ASSESSMENT AND MANAGEMENT OF

Skin & Soft Tissue Infection

Pediatric patients over 3 months

This care process model (CPM) is produced by Intermountain Healthcare's Pediatric Infectious Disease Team, a subgroup of the Pediatric Speciality Clinical Program. The CPM summarizes evaluation and treatment recommendations for skin and soft tissue infections (SSTIs) in children age 3 months and older. Recommendations are based on recent studies in peer-reviewed medical literature, local susceptibility data and practice patterns, and recent consensus guidelines from the Infectious Disease Society of America (IDSA).[IDSA]

WHY FOCUS ON PEDIATRIC SKIN AND SOFT TISSUE INFECTION (SSTI)?

- **It's common:** Between 1997 and 2005, there was a 50% increase in national ambulatory SSTIs, with the largest increases occurring in emergency departments among patients younger than 18 years old.[CHA]
- **It's costly:** In 2014, treatment costs for SSTIs in pediatric patients at Intermountain facilities exceeded $3 million.
- **Care varies widely and much of it is unnecessary:** In one recent study, two-thirds of children were exposed to either unnecessary broad-spectrum antibiotics, prolonged duration of antibiotic therapy, or both.[MOR] Similar unnecessary variation for diagnostic workup, ancillary testing, abscess management, and antibiotic prescribing likely exists across the Intermountain system.
- **There is an opportunity to reduce costs by eliminating care that is not beneficial:** Adult patients with SSTIs have benefitted from institutional guidelines that reduced exposure to testing and broad spectrum antibiotic therapy, without a change in rates of recovery from their infection.[JEN] We have a similar opportunity to improve the care we provide to children using a CPM and a robust local microbiologic database.

KEY RECOMMENDATIONS IN THIS CPM

- Ensure appropriate diagnostic testing.
- Ensure appropriate use of antibiotics.
  - Provide guidance about when antibiotics might **not** be necessary.
- Outpatient treatment is appropriate for the majority of patients.

GOALS AND MEASURES

In support of our overall goals of improving clinical outcomes and increasing appropriate use of resources, we will:

- Reduce the number of repeat procedures for pediatric patients with skin and soft tissue infections (SSTIs).
- Reduce admissions, readmissions, and unnecessary return for care.
- Increase compliance with SSTI antibiotic recommendations.
- Decrease antibiotic use in pediatric outpatients with purulent infections.
- Decrease use of preemptive antimicrobial therapy in patients with bite wounds.
- Monitor hospitalization trends.

Indicates an Intermountain measure

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The inside pages of this tool provide an algorithm and can be folded open and posted in your office or clinic. The back page provides a discussion of recommendations and information about resources and references.

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Pediatric patients over 3 months

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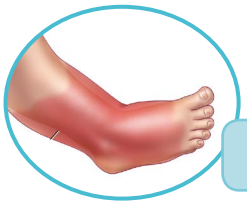
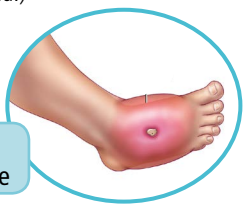
BITE WOUND? *See next page…*

ALGORITHM: ASSESSMENT, DISPOSITION, TREATMENT

(Recommendations do NOT apply to postoperative infections or infections on preseptal or genital area.)



Child presents to physician office or ED with
SKIN OR SOFT TISSUE INFECTION



NONPURULENT (a)
cellulitis, erysipelas

ANY of the following:

- *Infection size >1% of child's body (i.e., larger than area of child's hand)?*
- *Failed outpatient therapy? **(b)***
- *Systemic signs of infection **(c)**?*
- *Signs of necrotizing infection **(d)**?*
- *Immunocompromised (i.e., oncology or transplant patient)?*
- *Signs of deeper infection (e.g., bullae, sloughing)?*

no → **OUTPATIENT CARE**

NO cultures or other labs

TREAT (*See dosing guidelines, page 4*)
- cephalexin PO
- If allergic to cephalexin: clindamycin PO

yes → **INPATIENT CARE**

TRANSFER to ED for stabilization or ADMIT as inpatient if stable; CONSULT surgery if needed

Immunocompromised or necrotizing infection?

no → *Penetrating trauma or MRSA infection elsewhere? (g)*

no → **TREAT (See dosing guidelines, page 4)**
- cefazolin IV
- If allergic to cefazolin: clindamycin IV

yes → **TREAT (See dosing guidelines, page 4)**
- clindamycin IV
- If allergic to clindamycin: vancomycin IV

yes → **Blood culture, CBC w/diff, CMP**

TREAT empirically (See rationale, page 4)
1. vancomycin IV *AND*
2. clindamycin IV *AND*
3. pip/tazo IV
4. Also: consult Infectious Disease team

ADJUST therapy (See dosing guidelines, page 4)

When culture/susceptibilities return, if Group A *Streptococcus* or clostridial:
1. penicillin G IV *AND*
2. clindamycin IV

PURULENT
abscess, carbuncle, furuncle

Provide INITIAL INTERVENTION
- Perform incision and drainage **(e)**
- Consider ultrasound imaging if feasibility of drainage is unclear **(f)**
- Collect specimen and send for gram stain and culture ***unless*** the patient is experiencing a first episode and cellulitis is mild

ASSESS need for inpatient care

ANY of the following?
- *Fever >38.5ºC or other systemic signs **(c)**?*
- *Immunocompromised (i.e., oncology or transplant patient)?*
- *Patient looks unwell*

no → **OUTPATIENT CARE**

Does child have **more than mild cellulitis** surrounding the center of the infection?

no → **TREAT**
No antibiotics needed

yes → **TREAT (See dosing guidelines, page 4)**
Give anti-MRSA agent:
- TMP/SMX PO
- If allergic to TMP/SMX: clindamycin PO

yes → **INPATIENT CARE**

ADMIT, TREAT empirically (See rationale, page 4)
- Consider CBC and CRP
- clindamycin IV
- If allergic to clindamycin or if patient has a history of clindamycin-resistant staph: vancomycin IV
- If sepsis is present, see the sepsis protocol

NOTES

(a) Nonpurulent cellulitis

Nonpurulent cellulitis is generally caused by streptococci. *Staphylococcus aureus* rarely causes cellulitis — except when associated with penetrating trauma.

(b) Outpatient therapy should be considered failed if:

- The patient has not responded to antibiotic therapy after 3 days.
- Systemic signs or symptoms have developed.
- Infection has progressed beyond expectations.
- The patient cannot take antibiotics.

(c) Systemic infection

- Systemic signs include fever, chills, nausea, vomiting, and weakness.
- *Note that a child with SIRS (abnormal HR, RR, temp, WBC), hypotension, or organ dysfunction must be stabilized (per the Pediatric Sepsis Protocol)*

(d) Necrotizing infection

Infection is more likely to be necrotizing if any of the following are present:

- Severe pain disproportionate to clinical findings
- Subcutaneous tissue with a hard, wooden quality that extends beyond the area of apparent skin involvement
- Edema or tenderness extending beyond cutaneous erythema
- Crepitus, indicating Group A *Streptococcus*
- Skin necrosis or ecchymosis
- Rapidly spreading erythema

Treatment recommendations for necrotizing infection:

- ID team and surgical consult
- Emergent surgical evaluation/debridement (obtain culture from OR, routine/anaerobic)
- MRI or CT may also be helpful but should not delay surgical intervention.

ALGORITHM: DISPOSITION, TREATMENT

Child presents to physician office or ED with BITE WOUND (dog, cat, human)

Notify appropriate animal control authority for dog/cat bites. Contact local health department for information on rabies risk and need for prophylaxis.

NOT INFECTED OR < 6–12 HOURS SINCE BITE

ANY ONE of the following?

- ❒ *Immunocompromised patient*
- ❒ *Asplenic*
- ❒ *Advanced liver disease*
- ❒ *Preexisting or resulting edema in area of the wound*
- ❒ *Injury > 2.5 cm with significant gaping*
- ❒ *Suturable wound on face*
- ❒ *Wound on hand (of any size)*
- ❒ *Injury that may have punctured periosteum or joint capsule*

no / *yes*

TREAT as outpatient

- Clean the wound: copious irrigation **(h)**, cautious debridement.
- Give Tdap or DTaP vaccine as needed. **(i)**
- NO antibiotics are needed.

TREAT as outpatient (See dosing guidelines, page 4)

- Clean the wound: copious irrigation **(h)**, cautious debridement.
- Do NOT close the wound, unless it's on the child's face. For other locations, cover and consider loose closure for cosmetic reasons (especially large wounds).
- Do NOT use tissue adhesives (e.g., Dermabond).
- Give Tdap or DTaP vaccine as needed. **(i)**
- Give a 3- to 5-day course of preemptive antibiotics:
  - amoxicillin-clavulanate PO
  - If allergic to amoxicillin-clavulanate: TMP/SMX *AND* clindamycin PO

INFECTED

Abscess suspected or confirmed? — *yes* → Drain and culture (e)

no

EITHER of the following?

- ❒ *Systemic signs of infection* ***(c)***
- ❒ *Failed preemptive antibiotic therapy*

no / *yes*

TREAT as outpatient (See dosing guidelines, page 4)

- Open and clean the wound: copious irrigation **(h)**, cautious debridement.
- Give Tdap or DTaP vaccine as needed. **(i)**
- Give antibiotics.
  - amoxicillin-clavulanate PO
  - If allergic to amoxicillin: TMP/SMX *AND* clindamycin PO

ADMIT inpatient, TREAT (See dosing guidelines, page 4)

- Open and clean the wound: copious irrigation **(h)**, cautious debridement.
- Give Tdap or DTaP vaccine as needed. **(i)**
- Give antibiotics.
  - ampicillin-sulbactam IV
  - If allergic to ampicillin-sulbactam: ceftriaxone *AND* clindamycin

(e) Incision and drainage

In general, skin abscesses should be drained. Compared to ultrasound-guided aspiration, incision and drainage is much more likely to result in successful resolution at 7 days. For small (< 1–2 cm), more superficial abscesses that are pointing, application of heat may lead to spontaneous drainage.

Wound packing is associated with increased pain and probably does not significantly improve outcomes. For larger abscesses, a wick can be placed. An acceptable alternative is placement of two incisions with a loop of flexible sterile material (a vessel loop or thin rubber catheter) between the incisions and tied outside the skin. See illustration on page 4. This has comparable success as traditional incision and drainage with daily packing.

Local anesthesia can be suboptimal for incision and drainage, as the procedure may require a deep incision or breaking of abscess loculations. Procedural sedation is a useful adjunct for many children with abscesses.

(f) Ultrasound imaging

Ultrasound is more sensitive than clinical exam alone and is most useful when the clinical exam is equivocal. In a study of adult patients without a clear physician finding of abscess, ultrasound altered clinical management more than 50% of the time.

(g) MRSA risk factors in the pediatric population include contact with an infected person, recurrent skin infections, attendance at a child care facility or other group care setting, and participation in a contact sport.

(h) About irrigation

- Goals: Clean the wound while avoiding trauma to wound bed.
- Irrigate with a minimum of 200 cc per cm of wound.
- Use a 19-gauge blunt syringe or a ZeroWet splash guard or similar device.

(i) For a guide to tetanus prophylaxis in routine wound management, see health.state.mn.us/divs/idepc/diseases/tetanus/hcp/tetwdmgmtc.pdf

Rationale for Empiric Antibiotic Selection

Purulent SSTIs: *Staphylococcus aureus*, including methicillin-resistant *S. aureus* (MRSA), is commonly associated with purulent SSTIs. Incision and drainage are sufficient for simple cutaneous abscesses. However, when adjunctive antibiotics are indicated, drugs active against MRSA are encouraged. Antibiotic choices include trimethoprim/sulfamethoxazole, clindamycin, and vancomycin.

Nonpurulent SSTIs: Streptococcus species are the predominant pathogens responsible for nonpurulent SSTIs. Antibiotics active against these organisms include cephalexin, cefazolin, clindamycin, and vancomycin. These agents also have activity against methicillin-susceptible *S. aureus* (MSSA). Clindamycin and vancomycin have activity against MRSA. The addition of anti-MRSA therapy to cephalexin did not improve outcomes in uncomplicated cellulitis.[PAL]

Necrotizing fasciitis: Polymicrobial or monomicrobial infections, such as Group A Streptococcus, can cause necrotizing fasciitis. Broad-spectrum antibiotics are indicated as an adjunct to surgical management. Clindamycin should be included in the empiric choices to decrease pathogen toxin production.

Bite wound infections: These are generally polymicrobial. The organisms that cause these infections include oral flora of the biting animal: Pasteurella species (animal bites), *Eikenella corrodens* (human bites), Streptococcus species, *S. aureus*, and a number of anaerobes. Antimicrobials active against these organisms include amoxicillin/clavulanate or trimethoprim/sulfamethoxazole PLUS clindamycin. MRSA is infrequently isolated.

TABLE 1. Inpatient Dosing for Skin and Soft Tissue Infections

Drug	Route and Dose by Patient Weight
Cefazolin	33 mg/kg/dose (max 2,000 mg) IV every 8 hours
Clindamycin	10–13 mg/kg/dose (max 600 mg) IV every 8 hours
Vancomycin	20 mg/kg/dose (max 2,000 mg) IV every 8 hours
Ampicillin/sulbactam	50 mg/kg/dose (max 2,000 mg) IV every 6 hours (dose on ampicillin component)
Ceftriaxone	50–75 mg/kg/dose (max 2,000 mg) IV every 24 hours
Metronidazole	10 mg/kg/dose (max 500 mg) IV or by mouth every 8 hours
Piperacillin/tazobactam	75 mg/kg/dose (max 3,000 mg) IV every 6 hours (dose on piperacillin component)

TABLE 2. Outpatient Dosing for Skin and Soft Tissue Infections

Drug	Route and Dose by Patient Weight
Cephalexin	≤ 33 kg: 15 to 20 mg/kg/dose (max 500 mg) by mouth three times daily; > 33 kg: 500 mg by mouth four times daily. Pills available as 250 mg and 500 mg. Suspension available as 125 mg/5 mL and 250 mg/5 mL concentrations.
Clindamycin	10–13 mg/kg/dose (max 450 mg) by mouth three times daily. Pills available as 150 mg and 300 mg. Solution available as 75 mg/5 mL concentration.
Trimethoprim/ sulfamethoxazole	6 mg/kg/dose (max 320 mg) by mouth twice daily (dose on trimethoprim component). Pills available as 400 mg/80 mg, DS = 800 mg/160 mg. Solution available as 40 mg/5 mL trimethoprim concentration.
Amoxicillin/ clavulanate	20–45 mg/kg/dose (max 875 mg) by mouth twice daily (dose on amoxicillin component). Pills available as 250 mg/125 mg, 500 mg/125 mg, and 875 mg/125 mg. Suspension available as 200 mg/5 mL, 250 mg/5 mL, and 400 mg/5 mL ampicillin concentrations.

This CPM is based on best evidence at the time of publication. It is not meant to be a prescription for every patient. Clinical judgment based on each patient's unique situation is vital. We welcome your feedback; contact Carolyn.Reynolds@imail.org

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REFERENCES

IDSA Stevens DL, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. Clin Infect Dis. 2014; Jul 15;59(2):e10-52.

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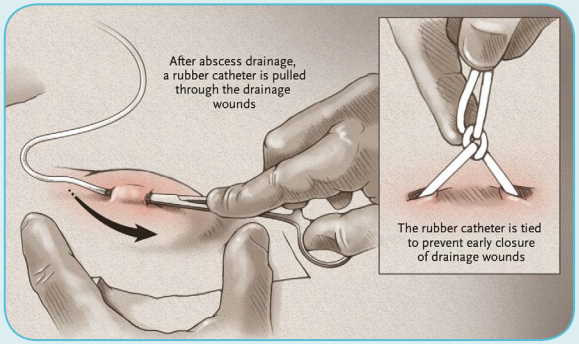
PAL Pallin DJ, et al. Clinical Trial: Comparative effectiveness of cephalexin plus trimethoprim-sulfamethoxazole versus cephalexin alone for treatment of uncomplicated cellulitis: a randomized controlled trial. Clin Infect Dis. 2013;56:1754.



1. Hemostat inserted between 2 small incisions after loculations are disrupted.

2. The 2 ends of the loop drain are affixed to each other without tension.

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