UCSF Benioff Children's Hospitals

Pediatric Access Center
(877) 822-4453 (877-UC-CHILD)

Pediatric Emergency Medicine Guide

Evidence-Based Pathways and Clinical Pearls for Emergency Departments

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Additional resources available at ucsfbenioffchildrens.org/ED-resources

Rev. 08.2025

Disclaimer: These clinical practice guidelines were developed by UCSF Benioff Children's Hospitals. They are intended to be used as a guide, but do not substitute for individual clinical judgment. Evaluation and treatment of specific patients should be adapted based upon the unique conditions of each patient, family and clinical environment. This material was published in August 2025.

UCSF Benioff Children's Hospitals

Overview

Introduction

This Pediatric Emergency Medicine Guide from UCSF Benioff Children's Hospitals is designed to provide clinicians throughout the community with rapid access to critical information. The guide contains evidence-based pathways and clinical pearls featuring best practices, guidelines, common antibiotics and medications, and child-specific dosing information.

Additional pediatric emergency resources can be found at **ucsfbenioffchildrens.org/ED-resources**.

UCSF Benioff Children's Hospitals Emergency Services

UCSF Benioff Children's Hospitals include two tertiary care pediatric emergency departments designed for infants, children and adolescents with serious illness and injuries. Our Oakland hospital is one of only three ACS-verified Level 1 Pediatric Trauma Centers in Northern California and is the region's highest-volume pediatric-only trauma center. Our San Francisco emergency department at Mission Bay is the city's only emergency department designed specifically for children and San Francisco's largest pediatric critical care receiving center. Together, our emergency departments care for more than 60,000 patients annually and facilitate thousands of transfers.

24/7 Pediatric Consultation & Transfer Services

Real-time support with just one call

UCSF Benioff Children's Hospitals have pediatric emergency physicians and subspecialists available 24/7 to consult on cases.

- Calls are answered by experienced pediatric critical care nurses who can quickly connect you with the right pediatric specialists.
- Transfers are efficient, with rapid acceptance and dispatch fully managed by our team.
- Expedited pediatric and neonatal transport is available, with helicopter access at both locations for your more seriously ill and injured patients.
- Transferring physicians are updated throughout the entire process.
- Inpatient teams provide comprehensive care, from general pediatrics to subspecialty and critical care services.

SCAN QR CODE TO CALL

For consults or transfers call:

Pediatric Access Center

(877) 822-4453 (877-UC-CHILD)

SCAN QR CODE TO VIEW

View the most recent version of this guide at ucsfbenioffchildrens.org/emergency-guide

EVIDENCE-BASED PATHWAY

Acute Asthma Exacerbations

Inclusion criteria:
- Age: > 24 months of age
- H/o asthma, reactive airway disease or wheezing +/- family history of asthma

Exclusion criteria:
- Contraindication/allergy to medications used within guideline
- Disease of other origin: pneumonia, bronchiolitis, croup
- Complicated medical history, including congenital/acquired heart disease, chronic lung disease/ bronchopulmonary dysplasia/cystic fibrosis, immune mediated disorders, tracheostomy

Criteria for radiographic imaging or labs:
- No absolute indication
- Consider radiographic imaging in children with fever > 39°C, hypoxia, focal abnormality on pulmonary examination, absence of family history of asthma, or those who respond less favorably than expected to bronchodilator therapy. May also be considered in patients with concern for presence of foreign body, pneumomediastinum or pneumothorax.
- Consider blood gas testing if there is a clinical worsening of mental status, neurologic and/or respiratory exam.

Discharge criteria:
- MPASS† ≤ 7
- Able to obtain/tolerate medicine and manage outpatient asthma

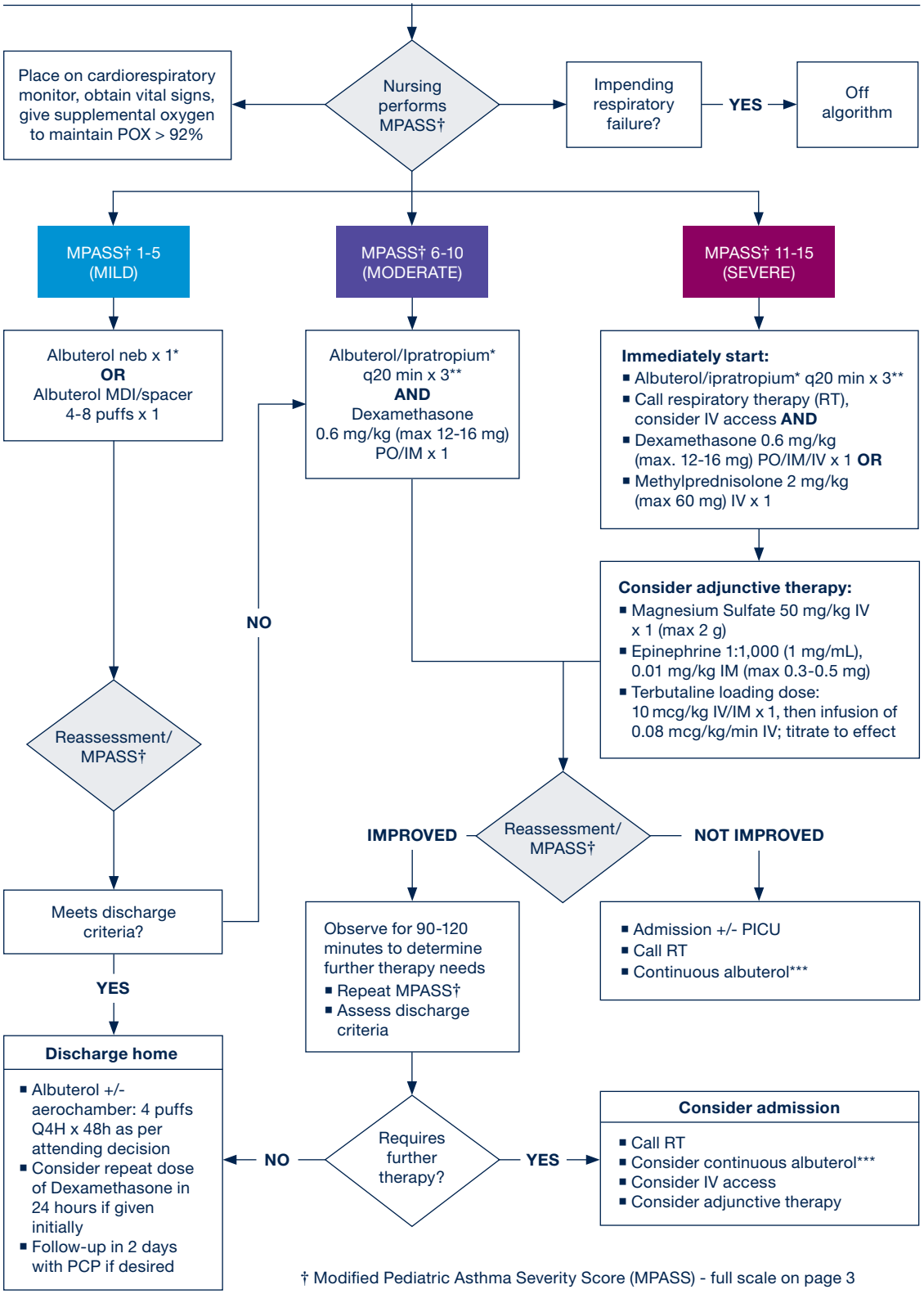
Dosing references:

* Albuterol:
< 20 kg (2.5 mg)
> 20 kg (5 mg)
Ipratropium:
< 20 kg (250 mcg)
> 20 kg (500 mcg)
Above dosing reference pertains to one-time nebulized treatments

** To be used with EZ-Flow device if available

*** Continuous Albuterol: 20 mg/hr

Respiratory Distress and Concern for Asthma Exacerbation



† Modified Pediatric Asthma Severity Score (MPASS) - full scale on page 3

Modified Pediatric Asthma Severity Score (MPASS)

	0	1	2	3
Oxygenation	> 98% on RA	95% - 97% in RA	90% - 94% on RA	< 90% on RA
Auscultation	No wheezing Normal breath sounds	End expiratory wheezes	Inspiratory and expiratory wheezes	Wheezing audible without stethoscope or silent chest
Retractions	No retractions	Intercostal retractions and/or diaphragmatic (belly) breathing	Two of the following: ▪ Intercostal ▪ Suprasternal ▪ Diaphragmatic (belly) breathing ▪ Nasal flaring (infant)	Three of the following: ▪ Subcostal ▪ Intercostal ▪ Substernal ▪ Supraclavicular ▪ Nasal flaring or head bobbing (infant)
Dyspnea	Absent dyspnea; speaks in complete sentences; alert; playful	Normal activity and speech. Some dyspnea, irritable, coughing after play	Decreased activity. 5- to 8-word sentences. Moderate dyspnea; not sleeping or eating; coughing after play	Not speaking. Severe dyspnea; grunting; lethargic, stops playing
Respiratory Rate				
Infant (birth - 1 yr)	< 60	60-80	81-99	≥ 100
Toddler (>1-3 yrs)	< 40	40-60	61-79	≥ 80
Preschool (> 3-6 yrs)	< 30	30-40	41-59	≥ 60
School Age (> 6 -12 yrs)	< 20	20-26	27-30	≥ 31
Adolescent (> 12-18 yrs)	< 18	18-23	24-27	≥ 28
Severity Scores	0	1-5 MILD	6-10 MODERATE	11-15 SEVERE

Approved: 1/2016 – Asthma Education Committee

MPASS has not been validated for use in the emergency department but is widely used for assessing asthma severity in UCSF Benioff Children's Hospitals.

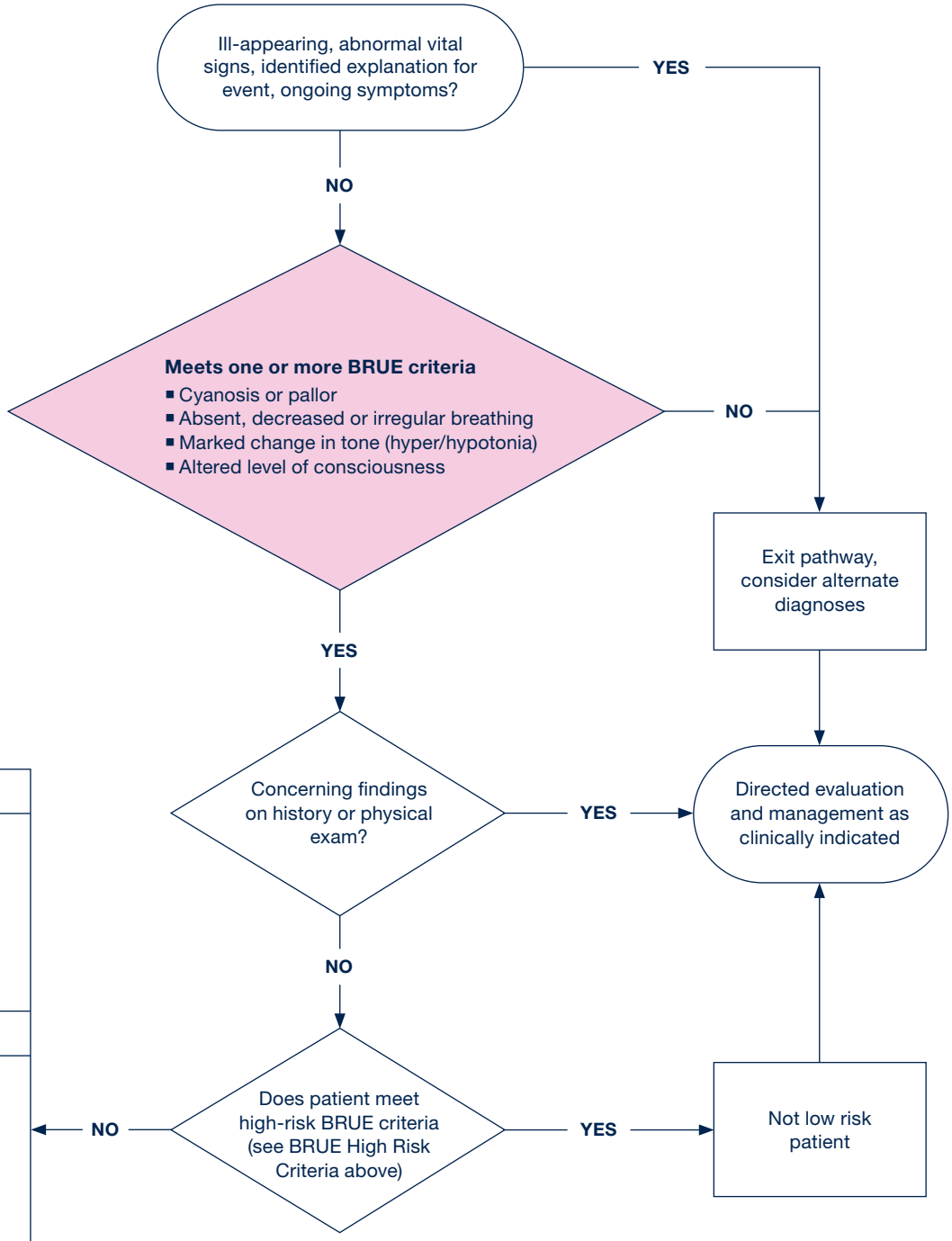
EVIDENCE-BASED PATHWAY

Brief Resolved Unexplained Event (BRUE)

Inclusion criteria:
- < 1-year-old with brief, resolved, unexplained event

Exclusion criteria:
- Significant underlying medical condition
- Not at baseline at time of evaluation

BRUE High Risk Criteria (any one of below)
- Age < 60 days
- Gestational age < 32 weeks and corrected gestation age < 45 weeks
- > 1 prior event
- Event lasted > 1 minute
- CPR by trained medical provider



Not necessary

- Routine lab or diagnostic testing
- Initiating home cardio-respiratory monitoring
- Medications for GER or seizures
- Admission solely for cardio-respiratory monitoring

Lower risk patient

- Educate caregivers about BRUE
- Engage in shared decision making
- Ensure close follow-up
- Observe patient in ED for 1-2 hours on continuous pulse ox and PO trial

Consider if clinically indicated

- 15 lead EKG
- Pertussis PCR, treat empirically if high level of suspicion

EVIDENCE-BASED PATHWAY

Febrile Infant 0-28 Days

UCSF Benioff Children's Hospitals

Inclusion criteria:
- Age: 0-28 days old
- Full term (≥ 37 weeks)
- Measured rectal temperature ≥ 38°C at home, outpatient or in ED

Exclusion criteria:
- Chronic medical condition
- Antibiotics in prior 72 hours

[1] **HSV risk factors:**
- Maternal fever or genital HSV lesions within 48 hours of delivery
- Infant: vesicles, seizures, mucus membrane ulcers, hypothermia
- Leukopenia, thrombocytopenia and/or elevated ALT
- CSF pleocytosis with non-bacterial profile

HSV infection should be considered if *any* of the above is present

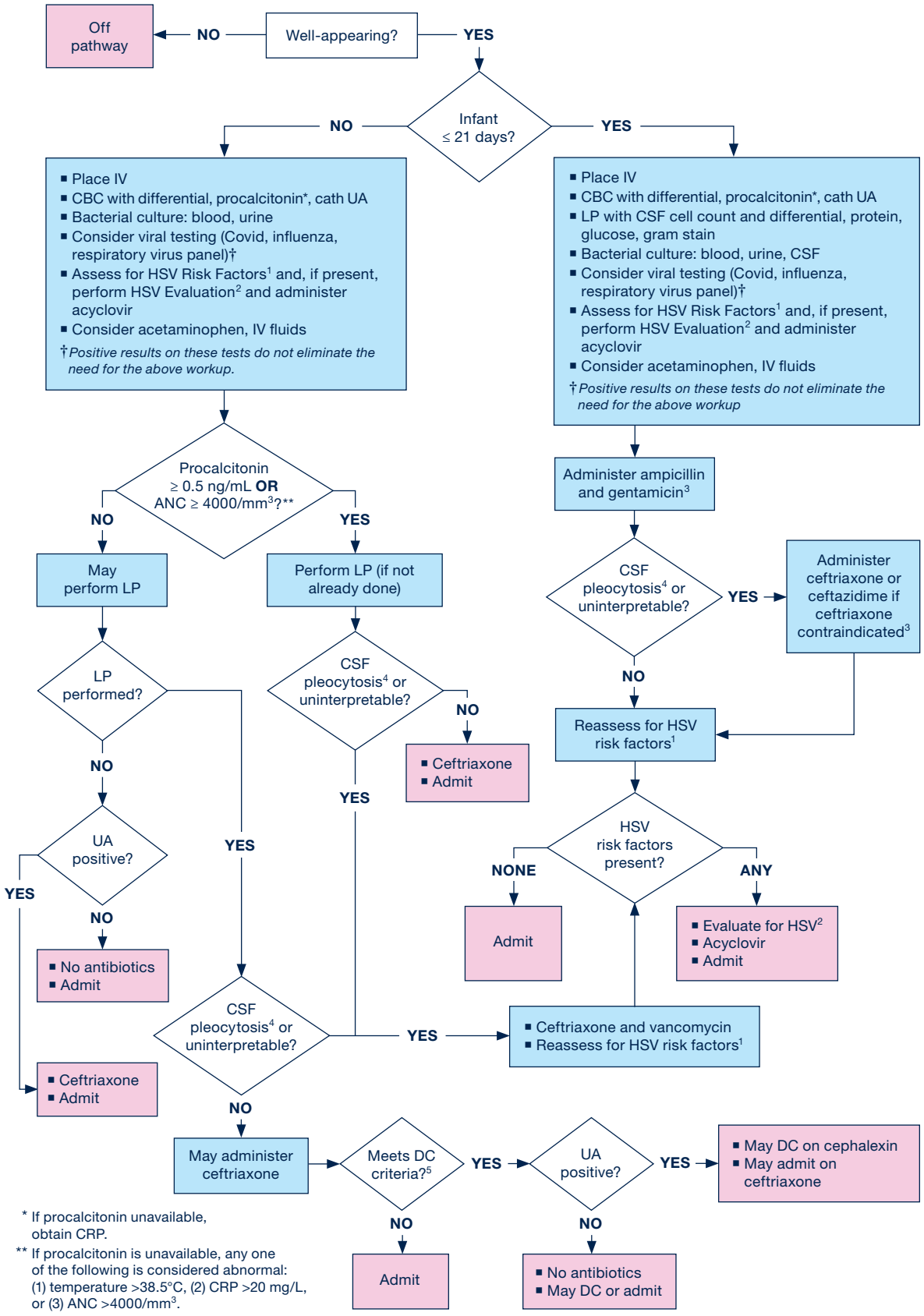
[2] **HSV evaluation:**
- AST/ALT
- Conjunctival, NP and OP HSV PCR swabs
- Vesicle (if present) HSV PCR
- HSV PCR, serum and CSF (LP recommended)

[3] **Antimicrobial selection and dosing reference:**
Guidelines for Empiric Therapy: Pediatrics at ucsfbenioffchildrens.org/empiric

SCAN QR CODE TO VIEW

[4] **CSF pleocytosis:**
- ≥ 15 WBC/µL

[5] **ED discharge criteria:**
- Caregiver feels comfortable observing child at home
- Caregiver able to receive communications from hospital
- Patient is tolerating POs (including antibiotics, if indicated)
- Follow-up in place for 12-24 hours



* If procalcitonin unavailable, obtain CRP.

** If procalcitonin is unavailable, any one of the following is considered abnormal: (1) temperature >38.5°C, (2) CRP >20 mg/L, or (3) ANC >4000/mm³.

EVIDENCE-BASED PATHWAY

Febrile Infant 29-60 Days

Inclusion criteria:
- Age: 29-60 days old
- Full term (≥ 37 weeks)
- Measured rectal temperature ≥ 38°C at home, outpatient or in ED

Exclusion criteria:
- Chronic medical condition
- Antibiotics in last 72 hours
- Received vaccines in past 48 hours
- Focal infection (ex. cellulitis, abscess, joint infection)
- Presence of identifiable viral syndrome:
  - Bronchiolitis
  - Hand-foot-mouth disease
  - Viral exanthem

[1] **HSV Risk Factors:**
- Maternal fever or genital HSV lesions within 48 hours of delivery
- Infant: vesicles, seizures, mucus membrane ulcers, hypothermia
- Leukopenia, thrombocytopenia and/or elevated ALT
- CSF pleocytosis with non-bacterial profile

HSV infection should be considered if *any* of the above is present

[2] **HSV Evaluation:**
- AST/ALT
- Conjunctival, NP and OP HSV PCR swabs
- Vesicle (if present) HSV PCR
- HSV PCR, serum and CSF

[3] **ED discharge criteria:**
- Caregiver feels comfortable observing child at home
- Caregiver able to receive communications from hospital
- Patient is tolerating POs (including antibiotics, if indicated)
- Follow-up in place for 12-24 hours

[4] **CSF pleocytosis:**
- ≥ 9 WBC/μL

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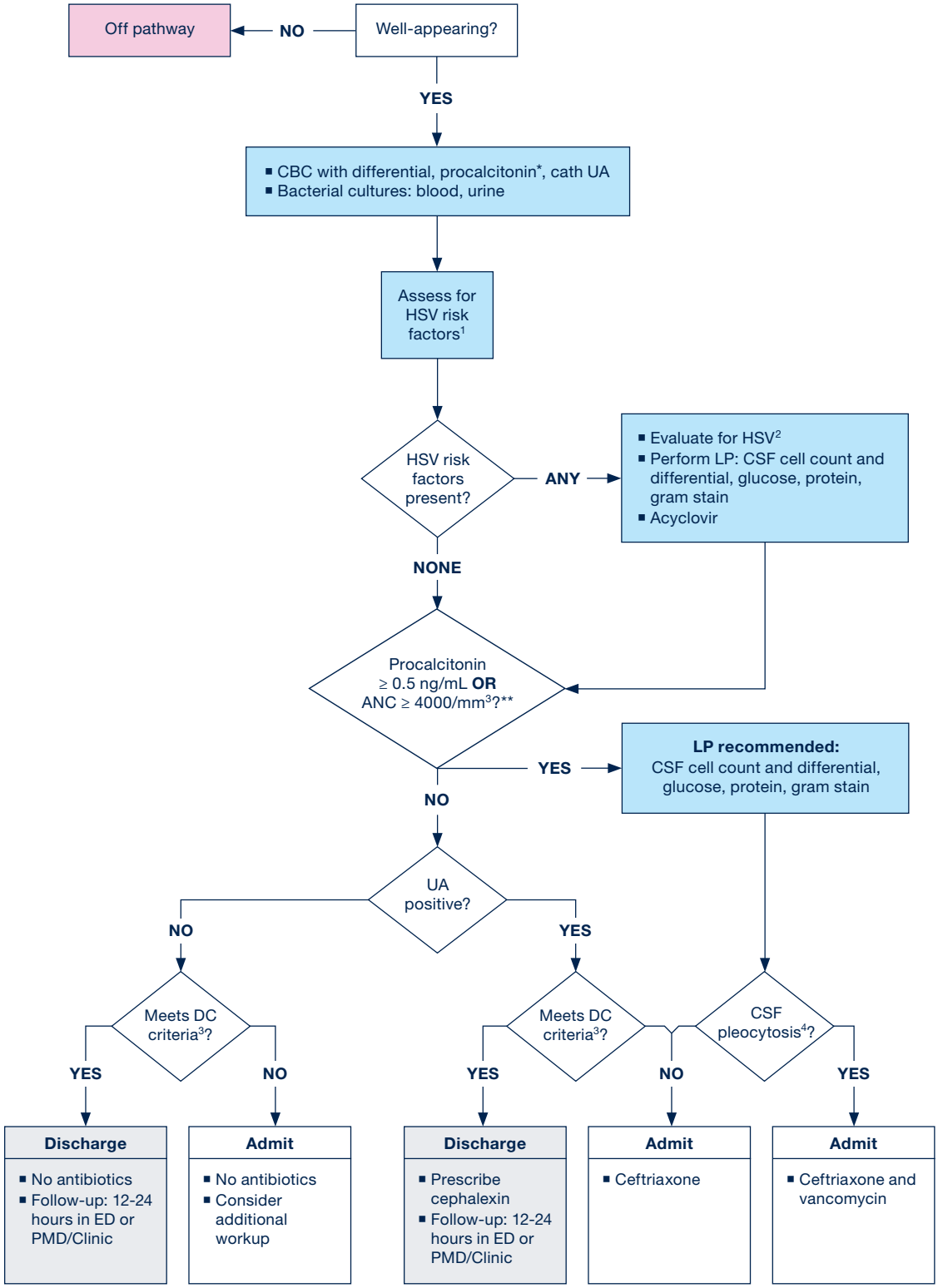
Antimicrobial selection and dosing reference: Guidelines for Empiric Therapy Pediatrics at ucsfbenioffchildrens.org/empiric



* If procalcitonin unavailable, obtain CRP.

** If procalcitonin is unavailable, any one of the following is considered abnormal: (1) temperature >38.5°C, (2) CRP >20 mg/L, or (3) ANC >4000/mm^3.

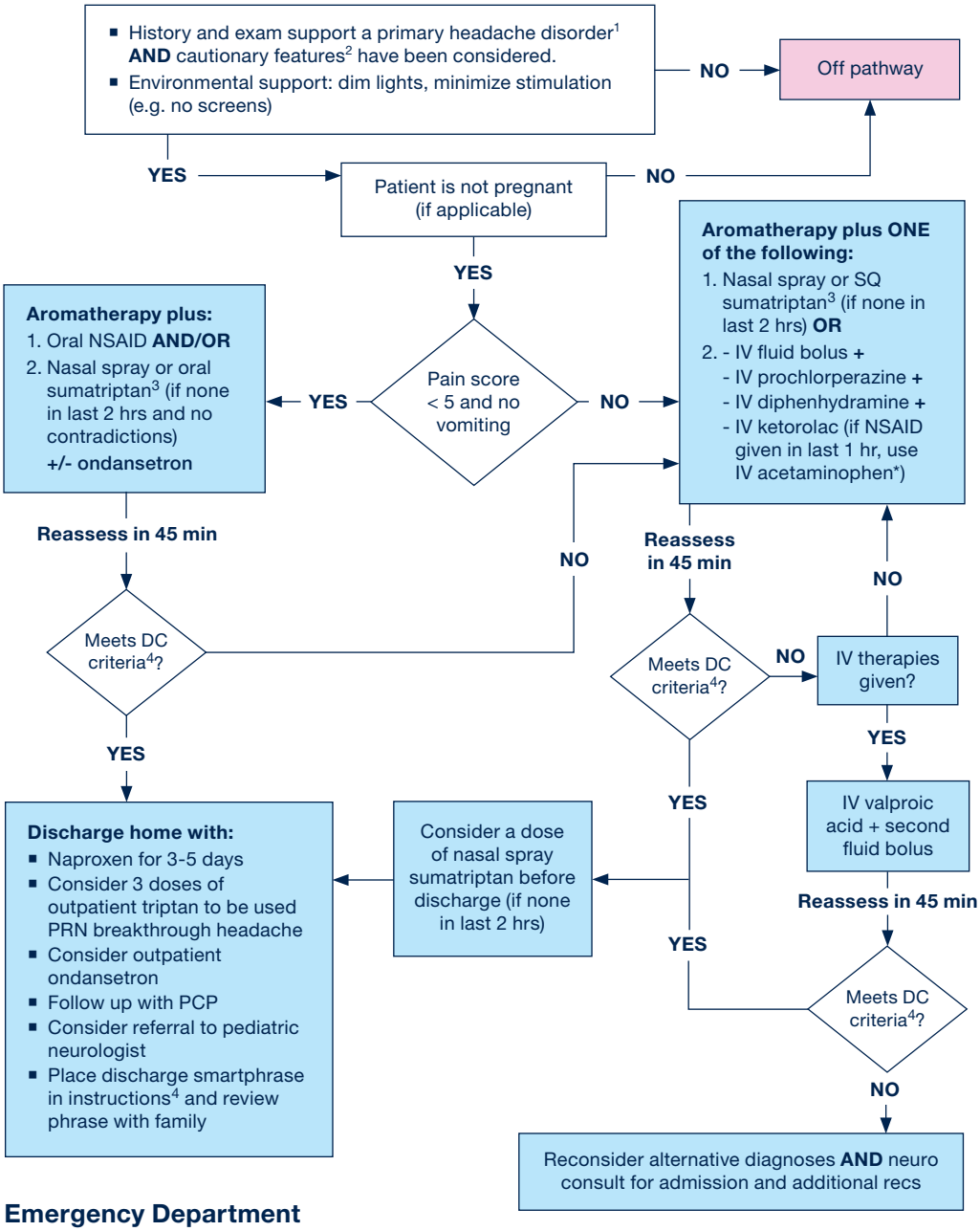
Primary Headache Disorder

UCSF Benioff Children's Hospitals

1. **Primary headache (HA) disorder:**
   - In Primary HA disorders, there is no concern for a secondary or underlying cause (e.g. prev. neurosurgery, acute head trauma, etc.).
   - This algorithm focuses on migraine and tension-type headaches.
2. **Cautionary features (NOT exclusionary):**
   - Age: < 6 years old
   - < 6-month headache history
   - Atypical presentation
   - Progressive severity in the ED
   - Position-related headache
   - Change in headache type
   - Presence of fever
   - Thunderclap onset
   - Immunosuppression
   - Abnormal neuro examination
3. **Triptan contraindications:**
   - Uncontrolled hypertension
   - H/o stroke, myocardial infarction or peripheral vascular disease
   - Hemiplegic and basilar migraines
   - Wolff-Parkinson-White syndrome

   Discharge criteria:
   - Patient and family comfortable with home management
   - Able to take oral medication
   - Headache discharge instructions discussed with patient/family
   - Patient able to secure medications for home management

   Discharge medications:
   - Naproxen: 10 mg/kg/dose BID (max 500 mg BID) x 3-5 days
   - Sumatriptan: Oral: 25 mg if < 40 kg | 50-100 mg if ≥ 40 kg Q2 hours PRN (or "as needed") for breakthrough headache, up to 3 doses.
   - Rizatriptan or Rizatriptan ODT for > 6yo; 5mg if < 40 kg; 10 mg if ≥ 40 kg
   - Ondansetron: 2 mg if < 15 kg | 4 mg if ≥ 15 kg
4. **Suggested discharge instructions:**
   - Use a Headache Diary (forms available at ucsfbenioffchildrens.org/headache)
   - SMART Habits: Healthy behaviors and stress-reduction strategies to reduce pain and prevent recurrence of headache are very important.
     - Sleep: At least 8 hours for teens (> 9 hrs for kids 6-12 yrs), go to sleep and awaken around the same time
     - Meals: At least 3, don't skip any, drink plenty of fluids (> 8 cups of water daily for kids > 9 yrs, more for high exertion or athletes), consider avoiding caffeine-containing substances
     - Activity: Exercise is really effective for treating and preventing headache
     - Relaxation: Music, massage, compresses, breathing, yoga, meditation
     - Triggers: Recognize and avoid them; the Headache Diary can help.



Emergency Department Therapeutics

Aromatherapy:
- Inhaled isopropyl alcohol. Deep inhalations with pad held 2 cm from nares for up to 1 min then rest 4 min. Can repeat every 5-10 min with up to 5 pads.

Enteral medications:
- Ibuprofen: 10 mg/kg (max 400 mg/dose)
- Naproxen: 10 mg/kg (max 660 mg/dose)
- Ondansetron: 0.15 mg/kg (max 8 mg/dose)

Sumatriptan:
- Oral: < 40 kg (25 mg) | ≥ 40 kg (50-100 mg)
- Nasal spray: < 40 kg (5 mg) | ≥ 40 kg (20 mg)
- Subcutaneous: < 40 kg (3 mg) | ≥ 40 kg (6 mg)

Parenteral medications:
- Ketorolac: 0.5 mg/kg (max 30 mg/dose)
  - *Can be used within 1 hr of PO NSAID if no renal insufficiency*
- Acetaminophen: 15 mg/kg (max 1 g/dose)
- Diphenhydramine: 1 mg/kg (max 50mg/dose)
- Prochlorperazine: 0.15 mg/kg (max 10mg/dose)
- Valproic acid: 20 mg/kg over 30 min (max 1 g)
- Metoclopramide: 0.1-0.25 mg/kg (max 10 mg/dose)
- Chlorpromazine: 0.5 mg/kg (max 25 mg/dose)

Diabetic Ketoacidosis: Assessment and Acute Management

DKA inclusion criteria:
- Glucose >200 mg/dL **AND**
- Ketones (typically ≥2+) **AND**
- Anion gap acidosis (pH≤7.3 or HCO3≤15)

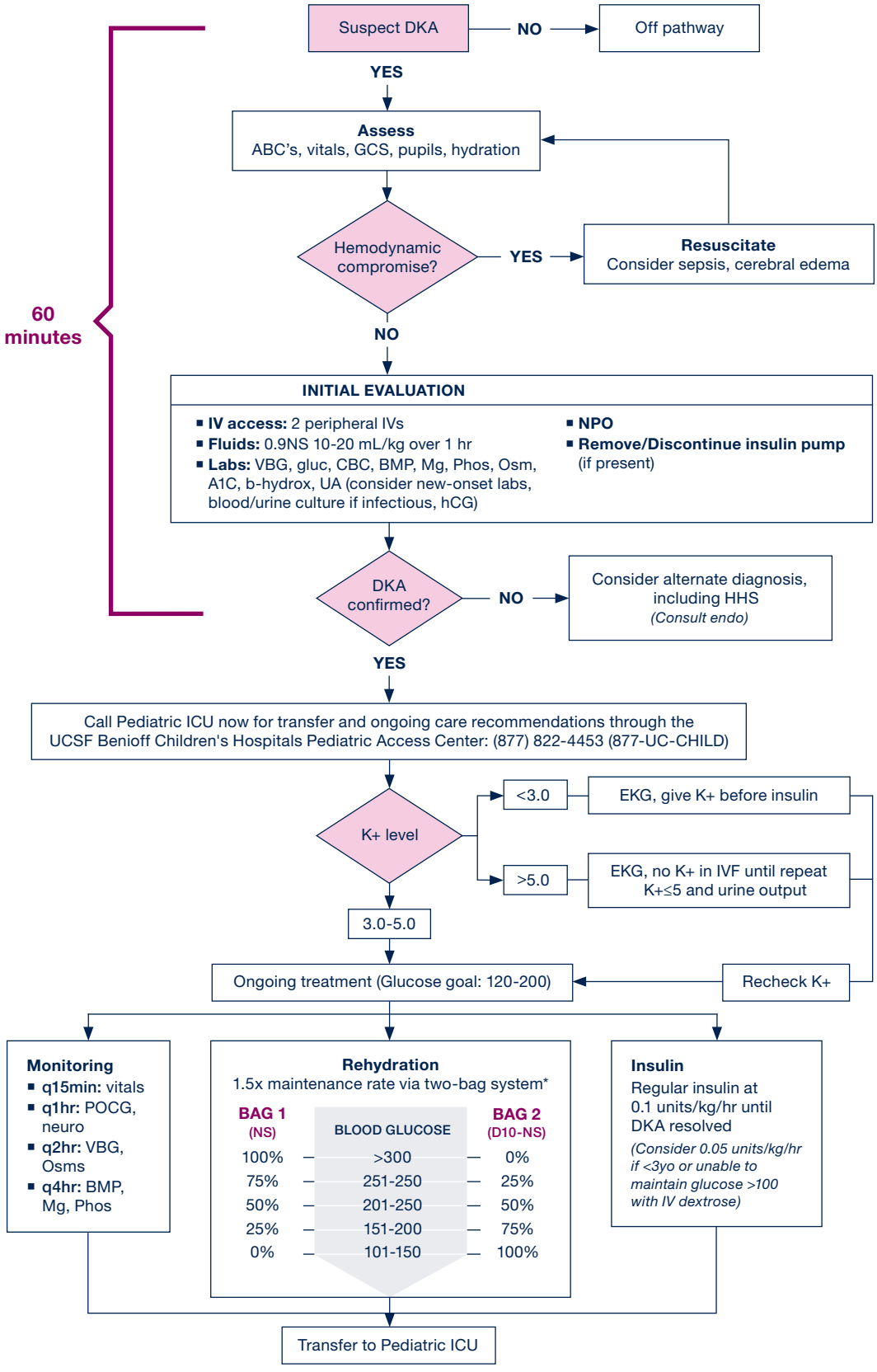
Special considerations:
- Age < 12 months – *consult endocrinology*

Cerebral edema:

Red flags:
- AMS, decreased HR, increased BP, incontinence, vomiting, irregular respirations, anisocoria, headache, lethargy

Treatment:
- Mannitol 0.5-1g/kg IV over 20 minutes, **OR**
- 3% saline 5-10mL/kg over 30 minutes

In DKA:
- Bolus IV insulin **not recommended**
- $NaHCO_3$ for acidosis correction **not recommended**
- IV fluid bolus for tachycardia alone **not recommended**
- **Avoid** corrected Na drop > 0.5–1 mEq/hr



*** DKA TWO-BAG SYSTEM**

Bag 1: Contains 0.9NS +/- electrolytes (typically combination of KCl and KPos)

Bag 2: Contains D10-0.9NS +/- electrolytes (typically combination of KCl and KPhos)

- If K+ <3, do not begin unsulin until K+ supplementation is initiated
- If K+ = 3-5, IVF should contain K+
- If K+ >5, IVF should *not* contain K+
- The combination of the two infusions should always equal 1.5x maintenance fluid rate.
- Begin D10-NS when glucose <300
- Optimal glucose decrease rate = 50-100mg/dL/hr
- If blood glucose falls, the insulin infusion is not typically adjusted. Instead, the balance of D10-NS is adjusted. Can also consider increasing D10-NS to D12.5-NS
- May consider 0.45NS instead of 0.9NS if concerned about or is developing hyperchloremic acidosis.

CLINICAL PEARL

Transferring Children with Acute Trauma

UCSF Benioff Children's Hospitals

Early transfer encouraged—not all injuries must be identified first

- The UCSF Benioff Children's Hospital Oakland Trauma Center does not expect all injuries to be fully defined before transfer.
- We encourage early contact with our trauma surgeons via the Pediatric Access Center at (877) 822-4453 (877-UC-CHILD) to help expedite the transfer of critically injured pediatric patients who may require definitive surgical management.
- If a patient's condition exceeds the capabilities of your facility, we welcome and encourage an immediate call for collaborative decision-making regarding local imaging and management. Please do not delay transfer to obtain local imaging such as CT scans.

Clinical considerations while waiting for transport:

Moderate/severe TBI	▪ Assume cervical injury, place collar ▪ Intubate if GCS <9 or decline by 2; (prefer no propofol in trauma); CO_2 goal 35-40 ▪ Signs and symptoms of elevated ICP - 1st choice: 3% NaCl 5ml/kg over 10-20 minutes - 2nd choice: Mannitol (**not** recommended in hemorrhagic shock/polytrauma); if pupillary evidence of herniation 0.25-1gm/kg infused over 5 minutes; must support with fluid replacement ▪ Seizure prophylaxis: Keppra 40mg/kg IV loading dose ▪ If open fracture (skull or face) – give antibiotics ▪ Avoid excess IV fluids if hemodynamically stable; if crystalloid needed for tachycardia, give 20 ml/kg normal saline or PlasmaLyte and assess for hemorrhage ▪ Normothermia, correct acidosis, INR goal <1.4 ▪ Consider tranexamic acid (TXA), see below ▪ No NSAIDs
Hemorrhage management: i.e., poly truama (TBI with additional injury)	▪ Pediatric hemorrhagic shock: Tachycardia for age, delayed capillary refill time, mottled; if hypotensive, assume >30% blood loss ▪ Assessment for blood consumption: - Penetrating, positive FAST exam, tachycardia, hypotension, acidosis (base deficit > -8.8, lactate >3.5) - >2 findings: activate Pediatric Massive Transfusion Protocol; switch from crystalloid to blood products - Give blood products in balanced ratios PRBC:FFP; weight based ~10 ml/kg ▪ TXA if within 3 hours from injury – 15 mg/kg over 10 minutes ▪ There is no evidence to support the use of mannitol in pediatric hemorrhagic shock. ▪ No NSAIDs
Orthopedic trauma	▪ Antibiotics for all open fractures within 60 minutes of arrival at ED
Spinal cord injury	▪ Steroids not recommended
Image transfer	▪ Imaging from your emergency department can be efficiently transferred to UCSF Benioff Children's Hospitals 24/7, expediting your patient's care and reducing radiation exposure. ▪ Contact your radiology technician, imaging library, or medical records team to request that your patient's images be pushed to the UCSF Film Library. Then confirm the transfer by calling (415) 353-1640, option 3, or emailing radiologyfilmlibrary@ucsfmedctr.org. A UCSF Film Library technician is available 24/7. ▪ For more information, visit ucsfbenioffchildrens.org/image-transfer. *If digital image transfer is not possible, please include all imaging studies with the patient upon transfer.*

CLINICAL PEARL

Antibiotic Prophylaxis in Pediatric Trauma

INJURY TYPE	RECOMMENDED AGENT	RECOMMENDED IV DOSING/FREQUENCY	ALTERNATIVE AGENT (severe beta-lactam allergy)	DURATION
ORTHOPEDIC (open fractures)				
Gustilo grade I and II	Cefazolin	30 mg/kg/dose (usual max 2000 mg; weight >120 kg, max 3000 mg) q 8 hrs	Clindamycin	24 hours
Gustilo grade III	Ceftriaxone + Vancomycin	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Vancomycin:** 15 mg/kg/dose (max 1000 mg) q 6 hrs	Levofloxacin + Clindamycin	48 hours
All open fractures with gross environmental contamination	Cefepime + Metronidazole	**Cefepime:** 50 mg/kg/dose (max 2000 mg) q 8 hrs **Metronidazole:** 10 mg/kg/dose (max 500 mg) q 8 hrs	Levofloxacin + Metronidazole	72 hours
Open pelvic fractures not involving bowel/ internal injury	Cefazolin	30 mg/kg/dose (usual max 2000 mg; weight >120 kg, max 3000 mg) q 8 hrs	Clindamycin	24 hours
Open pelvic fractures with laceration to bowel or vaginal wall	Ceftriaxone + Metronidazole	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Metronidazole:** 30 mg/kg/dose (max 1500 mg) q 24 hrs	Ciprofloxacin + Metronidazole	72 hours
NEUROSURGICAL				
Open skull fractures without dural involvement	Cefazolin	30 mg/kg/dose (usual max 2000 mg; weight >120 kg, max 3000 mg) q 8 hrs	Clindamycin	x1 with washout
Open skull fractures with dural involvement	Cefazolin	30 mg/kg/dose (usual max 2000 mg; weight >120 kg, max 3000 mg) q 8 hrs	Clindamycin	24 hours
Open skull fractures with dural involvement AND gross environmental contamination	Ceftriaxone + Metronidazole	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Metronidazole:** 10 mg/kg/dose (max 500 mg) q 8 hrs	Levofloxacin + Metronidazole	24 hours
BITES (human/cat/dog)				
No dural involvement	Ampicillin/ sulbactam	50 mg ampicillin/kg/dose (max 2000 mg ampicillin) q 6 hrs	Levofloxacin	5 days
Dural involvement	Ceftriaxone + Metronidazole	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Metronidazole:** 10 mg/kg/dose (max 500 mg) q 8 hrs	Levofloxacin + Metronidazole	5 days
PENETRATING TRAUMA				
Maxillofacial	Ampicillin/ sulbactam	50 mg ampicillin/kg/dose (max 2000 mg ampicillin) q 6 hrs	Clindamycin	24 hours
Thoracic	Cefazolin	30 mg/kg/dose (usual max 2000 mg; weight > 120 kg, max 3000 mg) q 8 hrs	Clindamycin	24 hours
Abdominal (includes blunt trauma with concern for hollow viscous injury)	Ceftriaxone + Metronidazole	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Metronidazole:** 30 mg/kg/dose (max 1500 mg) q 24 hrs	Ciprofloxacin + Metronidazole	24 hours
Abdominal with spinal cord injury	Ceftriaxone + Metronidazole	**Ceftriaxone:** 50 mg/kg/dose (max 2000 mg) q 24 hrs **Metronidazole:** 30 mg/kg/dose (max 1500 mg) q 24 hrs	Vancomycin + Ciprofloxacin	24 hours

Alternative agent dosing:
Ciprofloxacin: 10 mg/kg/dose (max: 400mg/dose) IV q 8 hours
Clindamycin: 10 mg/kg/dose (max 900 mg) q 8 hours
Levofloxacin: 10 mg/kg/dose (max 500 mg) q 12 hours (< 5 years old), q 24 hours (≥ 5 years old)

Pediatric Status Epilepticus Treatment Guidelines

UCSF Benioff Children's Hospitals

PHASE	ACTION
0-5 MINUTES Stabilization Phase	▪ Stabilize patient, monitor vital signs ▪ Time seizure from its onset ▪ Maintain airway, intubate if needed. If intubated, place ETCO2 monitor ▪ Collect finger stick blood glucose and treat as needed ▪ Obtain IV access and collect labs (CBC, BMP, Ca, Mg, Phos, VBG with lactate, urine toxicology screen, anti-seizure medication levels [if applicable]) ▪ Many epilepsy patients have an individualized seizure action plan. Consider asking the caregiver if they have a seizure action plan and follow accordingly.
5-15 MINUTES Initial Therapy Phase **Impending Status Epilepticus**	**Skip this stage if patient received 2 correct doses of benzodiazepines prior to arrival.** **Lorazepam** – 0.1mg/kg IV (max 4 mg) ▪ Repeat dose in 5 min for persistent seizure (maximum 2 total doses, including pre-hospital doses) ▪ If no IV access, use: - IM midazolam 5 mg for 13-40 kg patient, 10 mg for >40 kg patient - Buccal midazolam 0.5 mg/kg (max 10 mg) - IN midazolam 0.2 mg/kg (max 10 mg) - IN diazepam 0.2 mg/kg (max 20 mg) ▪ If no IV access, obtain IV access now *If clinical seizure persists 5 minutes after completion of second benzo dose, proceed to next stage.*
15-30 MINUTES Secondary Therapy Phase **Status Epilepticus**	**Load with ONE of the three following agents. (Note: If the patient is already on maintenance therapy for seizures, load with a medication that the patient is not already taking.)** ▪ **Fosphenytoin (Cerebyx)** – 20 mg/kg IV run over 10 minutes (max 1.5 g) ▪ **Valproic Acid (Depakote or Depakene)** – 40 mg/kg IV run over 10 minutes (max 3 g) - NOT for children younger than 2 years old - NOT for children known to have metabolic cause of epilepsy, inborn error of metabolism, or liver disease ▪ **Levetiracetam (Keppra)** – 60 mg/kg IV run over 10 minutes (max 4.5 g) **CALL CHILD NEUROLOGY NOW THROUGH THE UCSF BENIOFF CHILDREN'S HOSPITALS PEDIATRIC ACCESS CENTER: (877) 822-4453 (877-UC-CHILD)** **CALL PICU FOR TRANSFER/ADMISSION NOW IF:** ▪ Clinical seizure does not stop after this step ▪ Clinical seizure stops but there is concern for persistent subclinical seizure ▪ Anticipate advanced airway (if not already in place) Prepare for invasive BP monitoring with central line; ensure presence of at least two large-bore peripheral IVs. *If clinical seizure persists 5 minutes after completion of bolus, patient is in Refractory Status Epilepticus. Further management should be coordinated with Child Neurology and may include load with a second non-anesthetic agent above that was not already administered.* **For patients younger than 2 years old, consider:** ▪ **Phenobarbital** – 20 mg/kg IV run over 10 minutes (max 1 g) *If seizure persists after completion of infusion, repeat 10-20 mg/kg IV over 10 minutes.*

CLINICAL PEARL

Stroke Care in Children

WHEN TO CONSIDER STROKE ON THE DIFFERENTIAL DIAGNOSIS

- Acute onset focal neurological deficits (face, arm or leg weakness, aphasia, ataxia, diplopia, dysarthria or vertigo)
- Symptoms may occur with or without seizures or headache

WHEN TO CONSIDER *EMERGENT* TRANSFER

- Hyperacute ischemic stroke (for children older than 1 year and less than 24 hours since last seen well) for consideration of thrombolysis or thrombectomy*
- Nontraumatic intracranial hemorrhage for diagnostic or interventional angiogram and/or neurosurgical treatment of hemorrhage source
- Monitoring or intervention for intracranial pressure (ICP) after ischemic or hemorrhagic stroke

WHEN TO CONSIDER *URGENT* TRANSFER

- Diagnostic workup of acute ischemic stroke, including arterial wall imaging. Rapid diagnosis of arteriopathy and other stroke risk factors may help prevent early recurrent stroke or stroke extension.
- Large volume ischemic or hemorrhagic stroke at risk for elevated intracranial pressure
- Altered mental status after stroke for detection of subclinical seizures by continuous video EEG monitoring

* **Hyperacute ischemic stroke reperfusion treatment** improves outcomes in adults and may be offered to selected children at UCSF Benioff Children's Hospital San Francisco on a case-by-case basis after clinical and radiologic evaluation. Potential treatment options include IV thrombolysis and endovascular thrombectomy. Risks and benefits of these have been studied only in adults (≥18 years old). Major factors for consideration:
  - Time from last seen normal within 24 hours
  - Arterial occlusion on vascular imaging consistent with clinical syndrome. Discuss plan to obtain emergent vascular imaging before versus after transport.

WHILE AWAITING TRANSFER

- ☐ Consider need for airway, ventilation
- ☐ Obtain venous access (18 gauge preferred; 22 gauge OK for <30 kg); IV fluids NS for goal normovolemia
- ☐ Place cardiorespiratory monitor and pulse oximeter; record Q15-minute vital signs
- ☐ Oxygen supplementation to keep SaO^2 >95%
- ☐ Blood pressure (ischemic stroke): Typical goal of maintaining normal to high MAP for perfusion of penumbra (50-95% age norms or higher if chronic hypertension). Consider treatment with volume and pressors as needed.
- ☐ Blood pressure (hemorrhagic stroke): Consider treatment of severe hypertension if unsecured source (presumed ruptured aneurysm of AVM) while maintaining minimum MAP for age for adequate cerebral perfusion pressure
- ☐ Labs: CBC, platelets, PT/PTT, electrolytes, BUN/Cr, glucose, type and screen, β-HCG
- ☐ Point-of-care glucose; goal normoglycemia
- ☐ 12 lead EKG
- ☐ Bed rest. Head of bed flat if ischemic stroke; 30° if hemorrhagic stroke, elevated ICP or vomiting
- ☐ Make NPO
- ☐ Weight in kg
- ☐ Temperature: prevent hyperthermia, goal temp <37.5° C
- ☐ Evaluate for and treat seizures
- ☐ Consider a consultation with local neurosurgeon if obstructive hydrocephalus is present

To minimize delays, review history while awaiting transfer and communicate with transport team:

- ☐ Time from stroke ictus (last seen normal)
- ☐ Severity of deficit (NIHSS if possible)
- ☐ History of congenital heart disease, sickle cell disease, cancer, prior cerebral hemorrhage or tumor
- ☐ Medications: antiplatelet or anticoagulants
- ☐ Imaging and laboratory results
- ☐ Guardian contact information and availability for informed consent discussions

IMAGE TRANSFER

- Imaging from your emergency department can be efficiently transferred to UCSF Benioff Children's Hospitals 24/7, expediting your patient's care and reducing radiation exposure.
- Contact your radiology technician, imaging library, or medical records team to request that your patient's images be pushed to the UCSF Film Library. Then confirm the transfer by calling (415) 353-1640, option 3, or emailing radiologyfilmlibrary@ucsfmedctr.org. A UCSF Film Library technician is available 24/7.
- For more information, visit ucsfbenioffchildrens.org/image-transfer.

If digital image transfer is not possible, please include all imaging studies with the patient upon transfer.

Pediatric Guidelines: Antibiotics

CONDITION AND DURATION	FIRST CHOICE THERAPY	ALTERNATIVE THERAPY
HEAD AND NECK INFECTIONS		
Acute otitis media Duration ▪ <2 years old or any age with severe symptoms: 10 days ▪ 2-5 years old: 7 days ▪ 5 years old: 5 days Severe symptoms ▪ Moderate or severe otalgia ▪ Otalgia >48 hours ▪ Temperature >39°C	Recommend initial observation without antibiotic therapy for 48-72 hours in patients who meet the following criteria: ▪ 6 months to 2 years old: unilateral, no otorrhea, non-severe symptoms OR ▪ >2 years old: No otorrhea, non-severe symptoms If not meeting initial observation criteria: ▪ **Amoxicillin** – 45 mg/kg/dose (max 1000 mg/dose) PO BID	If patient does not respond to initial amoxicillin after 48-72 hours, has received amoxicillin in the preceding 30 days, has purulent conjunctivitis or has history of AOM not responsive to amoxicillin: ▪ **Amoxicillin-clavulanate (Augmentin)** – 45 mg/kg/dose (max 1000 mg amoxicillin/ dose) PO BID Penicillin allergy with lower risk for reaction: ▪ **Cefdinir** – 7 mg/kg/dose (max 300 mg/dose) PO BID Penicillin allergy with higher risk for allergic reaction: ▪ Consult AAP/AAFP guidelines
Streptococcal pharyngitis Duration for oral therapy: 10 days	**Amoxicillin** – 50 mg/kg/dose (max 1000 mg/dose) PO daily Anticipated difficulty tolerating or adhering to oral therapy: ▪ Weight <27 kg: **Benzathine Penicillin G** 600,000 units IM x 1 dose ▪ Weight ≥27 kg: **Benzathine Penicillin G** 1.2 million units IM x 1 dose	Penicillin allergy with lower risk for reaction: ▪ **Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO BID Penicillin allergy with higher risk for reaction: ▪ **Clindamycin** – 7 mg/kg/dose (max 300 mg/dose) PO TID
Dental infection Duration: 3-7 days, individualized for severity	**Amoxicillin** – 22.5 mg/kg/dose (max 875 mg/dose) PO BID Inpatient with severe infection: ▪ **Ampicillin-sulbactam (Unasyn)** – 50 mg/kg (max 2000 mg ampicillin/dose) IV Q6h	If insufficient response to first choice therapy: ▪ Change to **amoxicillin-clavulanate (Augmentin)** 22.5 mg/kg/dose (max 875 mg amoxicillin/dose) PO BID Penicillin or cephalosporin allergy with higher risk of reaction: ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) PO TID
Peritonsillar/retropharyngeal abscess Duration: 10-14 days based on severity and response to treatment Pediatric ENT specialist consult recommended to evaluate need for source control	**Ampicillin-sulbactam (Unasyn)** – 50 mg/kg (max 2000 mg ampicillin/dose) IV Q6h If patient has airway compromise, extensive abscess or history of documented MRSA infection or carriage in last 6 months, add **Vancomycin** If candidate for oral therapy: **Amoxicillin-clavulanate (Augmentin)** – 45 mg/kg/dose (max 1000 mg amoxicillin/ dose) PO BID	Penicillin or cephalosporin allergy with higher risk of reaction: ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) IV Q8h OR ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) PO TID

CONDITION AND DURATION	FIRST CHOICE THERAPY	ALTERNATIVE THERAPY
HEAD AND NECK INFECTIONS (continued)		
Lymphadenitis Acute, suppurative, bacterial, usually unilateral Duration: 10 days (or 5-7 days after abscess drainage, if applicable)	Without suspected dental source (e.g., no periodontal disease): ▪ **Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO TID **OR** ▪ **Cefazolin** – 25 mg/kg/dose (max 1000 mg/dose) IV Q8h With suspected dental source: ▪ **Amoxicillin-clavulanate (Augmentin)** – 22.5 mg amoxicillin/kg/dose (max 875 mg/dose) PO BID **OR** ▪ **Ampicillin-sulbactam (Unasyn)** – 50 mg/kg (max 2000 mg ampicillin/dose) IV Q6h	Penicillin or cephalosporin allergy with higher risk of reaction: ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) IV Q8h **OR** ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) PO TID
Orbital cellulitis/abscess Duration: 14-21 days. Longer duration may be indicated if there is significant bone destruction or large abscess that is not drained.	**Ampicillin-sulbactam (Unasyn)** – 50 mg/kg (max 2000 mg ampicillin/dose) IV Q6h If there is a large abscess, or the patient is anticipated to undergo surgical drainage, is toxic-appearing, has rapidly progressive proptosis or ophthalmoplegia, or has a history of MRSA infection or carriage in the last 6 months, add **vancomycin**.	Penicillin allergy with higher risk for reaction: ▪ Consult ID
COMMUNITY-ACQUIRED PNEUMONIA		
Outpatient Therapy		
▪ Antimicrobial therapy is not routinely indicated in children 3 months to 5 years old unless suspected bacterial etiology. ▪ Atypical pneumonia is rare in children < 5 years old ▪ Duration: 5 days	If typical bacterial etiology suspected: ▪ **Amoxicillin** – 45 mg/kg/dose (max 1000 mg/dose) PO BID If atypical bacterial etiology suspected: ▪ **Azithromycin** – 10 mg/kg/dose (max 500 mg/dose) PO x 1 dose on day 1, then 5 mg/kg/dose (max 250 mg/kg/dose) enterally daily for days 2-5	Penicillin allergy with lower risk for reaction: ▪ **Cefdinir** – 7 mg/kg/dose (max 300 mg/dose) PO BID Penicillin allergy with higher risk for reaction: ▪ **Azithromycin** – 10 mg/kg/dose (max 500 mg/dose) PO x 1 dose on day 1, then 5 mg/kg/dose (max 250 mg/kg/dose) PO daily for days 2-5
Inpatient Therapy		
▪ > 3 months old, suspected bacterial etiology, but not complicated (empyema, necrotizing pneumonia) ▪ Atypical pneumonia is rare in children < 5 years old ▪ Duration: 7 days	**Ampicillin** – 50 mg/kg/dose Q6h (max 2000 mg/dose) If atypical bacterial etiology suspected: ▪ **Azithromycin** – 10 mg/kg/dose (max 500 mg/dose) enterally x 1 dose on day 1, then 5 mg/kg/dose (max 250 mg/kg/dose) enterally daily for days 2-5	Penicillin allergy with lower risk for reaction: ▪ **Ceftriaxone** – 50 mg/kg/dose (max 2000 mg/dose) IV Q24h

Antibiotic Choices and Dosing

CONDITION AND DURATION	FIRST CHOICE THERAPY	ALTERNATIVE THERAPY
SKIN AND SOFT TISSUE INFECTIONS		
Cellulitis without abscess Duration: 5 days for non-severe infection	**Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO BID Inpatient/needs IV therapy: ▪ **Cefazolin** – 25 mg/kg/dose (max 2000 mg/dose) IV Q8h	Penicillin allergy with higher risk for reaction: ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) PO TID Inpatient/needs IV therapy: ▪ **Clindamycin** – 10 mg/kg/dose (max 900 mg/dose) IV Q8h
Abscess of skin or soft tissue Duration: 5 days following source control for non-severe infection I&D is recommended for source control in addition to antibiotics.	**Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO BID Inpatient/needs IV therapy: ▪ **Cefazolin** – 25 mg/kg/dose (max 2000 mg/dose) IV Q8h	▪ Penicillin or cephalosporin allergy with higher risk for reaction **OR** ▪ History or MRSA infection or carriage in last 6 months **OR** ▪ Trimethoprim-sulfamethoxazole susceptible MRSA **Trimethoprim-sulfamethoxazole (Bactrim/Septra)** – 5 mg/kg/dose (max 160 mg trimethoprim/dose) PO BID
Bite wound Duration: 3-5 days for prophylaxis of high-risk bites 7-10 days for treatment of established infection High-risk bite wounds for which antibiotic prophylaxis is recommended: ▪ Moderate or severe bites, especially with edema or crush injury ▪ Puncture wounds, especially if penetration of bone, tendon or joint ▪ Deep or surgically closed facial bites ▪ Hand or foot bite ▪ Genital area bites ▪ Bites in immunocompromised or asplenic patients ▪ Cat bites	**Amoxicillin-clavulanate (Augmentin)** – 22.5 mg amoxicillin/kg/dose (max 875 mg/dose) PO BID **OR** **Ampicillin-sulbactam (Unasyn)** – 50 mg/kg (max 2000 mg ampicillin/dose) IV Q6h	Penicillin or cephalosporin allergy with higher risk for reaction: ▪ **Trimethoprim-sulfamethoxazole (Bactrim/Septra)** – 5 mg/kg/dose (max 160 mg/trimethoprim/dose) PO BID **AND** ▪ **Clindamycin** – 10 mg/kg/dose (max 600 mg/dose) PO TID

CONDITION AND DURATION	FIRST CHOICE THERAPY	ALTERNATIVE THERAPY
URINARY TRACT INFECTIONS		
Urinary tract infection 2 months to 12 years old Duration: 7 days Modify therapy based on culture and susceptibilities	**Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO BID	Penicillin or cephalosporin allergy with higher risk for reaction or history of prior cefazolin-resistant UTI and trimethoprim-sulfamethoxazole susceptible organism: ▪ **Trimethoprim-sulfamethoxazole (Bactrim/Septra)** – 5 mg/kg/dose (max 160 mg/trimethoprim/dose) PO BID
Uncomplicated cystitis > 12 years old Duration: 3-5 days	**Nitrofurantoin (Macrobid)** – 100 mg/dose PO BID	**Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO BID
Pyelonephritis Community onset > 6 months old Duration: 7 days for most patients	**Ceftriaxone** – 50 mg/kg/dose (max 1000 mg/dose) IV Q24h If candidate for oral therapy: ▪ **Cephalexin** – 25 mg/kg/dose (max 500 mg/dose) PO TID	Penicillin or cephalosporin allergy with higher risk for reaction: ▪ **Ciprofloxacin** – 10 mg/kg/dose (max 400 mg/dose) IV Q8hr If candidate for oral therapy: ▪ **Ciprofloxacin** – 15 mg/kg/dose (max 500 mg/dose) PO BID

Definition of allergic reaction risk

Higher risk for reaction

- Hives
- Angioedema
- Laryngeal edema
- Wheezing or dyspnea
- Hypotension
- Treatment with epinephrine
- Intubation
- Patient unable to give any history due to medical condition or caregiver unavailable to provide information

Lower risk for reaction

- Itching only
- Mild, delayed rash (not hives)
- EMR lists allergy but patient and/or caregiver do not recall any details about the reaction

In addition to the above higher-risk criteria, patients with the following allergy history should generally not receive antibiotics of the same class without further evaluation by an allergy or infectious disease specialist:

- Lesions or ulcers involving the mucous membranes or skin desquamation (suggests Stevens-Johnson Syndrome/TEN)
- Rash, fever and lymph node, liver or kidney involvement (suggests drug reaction with eosinophilia and systemic symptoms (DRESS) or drug-induced hypersensitivity syndrome
- Fever, urticarial rash, arthritis (suggests serum sickness)

SCAN QR CODE TO VIEW

These are selected guidelines for empiric therapy for pediatric patients and are adapted for the emergency department setting. For a more comprehensive resource for pediatric empiric therapy, visit ucsfbenioffchildrens.org/empiric. The guidelines were developed by the Pediatric Antimicrobial Stewardship Programs at each campus to inform initial selection of empiric antimicrobial therapy for children at UCSF Benioff Children's Hospitals and affiliated outpatient sites. They were developed in collaboration with multiple clinical groups and represent a consensus based on evidence-based guidelines and local microbiology and susceptibility patterns.

Pediatric Pain Management

UCSF Benioff Children's Hospitals

Assessing pain in children

Use a pediatric pain scale. Anxiety often contributes to pain in children.

WONG-BAKER FACES® PAIN RATING SCALE

0	2	4	6	8	10
No Hurt	Hurts Little Bit	Hurts Little More	Hurts Even More	Hurts Whole Lot	Hurts Worst

Non-pharmacologic pain control in children – simple ways for ED staff to use specific techniques

- Encourage holding/physical contact between patient and family member/support person.
- Download a few favorite kid songs on your phone; have a kid's playlist ready.
- Take five deep breaths with the patient before doing anything painful (or use bubbles/pinwheel to encourage younger children to take deep breaths).
- Language we use with adults such as 'this will burn' or 'IV' may be stressful or confusing for children. Consider using 'feel warm' or 'small straw for medicine.'
- Encourage teenagers to use their headphones during procedures or pain crises.
- Have the patient tell you about their favorite summer activity or vacation and ask probing questions.
- A Child Life Specialist can help children and families through stressful or painful procedures.
- Distraction with a Buzzy Bee or ice can help with IV placement or injections.
- Breastfeeding or oral sucrose for patients 0-12 months.

Specific analgesics and anxiolytics

	AGENT	DOSING	ONSET OF ACTION
Mild pain	Ibuprofen (>6 months old)	10 mg/kg q6 hrs (max = 400 mg)	15-30 minutes
	Acetaminophen	15 mg/kg q6 hrs (max = 650 mg)	15-30 minutes
	Sucrose (infants)	0.1 - 0.5 mL	instant
Moderate to severe pain	Intranasal fentanyl (requires atomizer)	1.5 - 2 mcg/kg (max = 100 mcg) 1 mL/nostril max	1-2 minutes
Topicals	LET (4% lidocaine, 0.1% epinephrine, 0.5% tetracaine) Use on open wounds.	N/A	20-30 minutes
	EMLA (lidocaine, prilocaine) Use on intact skin.	N/A	60 minutes
	LMX-4 (4% lidocaine) Use on intact skin.	N/A	30 minutes
	Intradermal lidocaine (J-tip) Use on intact skin; useful for IV starts. Consider preparing patients by letting them know that J-tip application can make a popping sound due to a burst of air.	N/A	1-3 minutes
Anxiolysis	Midazolam (intranasal [atomizer])	0.4 – 0.5 mg/kg, max 10mg	10-15 minutes
	Midazolam (oral)	0.4 – 0.8 mg/kg, max 20mg	20-30 minutes
	Dexmedetomidine (intranasal [atomizer])	2 mcg/kg/dose (Make sure it's micrograms.) Max single dose: 100 mcg May give additional 1 mcg/kg 15 minutes after first dose (max 50 mcg second dose)	10-20 minutes

More resources and how we are trying to address pain for children: ucsfbenioffchildrens.org/comfort-promise

Hospital Locations

SAN FRANCISCO

OAKLAND

UCSF Pediatric Specialty Clinic Locations

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For questions and suggestions regarding this Pediatric Emergency Medicine Guide, contact BCH-info@ucsf.edu.

SCAN QR CODE TO CALL

For consults or transfers call:

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(877) 822-4453 (877-UC-CHILD)

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