

Common Challenges in Pediatric Pain

- **Myth:** children do not feel pain as their nervous system is not developed¹
- **Myth:** Let's get it over with quickly; he won't remember, he's scared.
- Failure to anticipate pain. (e.g. urethral caths, NG tube, labwork)
- Failure to assess² or difficulty in assessing pain in very young
- Fear of masking signs of a more serious etiology → No adverse outcome or delays in diagnosis attributed to admin of narcotic analgesia in acute abdominal pain^{3,4,5}
- Fear of adverse events & overdose (sedation, respiratory depression)⁶
- Tendency to underdose (lack of parent/caregiver understanding of toxicity; dosing without dose calculation)⁷
- **Transitioning:** maintaining pain control from *Recovery to Ward to Home*

Pain Assessment in Pediatrics

- ↑ documenting of pain score assoc. with ↑ analgesic use & ↓ pain⁸
 - Self-report scales⁹: 0-10 Numerical^{age 8+}; Faces Pain Scale-Revised *FPS-R*¹⁰, age 4+
 - Observational scales Observe changes from usual in these cues:
- | | |
|----------|---|
| Vocal | ♦ crying, screaming, yelling, moaning, whimpering |
| Social | ♦ quietness, irritability, difficult to console |
| Facial | ♦ furrowed brow, grimace, clenched teeth, tightly closed eyes |
| Activity | ♦ less movement, agitated, guarding of a body part |
| Physical | ♦ pallor, sweat, gasping/breathing change, tense/stiff |
| Other | ♦ changes in sleeping & eating patterns |
- See also FLACC scale: Face/Legs/Activity/Cry/Consolability¹¹; Reviews^{12,13}

Non-pharmacological Tips (↑ coping & pain threshold)

- **Neonate/infant:** bundle, kangaroo care, breast-feed, sucrose + sucking
- **Toddler:** distraction; **Older child:** preparation, explanation, distraction; assist parent on how to be calm; *non-procedural* talk most helpful.
- **Sucrose** Cochrane 14: best for single painful procedure (infant <18 months^{5,11,15}); + distraction. {Administer <2 minutes prior; 2ml of 25% sucrose solution e.g. *ToorSweet 24%* by oral syringe/dropper into mouth; or allow infant to suck from pacifier/breast. OK if NPO}
- Distraction/psychological techniques: Cochrane 16 very useful if age appropriate
 - o toys, books, bubbles, music, humour, TV, imagery, breathing, blowing pinwheel
 - o parent's presence; breastfeeding^{17,18}; position for comfort!; *Cough Trick*⁶⁵
- Pressure on injured or injection sites (e.g. immunizations¹⁰ seconds prior)
- Cold/hot compresses (e.g. cold for sprains, warmth for earache)
- Splinting, elevation, bandaging or dressing (immobilize area & ↓ pain)
- Information giving: brief description, what to expect feels cold/warm, little pinch, will help you!
- **NEVER, NEVER use the word needle¹⁹; don't let them see the needle**

EBM: Oral ibuprofen 10mg/kg = to oral morphine 0.5mg/kg post-op minor orthopedic

Specific Therapeutic Considerations

Abdominal acute -consider pain, age, ...	Opioid does not delay surgical decision ^{appendicitis²⁰} ; <i>Relaxed patient</i> ⇒ better exam & better diagnosis!
Burns, Minor ²¹ <5% TBSA in children	Cold compress x20-30min before applying a dressing. Give oral analgesic (ibuprofen or acetaminophen)
Chronic Daily Headache ^{22,23}	e.g. tension-type or transformed migraine; see migraine chart. TCAs, gabapentin, riboflavin, etc. Assess stressors & family hx! - consider analgesic rebound/overuse (if use >4x/week)
Earache acute otitis media (AOM): always treat pain whether "watchful waiting" or using antibiotics.	Acetaminophen or ibuprofen. Ensure adequate dose, initiate quickly (1st dose in emerg department/clinic!) Give round the clock x24-48hr. Warm heat-pad or cloth often helps. Ear drops: AURALGAN antipyrine & benzocaine: sensitizing; if perforated ear drum, avoid! Minimally effective ^{but option}
Emergency trauma (e.g. Musculoskeletal)	Ibuprofen in musculoskeletal trauma (extremities, back & neck) better than acetaminophen or codeine for pain relief and length of relief ²⁴ Opioids morphine suitable if moderate to severe pain
Heel poke	Breastfeeding, sucrose, sucking. Topical anaesthetic <u>no effect!</u>
Immunization* {pressure at site helps} Reviews: 25-28 Antipyretics may ↓ immune response.	25% oral sucrose & pacifier 2 minutes pre; effective ²⁷ {RCT ²⁸⁻³³ : infants ↓ pain 3.8 vs 4.8 @7min, return to baseline @9min} Topical anaesthetics: offer option to parents; OTC purchase; apply prior to appointment. Useful: ↓ pain 40%; (Table 2)
Lumbar puncture*	Topical anaesthetic; po acetaminophen or ibuprofen; may mix-in po midazolam ^{1yr +} ; sucrose if infant
NG Tube insertion	Lidocaine ^{Jelly} , sucrose & pacifier, or endotracheal ^{SPRY} if >2yr (burns & dose caution)
Open wound (Not near eye!) ²⁸ Explore to rule out retained foreign body!	Anaesthetics: administer <u>topically</u> e.g. LET , direct local infiltration or regional nerve block . Tetanus status? Tissue adhesive: ↓ pain in simple laceration <3cm ²⁹
IV insertion*	Sucrose alone in healthy term newborns, ↓ pain more than liposomal lidocaine +/- sucrose ⁶⁶ ; sucrose+EMLA was better if pre-term. Topical anaesthetics (Table 2); takes time to absorb; pain relief incomplete. Place in ≥2 sites over vein. (↑ in cannulation rate NTS ; ↓ procedure time ³⁰). Avoid mucous membrane contact or ingestion. AMETOP superior to EMLA for needles ³¹ ; Liposomal lidocaine MAXILENE effective, fast, less vasoactive. Vapocoolant Spray: PAIN EASE ; effect ≤60seconds ⁶⁴ . Nitrous oxide also useful.
Post-op analgesia. {Concurrent opioids via IV & epidural: resp.depr <1% ³² }	Start analgesia before child awakens (e.g. supp). Multimodal approach: pr naproxen or acetaminophen; if appropriate regional block (e.g. chest tube), epidural.

Preventing pain may decrease analgesic requirement for future procedures!

Q&As

Is alternating acetaminophen with ibuprofen appropriate?

- **Not** recommended by the Canadian Paediatric Society
- Increased risk of adverse events e.g. renal & potential for errors
- Monotherapy sufficient & preferred for vast majority³³. If not effective, may switch to or add the other. Mechanisms differ for pain; may give one round the clock, with other PRN for breakthrough.
- Reassess if pain unresolved; combining both is an option for pain

Alternatives in topical/local anaesthetic allergy?

- True allergy to local anesthetic is rare³⁴; often due to preservative
- Repeated use also ↑s potential for hypersensitivity reactions
- Consider formulation without preservative if available/suitable³⁵
- If allergy to amide (e.g. lidocaine, bupivacaine, mepivacaine, prilocaine): try an ester (procaine, tetracaine, benzocaine, cocaine) & vice versa.³⁶ {Allergy to both amide & ester: diphenhydramine^{1%} or benzyl alcohol; efficacy = to 1% lidocaine}

Extras: Drugs for Procedural Sedation (sedative/hypnotic adjuncts)

- Monitor for Procedural Sedation [check institution or department protocols & be aware of guidelines / liability implications. Should not be providing sedation & doing procedure.]
- **Midazolam:** as adjunct prior to minor procedures; PO onset 20-40min, duration 1hr; PO: <20kg: 0.5-0.75 mg/kg x1; ≥20kg: 0.3-0.5mg/kg/dose; Max 10-20mg PO; Note IV midazolam dose is MUCH lower than PO dose!!! (1/10th the dose) {IV: 0.05mg/kg/dose IV x1; repeat x1 prn; onset 10min}; **AE:** disinhibition, paradoxical agitation, **apnea**; Caution: ↓ hepatic or renal fx; **DI:** CNS depressants ↓ dose of both. {Nasal limited study: faster onset but ↓ sedation & duration than po; less effective than intranasal ketamine.³⁷}
- **Ketamine:** see protocol(s)³⁸; 0.5-2mg/kg IV; onset 1-5 min; duration 15-60min; **AE:** nystagmus, disassociative (looks awake but is asleep; inform parents); vivid dreams x48hrs (add low dose midazolam if ≥10 yrs to prevent nightmares); ↑BP, HR, salivation (co-administer atropine with 1st dose)³⁹; rash common but transient. Rare-Severe **AE:** laryngospasm, apnea, resp depression; recovery agitation, Preserves pharyngeal & resp fx. **CI:** airway instability, URTI, ↑ICP, ↑BP, acute globe injury, glaucoma, thyrotoxicosis, psych disorder. Age >1yr preferred; **DI:** 2B6.
- **N₂O:** (50/50mix O₂ demand valve): age >6: quick 3 min; short acting good for IV starts; **CI:** pneumothorax, bowel obstruction
- **Fentanyl** 1-4ug/kg IV x1 slow over 2 min; may repeat after 30-60min; rigidity possible with midazolam
- **Propofol:** CAUTION - SIGNIFICANT TOXICITY! ⇒ metabolic acidosis; ↑BP, ↑death in ICU! Reserve for anaesthesia. {Procedural sedation: 1mg/kg IVx1 then 0.5mg/kg q3-5min. Age >3}

- ⇒ **Route of administration:** generally use IV, PO; but PR rarely
 - o Avoid the IM route (add to pain; erratic absorption)⁴⁰
 - o PCA pump option in cancer pain for older children^{anaesthesia referral}
 - o Epidural: option if AEs systemic meds; psychological prep important
- ⇒ **Dosing:** by weight mg/kg or BSA and by the hour!!!
- ⇒ Be prepared to treat drug side effects as soon as they happen, or before {e.g. nausea, constipation & itch with opioids; dry mouth mouth care}

Table 1: Pain Medication in Pediatrics - Overview (See also RxFiles pain related charts at www.RxFiles.ca)

Drug	Dose in Peds [PO unless otherwise indicated]	Comments [Acetaminophen po: Max 90mg/kg/day some refs.]
Acetaminophen ^{TYLENOL} Liquids, chew-tab ^{80, 160mg} , Tab ^{325mg} , Supp ^{120mg, 325mg}	10-15mg/kg q4-6h; Max 75mg/kg/day ^{40wks} {Drops ^{Infant} : 80mg/ml; Liquid: 160mg/5ml Supp PR: 15-20mg/kg/dose Max 5 dose/24hr ^{OTC} }	• Caution if malnourished or dehydrated; ↑ hepatotoxicity? • Loading dose x1: Emerg or post-op option; ≤30mg/kg po; ≤40mg/kg rectal ⁴¹ ; (Toxic single dose <6yrs; ≥200mg/kg) Newborn 4-40wks: Max 60mg/kg/day; may give drops PR for doses ≤80mg
Ibuprofen ^{6Emon} Susp ^{20, 40mg/ml} ; Tab ^{100, 200mg}	5-10mg/kg q6-8h; Max 40mg/kg/day (Ibuprofen MOTRIN, ADVIL OTC Naproxen ALVEE OTC ≥12yrs)	• may give acetaminophen & NSAID together for pain ^{not fever} • some concern: long-term use may restrict healing ^{fractures}
Naproxen ^{>2yrs} Susp ^{25mg/ml} ; Tab ^{125mg}	2.5-5mg/kg BID; Max 20mg/kg/day; {PR: 25-49kg: 250mg/dose; ≥50kg: 500mg dose}	• caution in ↓ renal fx, dehydration & ? bleeding disorder • celecoxib FDA approval; Juvenile RA >2yrs 10-25kg: 50mg po BID
Codeine ^{>12}	0.5-1mg/kg PO q4h (requires metab 26%; ↑AEs)	• codeine <i>metabolizers</i> : <30% non-⇒ ineffective; rapid -⇒ ↑ risk;
Morphine Soln ^{1.5 mg/ml} ; Supp ^{5, 10mg} Tab ^{5, 10mg} (also SR & ER tabs)	0.2-0.4mg/kg PO q4h {IV: 0.05-0.1mg/kg IV/SC q2-4h} High alert drugs! Check drug & dose!	• codeine <i>not</i> for tonsil/adenoide-ectomy. *see approaches opioid • monitor respirations ♦ avoid meperidine (dysphoric, seizures) {reassess/titrate dose; forms: syrup & tab; codeine not PR}
HYDROMORPHONE FentaNYL ^{CAUTION!}	0.04-0.08 mg/kg PO q3-4h Patch officially CI: <18yrs & opioid naive;	• potent; chest wall rigidity in neonates; alternative routes used for incidental pain
Adjuncts for Neuropathic	Antidepressants (e.g. TCAs), anticonvulsants (e.g. gabapentin), tramadol: limited evidence, off-label use.	

♦ **Opioid Reversal:** naloxone **NARCAN** ♦ **Benzo Reversal:** Flumazenil (short acting, rarely needed). RA = rheumatoid arthritis SHR = Saskatoon Health Region
AE = adverse events **CI** = contraindications crm=cream **PACU** = post anesthesia care unit **PCA**=patient controlled analgesia

Table 2: Topical AnaestheticsOTC** Comments: use only on intact skin; avoid middle ear^{ototoxic}

AMETOP tetracaine (amethocaine) 4% Gel ^{x 95/15/1.5g} {ester} [write time on patch & remove per instructions blistering]	♦ Apply 30min ^{venipuncture} to 45min ^{venous cannulation} prior; lasts 4-6hrs after removal; Age: >1mo ^{term infant} ; Vasodilation ^(erythema, edema) Refrigerate* ¹ ; 1month @room temp
EMLA lidocaine ^{2.5%} + prilocaine ^{2.5%} crm ^{65/30g} ; Patch ^{5/8/25/25g} {amide} {Patch * cannot be cut; remove before MRI scan}	♦ 60+ min prior; occlusion required! Age: term infant; vasoconstriction (Rare: risk of methemoglobinemia: ↑ if <3mos; & in <1yr if DI's that ↑ Met-Hgb risk e.g. sulfonamides)
Lidocaine crm: 4% * LMX-4 , ELA-Max , {also 5% oint ⁷ }	♦ 60+ min prior; occlusion required! {vasoconstriction: venous access more difficult.}
MAXILENE Liposomal ¹ Lidocaine 4.5% ^{x 660-67/30g}	♦ 30+ min prior; last 1-2hr, occlusion not required; minimally vasoactive. (Avail: 4 or 5%)

Table 3: Other Local Anaesthetics** Comments: 45 minutes for good effect; **AVOID** mucous membranes⁴²

LET lidocaine 4% / epinephrine 0.1% / tetracaine 0.5% ^(SR) {Epinephrine (E): ↑ hemostasis, ↑ anaesthetic duration; AVOID: digits, nosetip, ear, penis (2° necrosis 2 nd artery)}	♦ topical anaesthetic for open wounds ^{esp facial/scalp} if <5cm ¹ in length; max 3mL 1) mix with cellulose ^{form gel} , apply to wound, cover - occlusive dressing 2) place LET soaked cotton ball into wound; apply pressure x20min
Methylcellulose / epinephrine 0.05% / cocaine 11.8%	♦ mixed solution with methylcellulose forms gel, preventing running; LET preferred!
Local Infiltration: 1) warm anaesthetic ^{37C} ; 2) use smaller gauge needle (e.g. 27 or 30-gauge); 3) inject at slow rate, proximal borders ^{1st} from inside wound edge, 4) pre-treat with topical anaesthetic, 5) consider buffering (sodium bicarb ^{0.9ml mix with 1ml 5mg/ml bicarb}); 6) pressure	
Lidocaine (L): onset rapid; duration ½ hr local (duration 1-2hr if regional block); Age 3yrs+ ✓ {L: 0.5%, 1%, 2%; L-E: 1%, 2% (L-E no preservative: 1.5%)}	Mepivacaine: onset 6-10min; duration 1-3hrs; - if Age <3yrs or weight <13.6kg, use [0.5-1.5%]; - little vasodilation & epinephrine seldom needed
	Bupivacaine (B): onset 8-12min; duration 4-6hr; Age 12yrs+ ✓; CI: sulfite allergy {B: 0.25%, 0.5%; B-E: 1%, 2%}

* avoid if amide allergy (rare); ** systemic toxicity (cardiac & CNS-seizures) possible but rare with appropriate use: (careful with dose & site).
 ⚡ = Exception Drug Status in SK * = Non-formulary in SK † = prior approval for NIHB ⊗ = not covered by NIHB ▼ = covered by NIHB

PEDIATRIC PAIN: Extras, Links & References

♦ **AMETOP: tetracaine** (amethocaine) **4% Gel**: Adults (including geriatrics) & children over 1 month of age: **Apply** contents of the tube to the skin starting from the centre of the area to be anesthetized & cover with an occlusive dressing. The contents expellable from 1 tube (approximately 1 g) will cover & anesthetize an area of up to 30cm² (6x5 cm (~ 3/4 area of a credit card)). Smaller areas of anesthetized skin may be adequate in infants & small children. Adequate anesthesia can usually be achieved for venepuncture following a 30-minute application time, & for venous cannulation following a 45-minute application time; after which the gel should be removed with a gauze swab & the site prepared with an antiseptic wipe in the normal manner. It is not necessary to apply tetracaine gel for longer than the above times & anesthesia is maintained for 4 to 6 hrs in most patients after a single application. [Clinical Trial in progress: Ametop vs Maxilene: <http://www.druglib.com/trial/02/NCT00353002.html>]

♦ **EMLA (lidocaine and prilocaine)** - for intact skin, requires occlusion, needs to be applied for at least one hour **Dose** — To attain adequate anesthesia, 1 to 2 g of EMLA cream should be applied per 10 sq cm (approximate size of a Canadian "toonie") of skin and covered with an occlusive dressing for 45 to 60 minutes. The maximum application areas recommended for children are Less than 10 kg —100 sq cm (~2.5x area of a credit card); 10 to 20 kg — 600 sq cm; Greater than 20 kg — 2000 sq cm; causes vasoconstriction & ? seizures.

See www.usask.ca/pediatrics/services/pain for information for parents on children's pain

♦ **acetaminophen use with vaccination**: may ↓ immunogenicity ∴ avoid if possible.
 ♦ **Benzocaine** –in NG tube placement controversial¹⁰ Causes methemoglobinemia!!! **AVOID!**
 ♦ **Lidocaine Intophoresis (Numby Stuff)**: mild electric current penetrates skin more quickly; effective in 10-20min.⁴³ EMLA similar or slightly better.^{44,45} (Tingle may be bothersome.)
 ♦ **TAC** tetracaine 0.5% / epinephrine 0.05% / cocaine ≤ 1.18%;⁴⁶ AE: seizures, arrhythmias, fatal; requires narcotic storage (LET preferred)
 ♦ **Cancer Pain**: Reference ⁴⁶
 ♦ **Urethral Catheterization**: lidocaine gel 2 min prior to insertion while setting up then use as the lubricant as well (video: <http://www.ahelthcare.com/press/meds/departments/urology/catheterization/index.htm>)
 ♦ **Acetaminophen vs ibuprofen**: <http://www.cps.ca/English/statements/DT/d98-01.htm> For fever:⁴⁷
 ♦ **SHR Peds Pain Links**: <http://www.usask.ca/pediatrics/services/pain/>
 ♦ **CADTH**. Short-Acting Agents for Procedural Sedation and Analgesia in Canadian Emerg.:

A Review of Clinical Outcomes and Economic Evaluation http://cadth.ca/media/pdf/00428_Short-Acting-Procedural-Sedation_to_a.pdf

Health Canada Advisory, March 2009: Caution regarding serious adverse events, including fatalities, with excessive application of topical anesthetics in adults & peds!

References {RxFiles Pediatric Pain Chart: Treatment Considerations, Q&As}

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⁴⁸Taddio **Pain Intensity Scoring:**

- ♦ Chose a scale that is age appropriate to patient & become familiar with using!
- ♦ Interpret in light of any other pain related physical factors (e.g. heart rate)
- ♦ Also interpret according to trends for improvement or worsening of pain control
- ♦ Sherbrooke algorithm for acute pain in children (post-op): gave regular analgesic according to pain scale: {0-3: acetaminophen; 3-6: naproxen + acetaminophen; 6-9: morphine + naproxen + acetaminophen; 9-10: notify MD. Overall ↓ in pain scores & a ↓ in opioid requirement.}
- ♦ Other links: **Visual Analogue Scale**: suitable for age 7+ [McGrath PA, Seifert CE, Speechley KN, et al. A new analogue scale for assessing children's pain: an initial validation study. *Pain*. 1996 Mar;64(3):435-43.] **Oucher Scale**: age 3-12: <http://www.oucher.org/history.html> BMJ Clinical Review: Pain Management and Sedation for Children in the Emergency Setting: http://www.bmj.com/cgi/content/full/339/oct30_1/b4234

FLACC SCALE – for assessing pain in very young children non-verbal; suitable for cognitively impaired			
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

♦ Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score ranging from zero and ten.

♦ From **The FLACC: A behavioral scale for scoring postoperative pain in young children**, by S Merkel and others, 1997.

Faces Pain Scale – Revised (FPS-R) – age 4+

This is a thumbnail image. The full-size FPS-R with instructions is available on page 3 at <http://www.iasp-pain.org/FPSR> Numbers are not shown to children.



From: Hicks CL, von Baeyer CL, Spafford PA, Van Koraar I, Goodenough B. The **Faces Pain Scale – Revised**. Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183. ©2001 International Association for the Study of Pain. Reprinted with permission.

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Vaccination & antipyretic interactions ^{Myers et al 2017}:

- Acetaminophen may interfere with pneumococcal vaccinations
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FDA Aug/12 is reviewing reports of children who developed serious adverse effects or died after taking **codeine** for pain relief after tonsillectomy and/or adenoidectomy for obstructive sleep apnea syndrome. Recently, three pediatric deaths and one non-fatal but life-threatening case of respiratory depression were documented in the medical literature.

FDA Jun/14 warns that prescription **oral viscous lidocaine** 2 percent solution should not be used to treat infants and children with teething pain. We are requiring a new Boxed Warning, FDA's strongest warning, to be added to the drug label to highlight this information. Oral viscous lidocaine solution is not approved to treat teething pain, and use in infants and young children can cause serious harm, including death

FDA May/18 is warning that over-the-counter (OTC) oral drug products containing benzocaine should not be used to treat infants and children younger than 2 years. We are also warning that benzocaine oral drug products should only be used in adults and children 2 years and older if they contain certain warnings on the drug label. These products carry serious risks and provide little to no benefits for treating oral pain, including sore gums in infants due to teething. Benzocaine, a local anesthetic, can cause a condition in which the amount of oxygen carried through the blood is greatly reduced. This condition, called methemoglobinemia, can be life-threatening and result in death.

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Health Canada Oct/20 is reminding parents and caregivers not to use products containing **benzocaine** in children under two years of age. Benzocaine products may cause a serious blood condition called methemoglobinemia (MeHb), which reduces the ability of red blood cells to deliver oxygen throughout the body.

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