

**Common Challenges in Pediatric Pain**

- **Myth:** children do not feel pain as their nervous system is not developed<sup>1</sup>
- **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 assess<sup>2</sup> 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<sup>3,4,5</sup>
- Fear of adverse events & overdose (sedation, respiratory depression)<sup>6</sup>
- Tendency to underdose (lack of parent/caregiver understanding of toxicity; dosing without dose calculation)<sup>7</sup>
- Maintenance of pain control when transitioning e.g. when going home

**Pain Assessment in Pediatrics (will vary with age, pain type, etc.)**

- **Documenting pain assessment:** assoc. with ↑analgesic use & ↓pain<sup>8</sup>
- **Self-report scales<sup>9</sup>:** e.g. **Acute:** NRS-11 Numerical (ensure numeric competency), age ≥ 6 yrs; **FPS-R** Faces Pain Scale-Revised, ≥ 7 yrs<sup>10</sup>; **CAS** Color Analogue Scale, ≥ 8 yrs. **Chronic:** NRS-11 ≥ 8 yrs; Other scales: Oucher numeric/photographic, Pieces of Hurt, VAS Visual Analogue Scale
- **Observational Report:** 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/Consolability<sup>11</sup>; Reviews<sup>12,13</sup>

**Non-drug Tips – Pain/Needle Pain {↑ coping & pain threshold}<sup>67</sup>**

**Use 3P Approach: Psychological** prep, distraction, **Physical** positioning, **Pharm.**

- **Parent:** assist on how to be calm; *non-procedural* talk most helpful
- **Neonate/infant:** bundle, kangaroo care, breastfeed, sucrose + sucking  
**Sucrose** Cochrane 14: best for single painful procedure (infant <18 months<sup>5,11,15</sup>); + distraction. {Administer <2 minutes prior; 2ml of 25% sucrose solution e.g. *Toor Sweet 24%* by oral syringe/dropper into mouth; or allow infant to suck from pacifier/breast. OK if NPO}
- **Toddler:** distraction; **Older child:** preparation, explanation, distraction
- **Distraction/psychological techniques:** Cochrane 16 very useful if age appropriate
  - toys, books, bubbles, music, humour, TV, imagery, breathing, blowing pinwheel
  - parent's presence; breastfeeding<sup>17,18</sup>; position for comfort!; *Cough Trick*<sup>65</sup>
- Pressure on injured or injection sites (e.g. immunizations<sup>5</sup> 10 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 needle<sup>19</sup>; 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**

<b>Abdominal acute</b> -consider pain, age, ...	<b>Opioid</b> does not delay surgical decision <sup>appendicitis<sup>20</sup></sup> ; <i>Relaxed patient</i> ⇔ <i>better exam &amp; better diagnosis!</i>
<b>Burns, Minor</b> <sup>21</sup> <5% TBSA in children	Cold compress x20-30min before applying a dressing. Give oral analgesic (ibuprofen or acetaminophen)
<b>Chronic Daily Headache</b> <sup>22,23</sup>	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)
<b>Earache</b> acute otitis media (AOM): always treat pain whether "watchful waiting" or using antibiotics.	Acetaminophen or ibuprofen. Ensure adequate dose, initiate quickly ( <b>1<sup>st</sup> dose in emerg</b> department/clinic!) Give round the clock x24-48hr. Warm heat-pad or cloth often helps. Ear drops: <b>AURALGAN</b> antipyrine & benzocaine: sensitizing; if perforated ear drum, avoid! Minimally effective <sup>but option</sup>
<b>Emergency trauma</b> (e.g. Musculoskeletal)	<b>Ibuprofen</b> in musculoskeletal trauma (extremities, back & neck) better than acetaminophen or codeine for pain relief and length of relief <sup>24</sup> <b>Opioids</b> morphine suitable if moderate to severe pain
<b>Heel poke</b>	Breastfeeding, sucrose, sucking. Topical anaesthetic <u>no effect!</u>
<b>Immunization*</b> (pressure at site helps) <small>Reviews: 21-24 Antipyretics may ↓ immune response; avoid giving pre-emptively.</small>	25% oral <b>sucrose</b> & pacifier 2 minutes pre; effective <sup>27</sup> {RCT <sup>28-33</sup> ; 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)
<b>Lumbar puncture*</b>	Topical anaesthetic; po acetaminophen or ibuprofen; may mix-in po midazolam 1yr+; <b>sucrose</b> if infant
<b>NG Tube insertion</b>	Lidocaine jelly; <b>sucrose</b> & pacifier, or endotracheal spray >2yr (burns & dose caution)
<b>Open wound (Not near eye)</b> <sup>28</sup> Explore to rule out retained foreign body!	<b>Anaesthetics:</b> administer <b>topically</b> e.g. <b>LET</b> , <b>direct local infiltration</b> or <b>regional nerve block</b> . Tetanus status? <b>Tissue adhesive:</b> ↓ pain in simple laceration <3cm <sup>29</sup>
<b>IV insertion*:</b>  <i>Use non-pharmacologic techniques. Explain steps if appropriate</i>	<b>Sucrose alone</b> in healthy term newborns, ↓ pain more than liposomal lidocaine +/- sucrose <sup>66</sup> ; sucrose+EMLA was better if pre-term. Biran <b>Topical anaesthetics</b> <sup>30</sup> : takes time to absorb; pain relief incomplete. Place in ≥2 sites over vein. (↑ in cannulation rate NNTs; ↓ procedure time <sup>30</sup> ) Avoid mucous membrane contact or ingestion. <b>AMETOP</b> superior to <b>EMLA</b> for needles <sup>31</sup> ; Liposomal lidocaine <b>MAXILENE</b> effective, fast, less vasoactive. <b>Vapocoolant Spray: PAIN EASE</b> ; effect ≤60seconds <sup>64</sup> . <b>Nitrous oxide</b> also useful.
<b>Post-op analgesia.</b> (Concurrent opioids via IV & epidural: resp.depr <1%) <sup>32</sup>	Start analgesia <b>before child awakens</b> (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!  
Link: [Management of Chronic Pain in Children & Young People](#) Scottish Guidelines 2018

**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 majority<sup>33</sup>. 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.
- May use concomitantly; if so, advise appropriate doses of each.

**Alternatives in topical/local anaesthetic allergy?**

- True allergy to local anesthetic is rare<sup>34</sup>; often due to preservative
- Repeated use also ↑s potential for hypersensitivity reactions
- Consider formulation without preservative if available/suitable<sup>35</sup>
- If allergy to amide (e.g. lidocaine, bupivacaine, mepivacaine, prilocaine): try an **ester** (procaine, tetracaine, benzocaine, cocaine) & vice versa.<sup>36</sup> {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 & Vital Signs. Check **protocols** & be aware of guidelines/liability implications (institutional/departmental/professional). Should not be providing sedation & doing procedure.

- **N<sub>2</sub>O:** (50/50mix O<sub>2</sub>, demand valve) : age ≥ 3: quick 3 min short acting good for IV starts; **CI:** pneumothorax, bowel obstruction
- **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.<sup>37</sup>}
- **Ketamine:** see protocol(s)<sup>38</sup>; 0.5-2mg/kg IV; onset 1-5 min; duration 15-60min; **AE:** nystagmus, dissociative (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 1<sup>st</sup> dose)<sup>39</sup>; 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.
- **Fentanyl:** rigidity possible with midazolam
- **Propofol:** CAUTION - SIGNIFICANT TOXICITY! ⇔ metabolic acidosis; ↑BP, ↑death in ICU! Reserve for anaesthesia.

**⇒ Route of administration:** generally use **IV, PO**; but PR rarely

- Avoid the **IM route** (add to pain; erratic absorption)<sup>40</sup>
- PCA pump option in cancer pain for older children <sup>anaesthesia referral</sup>
- Epidural: option if AEs to PO, IV meds; consider when indicated e.g. amputation
- Patch: convenient & less messy vs crms; strong adhesion & pain on removal.

**⇒ Dosing:** by weight mg/kg or per body surface area **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 <sup>mouth care</sup>)

**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.]
<b>Acetaminophen</b> <sup>TYLENO</sup> <sup>▼</sup> Liquids, chew-tab <sup>80, 160mg</sup> , Tab <sup>325mg, Supp<sup>120mg, 325mg</sup></sup>	10-15mg/kg q4-6h; Max 75mg/kg/day <sup>40weeks</sup> {Drops <sup>infant</sup> : 80mg/ml; Liquid: 160mg/5ml Supp PR: 15-20mg/kg/dose Max 5 doses/24hr} OTC	• Caution if malnourished or dehydrated; ↑ hepatotoxicity? • <b>(Loading dose</b> x1: Emerg or post-op option; ≤30mg/kg po; ≤40mg/kg rectal <sup>41</sup> ; {Toxic single dose <6yrs: ≥200mg/kg}; <b>Newborn 4-40wks:</b> Max 60mg/kg/day; may give drops PR for doses <80mg}
<b>Ibuprofen</b> <sup>2</sup> <sup>ibumon</sup> Susp <sup>20, 40mg/ml</sup> , Tab <sup>100, 200mg</sup>	5-10mg/kg q6-8h; Max 40mg/kg/day (ibuprofen <b>MOTRIN, ADVIL</b> OTC. Naproxen <b>ALVIE</b> OTC >12yrs)	• may give acetaminophen & NSAID together for pain, <sup>not fever</sup> • some concern in long-term use may restrict healing fractures
<b>Naproxen</b> <sup>2</sup> <sup>2yrs</sup> Susp <sup>25mg/ml</sup> , Tab <sup>125mg</sup>	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
<b>Morphine</b> Soln <sup>1, 5 mg/ml</sup> , Supp <sup>5, 10mg</sup> , Tab <sup>5, 10mg</sup> (also SR & ER tabs)	0.2-0.4mg/kg PO q4h <sup>High alert drugs!</sup> {IV: 0.05-0.1mg/kg IV/SC q2-4h} <sup>Check drug &amp; dose!</sup>	• monitor respirations • avoid meperidine (dysphoric, seizures) • reassess/titrate; forms: syrup, tab) • avoid tramadol in peds
<b>HYDROMORPHONE</b> <b>FentaNYL</b> <sup>CAUTION!</sup> <sup>7</sup>	0.04-0.08 mg/kg PO q3-4h Patch officially CI: <18yrs & opioid naive	• Note: <b>Codeine</b> <u>not</u> recommended in peds; Avoid in lactation (morphine toxicity risk in ultrarapid CYP2D6 metabolizers) • potent; chest wall rigidity neonates; alternative routes incidental pain
<b>Options for Neuropathic</b>	Antidepressants (e.g. TCAs), anticonvulsants (e.g. gabapentin, others), SNRIs (e.g. duloxetine)	

• **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 Anaesthetics\*\*OTC** Comments: use only on intact skin; avoid middle ear <sup>ototoxicid</sup>

<b>AMETOP</b> tetracaine (amethocaine) 4% Gel <sup>X</sup> <sup>515/1.5g</sup> {ester} [write time on patch & remove per instructions blistering]	• Apply 30min <sup>venipuncture</sup> to 45min <sup>venous cannulation</sup> prior; lasts 4-6hrs after removal; occlusion required! Age: >1mo <sup>term infant</sup> ; Vasodilation <sup>(erythema, edema)</sup> ; Refrigerate <sup>42</sup> .
<b>EMLA</b> lidocaine <sup>2.5%</sup> + prilocaine <sup>2.5%</sup> Crm. <sup>565/30g</sup> Patch <sup>138/2pat</sup> {amide} {Patch *X 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)
<b>MAXILENE 5</b> Liposomal <sup>4</sup> Lidocaine 5% Crm <sup>X</sup> <sup>564-72/30g</sup> Similar-alternative products 4-5% - LMX-4, ELA-Max {5% oint <sup>43</sup> }	• 15-45+ min prior; lasts 1-2hr, occlusion <u>not</u> required; minimally vasoactive. (Various products - strength may vary – e.g. LMX-4 = 4% crm)

**Table 3: Other Local Anaesthetics\*\*** Comments: 45 minutes for good effect; **Avoid mucous membranes**<sup>42</sup>

<b>LET</b> lidocaine 4% / epinephrine 0.1% / tetracaine 0.5% <sup>(SR)</sup> <b>Epinephrine</b> (E): ↑ hemostasis, ↑ anaesthetic duration; <b>AVOID:</b> digits, nose/tip, ear, penis (2° necrosis <sup>end artery</sup> )	• topical anaesthetic for <b>open wounds</b> <sup>esp facial/scalp</sup> if <5cm <sup>ln</sup> length; max 3mL 1) mix with cellulose <sup>form gel</sup> , 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 <sup>37C</sup>; 2) use smaller gauge needle (e.g. 27 or 30-gauge); 3) inject at slow rate, proximal borders 1<sup>st</sup>, from inside wound edge, 4) pre-treat with topical anaesthetic; 5) consider buffering (sodium bicarb 9ml mix with 1ml 1mEq/ml bicarb) for less pain, 6) pressure

**Lidocaine (L):** local onset rapid; duration ½ hr {duration 1-2hr if regional block, Age 3yrs+ ✓  
{L: 0.5%, 1%, 2%; L+E: 1%, 2%; (L+E no preservative: 1.5%)  
**Mepivacaine:** local 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):** local 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 X =Non-formulary in SK 7=prior approval for NIHB 8=not covered by NIHB 9=covered by NIHB

## PEDIATRIC PAIN: Online 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 30cm<sup>2</sup> (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](http://www.usask.ca/pediatrics/services/pain) for information for parents on children's pain

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

- ♦ **acetaminophen use with vaccination:** may ↓ immunogenicity ∴ avoid if possible.
- ♦ **Benzocaine** —in NG tube placement controversial<sup>10</sup> Causes methemoglobinemia!!! **AVOID!**
- ♦ **Lidocaine iontophoresis (Numby Stuff):** mild electric current penetrates skin more quickly; effective in 10-20min.<sup>43</sup> EMLA similar or slightly better.<sup>44,45</sup> (Tingle may be bothersome.)
- ♦ **TAC** tetracaine 0.5% / epinephrine 0.05% / cocaine ≤ 11.8%; AE: seizures, arrhythmias, fatal; requires narcotic storage (LET preferred)
- ♦ **Cancer Pain:** Reference <sup>46</sup>
- ♦ **Urethral Catheterization:** lidocaine gel 2 min prior to insertion while setting up then use as the lubricant as well (video: <http://www.ahc@care.com/hcpa/medica/departments/urology/catheterization/index.html>)
- ♦ **Acetaminophen vs ibuprofen:** <http://www.cps.ca/English/statements/DT/dt98-01.htm> For fever.<sup>47</sup>
- ♦ **SHR Peds Pain Links:** <http://www.usask.ca/pediatrics/services/pain/> ; **Clinic:** <https://momsandkidsask.saskhealthauthority.ca/infant-child-health/specialty-care/pain-clinic>
- ♦ **CADTH.** Short-Acting Agents for Procedural Sedation and Analgesia in Canadian Emerg.: [http://cadth.ca/media/pdf/00428\\_Short-Acting-Procedural-Sedation\\_to\\_e.pdf](http://cadth.ca/media/pdf/00428_Short-Acting-Procedural-Sedation_to_e.pdf)

A Review of Clinical Outcomes and Economic Evaluation [http://cadth.ca/media/pdf/00428\\_Short-Acting-Procedural-Sedation\\_to\\_e.pdf](http://cadth.ca/media/pdf/00428_Short-Acting-Procedural-Sedation_to_e.pdf)

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#### Vaccination & antipyretic interactions Wyszowski 2017;

- Acetaminophen may interfere with pneumococcal vaccinations
- Ibuprofen may interfere with pertussis and tetanus 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 April/12 is informing Canadians that it has requested companies to add new risk statements to the packaging and labelling of licensed benzocaine products. In April 2011, Health Canada reminded Canadians of certain health risks associated with **benzocaine** products, including a very rare but serious blood condition known as **methemoglobinemia** that can affect sensitive individuals.

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 (MetHb), which reduces the ability of red blood cells to deliver oxygen throughout the body.

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