective in term infants (superior to sweetening agents)

- Shah PS, Cochrane Database of Systematic Reviews 2006, Issue 3

Ineffective in preterm infants?


Sucrose for Children 0-12 months

Infants

Procedural Pain

Classification of Procedures on NICU (from clinicians' opinions)

- No pain (0-2): head u/s, chest x-ray, diaper change
- Discomfort (2-4): nasal prongs, eye exam (no manipulation), nasal/oral suction, NG tube, extubation
- Real pain (4-6): tracheal suction, umbilical cath, bladder cath, S/Q injection, remove CVL/art line/Tcp
- More pain (6-7): heel stick, I/M injection, venipuncture, peripheral IV, remove chest tube
- Lots of pain (7-8): arterial puncture, tracheal intubation, arterial catheter, CVL catheter
- Unbearable pain (8-10): circumcision, lumbar puncture, chest tube placement, bone marrow biopsy

Neonates

Nonpharmacologic, supportive measures:
- Breastfeeding (Shah PS, Cochrane Database of Systematic Reviews 2006, Issue 3)
- Sucrose (Stevens B, Cochrane Database of Systematic Reviews 2004, Issue 3)
- Nesting/Swaddling
- Kangaroo care (Gray Pediatrics 2000; Johnston APAM 2003)
- Dimming light & noise


Premature 28-36 wks: For heelstick Kangaroo care more effective than oral glucose, which is more effective than placebo

Morphine does NOT provide adequate analgesia for acute procedural pain among preterm neonates

Providing natural warmth [Infant Warmer System] to newborn infants during painful procedure decreases crying and grimacing on par with the "gold" standard treatments of sucrose or pacifier.

Combination of sucrose and radiant warmth effective analgesic in newborns; reduces pain better than sucrose alone

Integrative Therapies for Neonates
Suggested Ladder of Pain Management for Neonates

1. Avoid Painful Procedures
2. Sucrose, Pacifier, Kangaroo Care, Swaddling
3. Topical Anesthetic Cream
4. Acetaminophen (Paracetamol) PO or PR
5. Opioids (Fentanyl, Morphine) - slow infusion plus bolus
6. Local Anesthetics: SC infiltration; nerve blocks
7. Deep Sedation/Analgesia or General Anesthesia

Medium - Severe Pain

Mild (- Medium) Pain


dummy (Aus.) = pacifier (US)
3. Positioning

“Non-negotiable” Components of Needle Pain Prevention in Children

http://vimeo.com/106286508

Pediatric Analgesia in 1985
“Papoose Boards”

4 Sizes to Fit All Ages

- New, Small Size
- Regular Size
- Large Size
- Extra Large Size

• When feasible, offer choice to child (parent's lap?)

• Parents not “partners in crime”

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**Comfort Positions**

Children’s of Central California, Madera 2014

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**Comfort positions for needle procedures**

**Babies (0-12 months)**
- Held by parent
- Comfortable short to do
- Pacifier with sugar water or breastfeeding
- Distraction: favorite toy, blanket or music

**Toddlers and preschoolers (1-5 years)**
- Held by parent, sitting upright is best
- Distraction: bubbles, books, toys or music

**School age (6-12 years)**
- Held by parents or close by, upright is best
- Distraction: interactive toys, books or electronics
- Child may choose to watch or lay down

**Teens (13-18 years)**
- Parents available
- Sitting upright is best
- Distraction: interactive toys, books or electronics
- Teen may choose to watch or lay down
Swaddling, facilitated tucking, kangaroo care
Thanks to C. Celeste Johnston
Johnston et al in Arch Ped Adol Med 2003


“Non-negotiable” Components of Needle Pain Prevention in Children
With quote from our phlebotomist

http://vimeo.com/106286508
Integrative Therapies for Needles Procedures


- Strong evidence that **distraction and hypnosis** effective in reducing pain and distress that children and adolescents experience during needle procedures
- Promising but limited/no evidence for preparation and information or both, combined CBT, parent coaching plus distraction, suggestion, or virtual reality

### Integrative Therapies for Needle Procedures


- **Parent coaching**: Certain types of parental behaviors (e.g., nonprocedural talk, suggestions on how to cope, humor) have been related to decreases in children’s distress and pain, whereas others (e.g., reassurance, apologies) have been related to increases in children’s distress and pain Taddio A, Chambers CT, Halperin SA, et al. Inadequate pain management during childhood immunizations: the nerve of it. Clin Ther 2009;31(Suppl 2):S152-67.

### Distraction (Led by Provider, Parent/Caregiver or Child)

- Distraction is a technique to attract the child’s attention away from the procedure. It is effective for children of all ages.
- Use procedural language and allow the child to help select the distraction. Allow children to choose for the child and involve them in helping with distractions.
- Choose an engaging distraction strategy. Imagine fun, bubbles,6 singing, dressing the imagination (e.g., “Is your mind on other things that would be of interest to them?”)
- Touch: toys, balloons, pacifiers, shops, party blowers, etc. Touching, singing, applying attention to something in the environment (e.g., rocking doll)
- Nonverbal cues (e.g., music, blinking, nonverbal talk (talking more, etc.)
- Acheivement: games, videos, cartoons, toys, etc.
- Easy listening music, etc.

### Deep Breathing

- Promote children’s ability to take slow deep breaths.
- Deep breaths can be facilitated by a parent’s presence or pacifiers, which are used as distracting techniques.

### Simple Suggestion

- **DO NOT tell children that “it won’t hurt”** because evidence shows that this is ineffective. It is better to be honest and let children know potential discomfort will be experienced.
Distraction

- Reduction of fear and anxiety
- Determine if child wishes to watch or be distracted
- Young children: books, bubbles and pinwheels
- Coaching roles for parents
- Older children: video games and biofeedback

Children’s Youth Advisory Counsel
https://vimeo.com/128990829
Do you remember Marius...?

How about a Plan B!

LET Anesthesia

- Sitting upright
- Distraction
- Topical Anesthesia
- 3mL LET-gel: Lidocaine 4%-Epinephrine 0.18% - Tetracaine 0.5%


How many mistakes can you spot?

“Non-negotiable” Components of Procedural Pain Prevention in Children

Plan B
(or deferral process)

(5) (Intranasal) Systemic Analgesia
(6) Sedation

Nasal mucosa richly vascularized
- Fenestrated epithelium drains by way of the facial and
  sphenopalatine veins
- Avoiding first pass metabolism

- Hydromorphone: ER trauma patients - plasma concentration similar to those after IV administration


Intranasal Opioid Application

- Drops or spray diluted in normal saline 0.9%
- Pharmacokinetic profile similar to i.v. in children

https://intranasal.net/deliverytechniques/default.htm
Intranasal Fentanyl Application:
Pharmacokinetic profile similar to i.v. in children

- RCT: 24 children (4-8 years);
  Burn dressing changes; Control: oral morphine; Titrated until pain free;
  intranasal dose slightly higher (1.4 mcg/kg + 15 mcg Q5min) 
  - pain relief comparable; safety profile acceptable, no serious adverse events
- RCT: 32 children (3-12 years), postoperative analgesia, control: i.v. fentanyl, titrated until pain free
  - intranasal dose slightly higher (1.4 mcg/kg); pain relief comparable; safety profile acceptable, no serious adverse events
- Case report: Acute pain ER, 48 children (3-12 years), dose applied every 5 minutes as required
  - Median dose: 1.5 mcg/kg; good pain control; no side effects

What’s Plan B?
If adequate procedural analgesia not feasible with the “4 Non-Negotiables” alone, refer patient to:

1. Child Life (shouldn’t have been involved by now?)
2. Needle Phobia: psychology (CBT)
3. Mild sedation: Nitrous gas

or
4. Moderate/deep sedation (e.g. ketamine, propofol)

Note:
A sedative alone (such as a benzodiazepine) can never be a substitute for procedural analgesia.

Numbing the skin under general anesthesia?

- Topical anesthesia “numbing the skin” even works for kids under general anesthesia

  "Excuse me, but is this The Society for Asking Stupid Questions?"

- 51 children (ages 1-12 years) under sevoflurane monoaesthesia: Clinical cannulation evoked significant increase (34.2 +/- 8.3%) in delta activity (P=0.042), without concomitant changes in heart rate or reflex withdrawal, which was not observed when local anaesthetic was applied (P=0.30). Herley C, Poonan R, Goksan S, et al. Noxious stimulation in children receiving general anaesthesia evokes an increase in delta frequency brain activity. Pain. Nov 2014;155(11):2368-2376

- S 90 children (ages 5-13 years) under halothane: Clinical cannulation evoked significant increase in delta activity (P<0.05), without concomitant changes in heart rate or reflex withdrawal. Protoman canalisation evoked no significant increase in delta activity (P>0.05). Havelka S, et al. Clinical cannulation evokes a significant increase in delta activity in children receiving general anaesthesia. Pain. Oct 2015; 156(9):1699-1702
IV Access Under Nitrous Gas

22 months-old, Lidocaine 4% cream in place, needed IV for radiologic procedure, history of challenging IV access in
the past.

Educating parents?

- educating parents about pain management in a hospital outpatient setting leads to higher use of pain interventions
185-191
- "It Doesn’t Have to Hurt" initiative led by Centre for Pediatric Pain Research http://itdoesnthavetohurt.ca
- Children’s Comfort Promise: Family/Patient Education for different age-groups:
  - Family-intro: http://vimeo.com/105979936
  - Family-infants http://vimeo.com/105979255
  - Family-toddlers http://vimeo.com/105979947
  - Family-school age http://vimeo.com/105979937
  - Family-teens http://vimeo.com/105979942

www.cmaj.ca/cgi/content/full/cmaj.101720/DC1
Implementation plan for prevention and treatment of needle pain

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3-year Systemwide Lean Value Stream

We will do everything possible to prevent and treat pain.

Progress to Date: Children Impacted (annually):

- Radiology: 90%
- Emergency Room: 95%
- Neonatal: 90%
- Critical Care: 90%
- Primary Care: 90%
- Specialty: 90%

4,500 Children Impacted
Picker Systemwide: Pain controlled all the time

Usually/Always

Q3 2014
Q4 2014
Q1 2015
Q2 2015
Q3 2015

Roll-out

Conclusions Needle Pain Prevention

Treatment protocol for painful procedures is expected standard of care in 21st century:

Non-negotiable:
• positioning, topical anesthesia, integrative therapies, sucrose
• plus/minus sedation

Further Reading

Reducing pain during vaccine injections: clinical practice guideline

Just say stop!

http://pediatric-pain.ca/it-doesnt-have-to-hurt

www.childrensMN.org/comfortpromise

Further Training: CIPPC@ChildrensMN.org

10th Annual Pediatric Pain Master Class
- Minneapolis, Minnesota, USA | June 17-23, 2017

Education in Palliative & End-of-life Care (EPEC): Become an EPEC-Pediatrics Trainer
- Montréal, Quebec, Canada | April 29-30, 2017 (Professional Development Workshop: 04/28/17)