Pediatric Skin & Soft Tissue Infections Clinical Pathway
Johns Hopkins All Children’s Hospital

Pediatric Skin & Soft Tissue Infections (SSTI) Clinical Pathway

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This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patient based on the patient’s individualized circumstances and the practitioner’s professional judgment.
Rationale

This protocol was developed by a consensus group of JHACH Hospitalists, Infectious Disease Physicians and EC Physicians to standardize the management of skin and soft tissue infections in the outpatient and inpatient setting.

Background

Cellulitis and abscess are among the most common skin and soft tissue infections. Cellulitis is defined as an area of skin erythema, edema and warmth. Abscess is defined as a collection of pus within dermis or subcutaneous space. Skin and soft tissue infection in children account for a large portion of Emergency Center visits annually as well as inpatient admissions. While Staphylococcus aureus is the most common cause of suppurative skin and soft tissue infections in otherwise healthy children, this guideline will discuss the microbiology and treatment of less common etiologies as well.
Non-Suppurative Cellulitis

Non-Suppurative Cellulitis = Cellulitis with intact skin and no evidence of purulent drainage

- Majority of cases are caused by beta-hemolytic streptococci, often group A streptococci (
  \(S.\ pyogenes, \text{GAS}\), but also groups B (GBS), C, F, or G streptococci
  - Beta-hemolytic streptococci are uniformly susceptible to penicillin
  - Clindamycin resistance remains low (<10%) for group A streptococci
  - TMP/SMX and doxycycline are NOT active against group A streptococci
- \textit{Staphylococcus aureus} is a less common cause of non-suppurative cellulitis
- Blood and tissue cultures are generally unnecessary for typical cases of non-suppurative cellulitis; consider cultures and MRSA-SA PCR skin/soft tissues in those with immune compromising conditions, hemodynamic instability, unusual predisposing factors (immersion injury, animal bites), or failure of first-line antibiotic therapy
- Cellulitis may worsen in the first 24 hours after initiating appropriate antibiotic therapy as sudden destruction of pathogens releases potent enzymes that increase local inflammation

- \textbf{Mild or moderate disease}: PO/IV therapy (Duration 5 days)
  - If no personal/household history of MRSA and low suspicion for MRSA:
    - \textbf{Cefazolin} 50 mg/kg/day IV divided every 8 hours (max daily dose: 6 g/day), OR
    - \textbf{Cephalexin} 50 mg/kg/day PO divided every 6 or 12 hours; maximum daily dose: 2,000 mg/day
  - If + personal/household history of MRSA or suspicion for MRSA:
    - \textbf{TMP-SMX} 8 mg/kg/dose of the TMP component PO q12h (max 320 mg of TMP PO q12h) \textbf{PLUS Amoxicillin} 20 mg/kg/dose PO q8h (max 500 mg PO q8h), OR
    - \textbf{Clindamycin} 10 mg/kg/dose PO/IV q8h (max 450 mg PO q8h)

- \textbf{Severe disease}: Defined as patient with hemodynamic instability, ill or toxic appearance, immunocompromised, concern for necrotizing infection, poor compliance or previous failure of outpatient treatment. Consider initial IV therapy. Infectious Disease should be consulted. Consider convert to PO therapy after favorable clinical response observed (Total duration 7 days)
  - \textbf{Cefazolin} 33mg/kg/dose IV q8h (max 2000mg IV q8h) If no personal/household history of MRSA and low suspicion for MRSA OR
  - \textbf{Clindamycin} 10 mg/kg/dose IV q8h (max 600 mg IV q8h) if clinically stable and immune competent OR
  - \textbf{Vancomycin} (see “Vancomycin IV Order Set” in Cerner for dosing recommendations) if immunocompromised and/or ill-appearing.
**Johns Hopkins All Children’s Hospital**
**Non-Suppurative Skin & Soft Tissue Infections Clinical Pathway**

**Special Considerations:**
See companion guidelines for special clinical scenarios, including infections related to:
- Cat and dog bites
- Human bites
- Water exposure
- Odontogenic origin
- Preseptal/Orbital origin
Please review companion guideline for antibiotic dosing information

**Non-Suppurative Skin & Soft Tissue Infections**
Cellulitis/Erysipelas/Impetigo

**Are any of the following conditions present:**
- Hemodynamically unstable
- Ill or Toxic-Appearing
- Immunocompromised
- Concern for necrotizing infection
- Circumferential infection
- Poor compliance or social concerns
- Failed appropriate outpatient treatment

**YES**
Admit Inpatient status
Consider tissue cultures, MRSA-SA PCR
IV antibiotics

**Severe Infection?**
- Immunocompromised
- Signs of deep/necrotizing infection
- Hemodynamically unstable
- Sepsis

Consider blood culture
IV Vancomycin
Consult ID for additional recommendations
Duration 7 days or per ID recommendations

**Mild to Moderate Infection?**
Typical appearance
Hemodynamically stable

Personal/household history, or suspicion for MRSA?

**YES**
IV Clindamycin

**NO**
IV Cefazolin

**Outpatient therapy**
Oral antibiotics x 5 days
Consider adding topical antibiotics for impetigo BID x 5 days

**Personal/household history, or suspicion for MRSA?**

**Yes**
TMP-SMX plus Amoxicillin
OR Clindamycin PO

**No**
Cefalexin PO
Suppurative Cellulitis and Cutaneous Abscesses

**Suppurative Cellulitis** = Cellulitis with purulent drainage

- Majority of cases are caused by S. aureus (MRSA or MSSA)
  - TMP/SMX, doxycycline, and clindamycin remain active against the majority of community-acquired MRSA isolates from previously healthy individuals
  - Fluoroquinolones are NOT recommended for the treatment of S. aureus infections, even if found to be susceptible in vitro
- Blood cultures are generally not necessary, however, purulent drainage can be sent for culture and susceptibility testing, as well as MRSA-SA PCR from skin/soft tissues

**Cutaneous Abscess**

- *S. aureus* causes the majority of skin abscesses
- Incision and drainage (I&D) is the primary treatment for cutaneous abscesses
- Previously, if not systemically ill and abscess < 5 cm (cellulitis and abscess total) and adequately drained, no systemic antibiotic therapy is needed. Currently, almost all abscess requiring I&D will receive antibiotics unless very minor.
- However, systemic antibiotics can be considered for the following patients:
  - Severe or rapidly progressive infection
  - Presence of extensive associated cellulitis ( > 5 cm in diameter)
  - Associated septic phlebitis
  - Location of abscess in an area where drainage is difficult (e.g. face, genitalia, hands, feet)
  - Immunocompromised
  - Hemodynamically unstable
- At the time of I&D, cultures and MRSA-SA PCR from skin/soft tissues are strongly recommended for children who are immunocompromised or warrant hospital admission

**Mild disease:** total area involved, including cellulitis, is < 5 cm and there are no systemic symptoms
- Simple I&D is recommended
- Antibiotics now recommended for all I&D except for most minor cases

**Moderate disease:** ≥ 5 cm total area of involvement and/or systemic symptoms. Consider I&D with vessel loop technique or Surgery consult. PO antibiotic therapy is recommended (Duration 5 days)
- Clindamycin 10 mg/kg/dose PO q8h (max 450 mg PO q8h)
  OR
  - Doxycycline 2.2 mg/kg/dose PO q12h (max 100 mg PO q12h) (only for ≥ 8 years old)  OR
  - TMP/SMX 8-10 mg/kg/dose of the TMP component PO q12h (max 320 mg of TMP PO q12h)
  OR
o If MSSA: Cephalexin 25 to 50 mg/kg/day PO divided every 6 or 8 hours; maximum daily dose: 2,000 mg/day

- **Severe disease**: See algorithm for special circumstances. Consider initial IV therapy. Convert to PO therapy after favorable clinical response observed (Total duration **7 days**)
  o **Clindamycin** IV if clinically stable and immune competent. 10 mg/kg/dose IV q8h
  OR
  o **TMP/SMX** IV if clinically stable and immune competent. 8-10 mg/kg/dose of the TMP component IV q12h
  o **Vancomycin** if immunocompromised or clinically unstable (see “Vancomycin IV Order Set” in Cerner for dosing recommendations) (goal trough 10-15 mcg/mL)
Suppurative Skin & Soft Tissue Infections Clinical Pathway

Suppurative Skin & Soft Tissue Infections
Abscess/Boil/Carbuncle/Furuncle

Mild Infection
< 5 cm
No systemic symptoms
Simple I&D
Antibiotics unless very minor
Discharge home

Moderate Infection
≥ 5 cm
and/or
Systemic symptoms

Severe Infection
- Hemodynamically unstable
- Ill or Toxic-Appearing
- Immunocompromised
- Concern for necrotizing infection
- Poor compliance or social concerns

OR

High Risk Location?
Face, Hand, Foot, Peri-anal

NO
I&D with Vessel Loop
Send culture & MRSA-SA
PCR
If history, exposure, risk, or
PCR + MRSA:
PO TMP-SMX, Clinda, or
Doxycycline if ≥ 8 yrs
If low suspicion for MRSA
or PCR negative:
PO Cephalexin
5 days of antibiotic therapy
Discharge home
Follow-up in Wound Clinic

YES
Consult appropriate surgical service

High Risk Location?
Face, Hand, Foot, Peri-anal
OR
Concerns for necrotizing infection

NO

Hemodynamically unstable
III or Toxic-Appearing?
Immunocompromised?
Concern for necrotizing infection?

Consult Appropriate
Surgical Service and ID
Admit
Inpatient Status
IV Vancomycin

Well-appearing
Social/compliance issues?
Failed simple I&D?
I&D with Vessel Loop in
ED
Send culture & MRSA-SA
PCR
Admit
Inpatient Status
IV Clindamycin or TMP-SMX
7 days total antibiotic therapy
Cat and Dog Bites

- Microbiology: *S. aureus*, streptococci, oral anaerobes, *Pasteurella multocida*, *Capnocytophaga canimorsus*
- Refer to the Red Book for post-exposure prophylaxis guidelines including rabies, tetanus, etc.
- Reminder, these guidelines are for infections associated with recent cat and dog bites, not for prophylaxis from infection following an acute bite (see Red Book)
- **Amoxicillin/clavulanate** 20 mg/kg/dose of amoxicillin component PO q8h (max 500 mg of amoxicillin component PO q8h) **OR ampicillin/sulbactam** 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h) for **5 days**
- **PCN allergy:** **TMP/SMX** 5 mg/kg/dose of the TMP component PO/IV q12h (max 320 mg of TMP PO/IV q12h) **PLUS clindamycin** 10 mg/kg/dose PO/IV q8h (max 450 mg PO q8h, max 600 mg IV q8h), both for **5 days**

Human Bites

- Microbiology: streptococci, *S. aureus*, oral anaerobes, and *Eikenella corrodens*
- **Amoxicillin/clavulanate** 20 mg/kg/dose of amoxicillin component PO q8h (max 500 mg of amoxicillin component PO q12h) **OR ampicillin/sulbactam** 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h) for **5 days**
- **PCN allergy:** **Clindamycin** 10 mg/kg/dose PO/IV q8h (max 450 mg PO q8h, max 600 mg IV q8h) **PLUS ciprofloxacin** 15 mg/kg/dose PO q12h or 10 mg/kg/dose IV q12h (max 500 mg PO q12h, max 400 mg IV q12h) for **5 days**
Water-Related Injuries

- The following are guidelines for treatment of skin and soft tissue infections associated with water-related injuries, not to prevent infection after an injury. Please refer to the Red Book for prophylaxis recommendations.

- **Fresh or brackish water injury:** Aeromonas hydrophila and Plesiomonas shigelloides should be covered (along with skin flora): Clindamycin 10 mg/kg/dose PO/IV q8h (max 450 mg PO q8h, max 600 mg IV q8h) PLUS ciprofloxacin 15 mg/kg/dose PO q12h or 10 mg/kg/dose IV q12h (max 500 mg PO q12h, max 400 mg IV q12h) (for any age)

- **Saltwater injury:** Vibrio spp. (primarily *V. vulnificus*) should be suspected in patients ill-appearing or with bullae, vesicles, and ulcers after exposure to seawater or raw oysters. General pediatric surgery should be consulted for potential debridement. Treat with Ceftriaxone 50 mg/kg/dose IV q24h (max 1000 mg IV q24h) PLUS doxycycline 2.2 mg/kg/dose PO/IV q12h (max 100 mg PO/IV q12h) (only for ≥ 8 years old)

Odontogenic Infections

- Microbiology: polymicrobial; Streptococcus, anaerobes
- Consider moist heat application and/or mouth rinses
- **Mild to moderate:** PO therapy (Duration 14 days)
  - Amoxicillin/clavulanate 20 mg/kg/dose of amoxicillin component PO q8h (max 500 mg)
    - of amoxicillin component PO q12h
    - OR
  - PCN allergy: Clindamycin 10 mg/kg/dose PO q8h (max 450 mg PO q8h)
- **Severe:** Consider initial IV therapy. Convert to PO therapy after favorable clinical response observed (Total duration 14 days)
  - Ampicillin/sulbactam 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h)
    - OR
  - PCN allergy: Clindamycin 10 mg/kg/dose IV q8h (max 450 mg PO q8h, max 600 mg IV q8h)
Necrotizing Fasciitis

Necrotizing Fasciitis = Aggressive infection that tracks along the superficial fascia and compromises the tissue between the skin and underlying muscles

- **Microbiology:**
  - Monomicrobial form usually caused by *S. pyogenes, S. aureus, Vibrio vulnificus*, or Clostridial spp.
  - Polymicrobial form can be caused by anaerobes, streptococci, and gram-negative rods

- **Features suggestive of necrotizing fasciitis include:**
  1. severe pain disproportional to the clinical findings;
  2. failure to respond to initial antibiotic therapy;
  3. systemic toxicity;
  4. edema or tenderness extending beyond the cutaneous erythema;
  5. crepitus, indicating gas in the tissues;
  6. bullous lesions;
  7. skin necrosis or ecchymoses;
  8. copious non-purulent discharge

- **These are surgical emergencies and debridement is essential; Pediatric surgery should therefore be consulted STAT**

- **CT or MRI can help with diagnosis, however if moderate to high suspicion, surgical exploration is the preferred diagnostic method**

- **DO NOT delay surgical intervention to obtain imaging**

- **Infectious disease should be consulted, with urgent physician-to-physician communication strongly encouraged**

- **In addition to routine blood cultures, deep tissue cultures should be obtained in the OR**

- **Duration of therapy: IV antibiotics should be continued until further debridement is no longer necessary, patient has improved clinically, AND afebrile for 48-72 hours**

  - **Vancomycin IV** (see “Vancomycin IV Order Set” in Cerner for dosing recommendations)
    - (goal trough 10-15 mcg/mL) PLUS Ciprofloxacin 10 mg/kg/dose IV q8h (max 400 mg IV q8h)
    - **PLUS Clindamycin** 13 mg/kg/dose IV q6h (max 900 mg IV q8h)

Preseptal and Orbital Cellulitis

- **Microbiology:** *S. aureus, S. pneumoniae, H. influenzae, M. catarrhalis, oral anaerobes*

- **Preseptal Cellulitis:** Involves tissues anterior to the orbital septum
  - Presents with fever, acute onset and rapid progression of eyelid swelling, and periorbital tissues are swollen and erythematous

- **Orbital Cellulitis:** Involves tissues posterior to the orbital septum
  - May present with fever, eye pain, swelling, proptosis, impairment of extraocular eye movements, and loss of visual acuity or chemosis
  - CT with contrast is recommended to evaluate for subperiosteal abscesses, which if present, may require surgical drainage
  - Cavernous sinus thrombosis is a rare but potential complication of orbital cellulitis
  - Always consult Infectious Disease and Ophthalmology +/- ENT

- **See table below for empiric therapy**
<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Empiric IV Therapy</th>
<th>Empiric PO or PO Step Down Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preseptal cellulitis</strong></td>
<td><strong>Cefazolin</strong> 25 to 100 mg/kg/day IV divided every 8 hours (max daily dose: 6 g/day)</td>
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<tr>
<td>with clear skin source (insect bite, trauma, acne, etc.)</td>
<td><strong>OR</strong></td>
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<td></td>
<td><strong>If personal or household history of MRSA:</strong></td>
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<tr>
<td></td>
<td><strong>Clindamycin</strong> 10 mg/kg/dose IV q8h</td>
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<tr>
<td></td>
<td><strong>Total duration:</strong> 7 days</td>
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<tr>
<td></td>
<td><strong>Preseptal cellulitis</strong> due to sinusitis, dental, or otherwise unclear source</td>
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<tr>
<td></td>
<td><strong>Ampicillin/sub lactam</strong> 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h)</td>
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<td></td>
<td><strong>If PCN allergy:</strong></td>
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<td></td>
<td><strong>Ceftriaxone</strong> 50 mg/kg/dose IV q24h (max 1000 mg IV q24h)</td>
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<td></td>
<td><strong>OR</strong></td>
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<td></td>
<td><strong>Levofloxacin</strong> 10 mg/kg/dose IV q12h if &lt; 5 y/o and 10 mg/kg/dose IV q24h if ≥ 5 y/o (max 750 mg/day) +/-</td>
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<td><strong>Clindamycin</strong> 10 mg/kg/dose IV q8h (max 600 mg IV q8h)</td>
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<tr>
<td></td>
<td><strong>Addition of clindamycin is warranted for dental or unclear sources.</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>Total duration:</strong> 7 days</td>
<td></td>
</tr>
<tr>
<td><strong>Orbital Cellulitis</strong></td>
<td><strong>Ampicillin/sub lactam</strong> 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h)</td>
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<tr>
<td>without evidence of intracranial extension</td>
<td><strong>+/- Vancomycin</strong> (see “Vancomycin IV Order Set” in Cerner for dosing) (goal trough 15-20 mcg/mL)</td>
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<tr>
<td></td>
<td><strong>Add vancomycin if reasonable concern for MRSA.</strong></td>
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<td></td>
<td><strong>PCN allergy:</strong></td>
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<td></td>
<td><strong>Levofloxacin</strong> 10 mg/kg/dose IV q12h if &lt; 5 y/o and 10 mg/kg/dose IV q24h if ≥ 5 y/o (max 750 mg/day) +/- Vancomycin (see “Vancomycin IV Order Set” in Cerner for dosing) (goal trough 15-20 mcg/mL)</td>
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<td><strong>Add vancomycin if reasonable concern for MRSA.</strong></td>
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<td></td>
<td><strong>Always start with IV therapy. Discuss possibility of PO step down and duration of therapy in consultation with ID.</strong></td>
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<tr>
<td><strong>Orbital Cellulitis</strong></td>
<td><strong>Call ID urgently for recommendations</strong></td>
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<tr>
<td>with evidence of intracranial extension/involvement</td>
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<tr>
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<td><strong>Always start with IV therapy. Discuss possibility of PO step down and duration of therapy in consultation with ID.</strong></td>
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</tr>
</tbody>
</table>

1 Consider Ceftriaxone if low suspicion for true IgE mediated allergy

2 Consider Levofloxacin if concern for true IgE mediated allergy
References

1. AAP Red Book
Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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