JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Pediatric Skin & Soft Tissue Infections Clinical Pathway

JOHNS HOPKINS
All Children's Hospital

Johns Hopkins All Children's Hospital

Pediatric Skin & Soft Tissue Infections (SSTI) Clinical Pathway

Table of Contents

Updated: January 2020
Owners: Paola Dees, MD
Mary Chrisochos, DO

Johns Hopkins All Children's Hospital

Pediatric Skin and Soft Tissue Infections (SSTI) Clinical Pathway

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*, 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
- *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

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

- 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)
    - Cefazolin 33mg/kg/dose IV q8h (max 2000mg IV q8h) If no personal/household history of MRSA and low suspicion for MRSA
      OR
    - Clindamycin 10 mg/kg/dose IV q8h (max 600 mg IV q8h) if clinically stable and immune competent
      OR
    - 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

NO

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

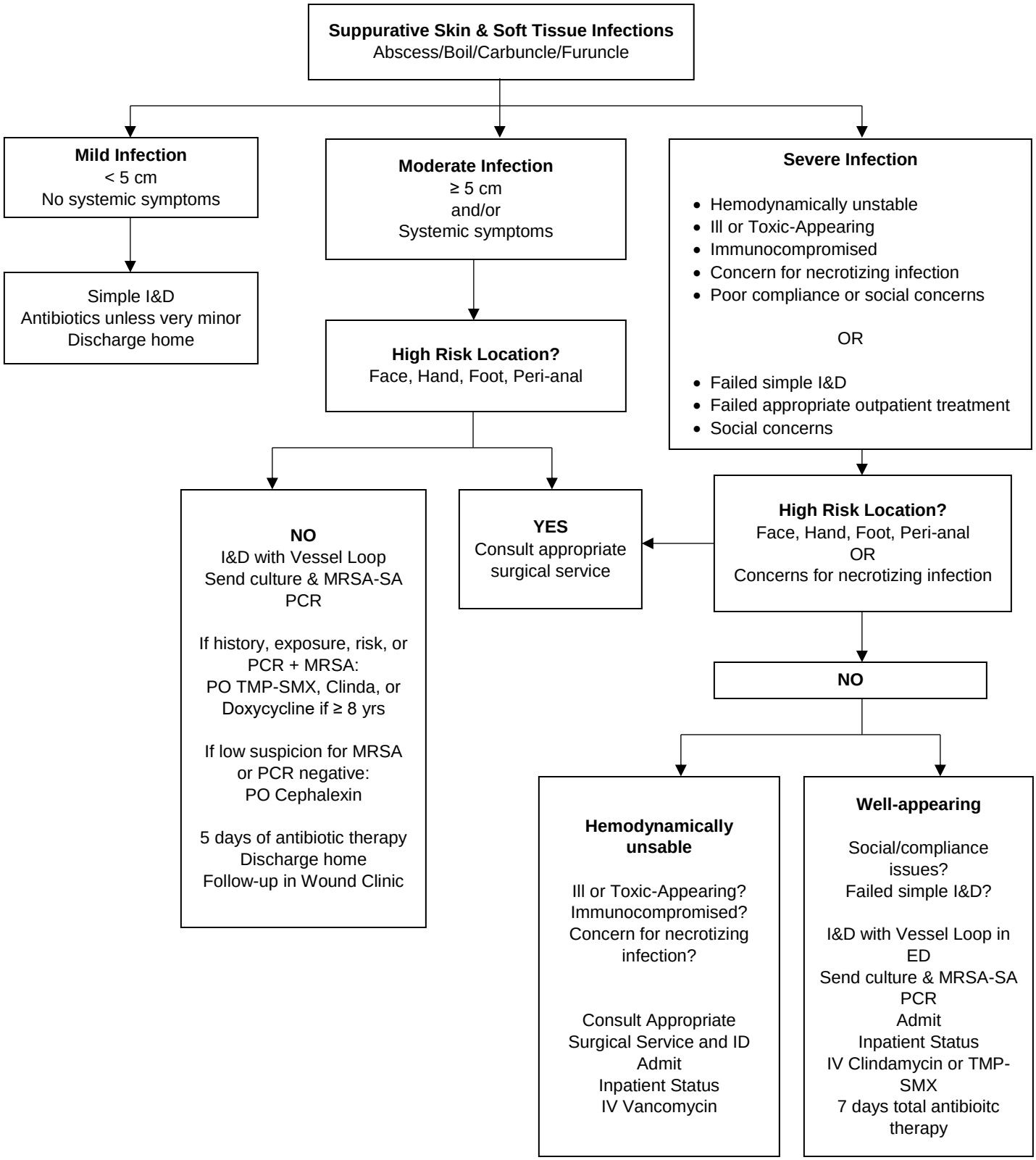
- Moderate disease: ≥ 5 cm total area of involvement and/or systemic symptoms. Consider I&D with vessel loop technique or Surgery consult. PO antibiotic therapy is recommended (Duration 5 days)
    - Clindamycin 10 mg/kg/dose PO q8h (max 450 mg PO q8h)
      OR
    - Doxycycline 2.2 mg/kg/dose PO q12h (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

- 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)
  - Clindamycin IV if clinically stable and immune competent. 10 mg/kg/dose IV q8h OR
  - TMP/SMX IV if clinically stable and immune competent. 8-10 mg/kg/dose of the TMP component IV q12h
  - Vancomycin if immunocompromised or clinically unstable (see "Vancomycin IV Order Set" in Cerner for dosing recommendations) (goal trough 10-15 mcg/mL)

Johns Hopkins All Children's Hospital

Suppurative Skin & Soft Tissue Infections Clinical Pathway



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 extraoccular 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

Type of Infection	Empiric IV Therapy	Empiric PO or PO Step Down Therapy
Preseptal cellulitis with clear skin source (insect bite, trauma, acne, etc.)	**Cefazolin** 25 to 100 mg/kg/day IV divided every 8 hours (max daily dose: 6 g/day) **OR** **If personal or household history of MRSA:** **Clindamycin** 10 mg/kg/dose IV q8h	**Cephalexin** 25 to 50 mg/kg/day PO divided every 6 or 12 hours; maximum daily dose: 2,000 mg/day **OR** **If cephalosporin allergy or history of MRSA:** **Clindamycin** 10 mg/kg/dose PO q8h (max 450 mg PO q8h) **Total duration: 7 days**
Preseptal cellulitis due to sinusitis, dental, or otherwise unclear source	**Ampicillin/sulbactam** 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h) **If PCN allergy:** **Ceftriaxone**[1] 50 mg/kg/dose IV q24h (max 1000 mg IV q24h) **OR** **Levofloxacin**[2] 10 mg/kg/dose IV q12h if < 5 y/o and 10 mg/kg/dose IV q24h if ≥ 5 y/o (max 750 mg/day) **+/-** **Clindamycin** 10 mg/kg/dose IV q8h (max 600 mg IV q8h) Addition of clindamycin is warranted for dental or unclear sources.	**Amoxicillin/clavulanate** 20 mg/kg/dose of amoxicillin component PO q8h (max 500 mg of amoxicillin component PO q8h) **If PCN allergy: Levofloxacin** 10 mg/kg/dose PO q12h if <5 y/o and 10 mg/kg/dose PO q24h if ≥5 y/o (max 750 mg/day) **+/-** **Clindamycin** 10 mg/kg/dose PO q8h (max 450 mg PO q8h) Addition of clindamycin is warranted for dental or unclear sources. **Total duration: 7 days**
Orbital Cellulitis without evidence of intracranial extension	**Ampicillin/sulbactam** 50 mg/kg/dose of ampicillin component IV q6h (max 2000 mg of ampicillin component IV q6h) **+/-** **Vancomycin** (see "Vancomycin IV Order Set" in Cerner for dosing) (goal trough 15-20 mcg/mL) Add vancomycin if reasonable concern for MRSA. **PCN allergy: Levofloxacin** 10 mg/kg/dose IV q12h if < 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) Add vancomycin if reasonable concern for MRSA.	Always start with IV therapy. Discuss possibility of PO step down and duration of therapy in consultation with ID.
Orbital Cellulitis with evidence of intracranial extension/involvement	Call ID urgently for recommendations	Always start with IV therapy. Discuss possibility of PO step down and duration of therapy in consultation with ID.

[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
2. Daum RS, et al. A placebo-controlled trial of antibiotics for smaller skin abscesses. N Engl J Med 2017;376:2545-55. DOI: 10.1056/NEJMoa1607033
3. Frazee B. Antibiotics for simple skin abscesses: the new evidence in perspective. Emerg Med J 2018;35:277–278. doi:10.1136/emermed-2017-207323
4. Hauser A, Fogarasi S. Periorbital and orbital cellulitis. Pediatr Rev. 2010 Jun;31(6):242-9.
5. Miller, LG; Spellberg, B. Treatment of community-associated methicillin-resistant Staphylococcus aureus skin and soft tissue infections with drainage but no antibiotic therapy. Pediatr. Infect. Dis. J., 2004 vol. 23(8) pp. 795; author reply 795-6.
6. Scott HF, Deakyne SJ, Woods JM, Bajaj L. The prevalence and diagnostic utility of systemic inflammatory response syndrome vital signs in a pediatricemergency department. Acad Emerg Med. 2015 Apr;22(4):381-9. doi: 10.1111/acem.12610. Epub 2015 Mar 16.
7. Stevens DL, Bisno AL, Chambers HF, 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.
8. Talan DA, et al. Subgroup Analysis of Antibiotic Treatment for Skin Abscesses. Ann Emerg Med. 2018 January ; 71(1): 21–30. doi:10.1016/j.annemergmed.2017.07.483
9. Talan DA, et al. Trimethoprim–Sulfamethoxazole versus Placebo for Uncomplicated Skin Abscess. N Engl J Med 2016;374:823-32. DOI: 10.1056/NEJMoa1507476
10. Wald ER. Periorbital and Orbital Infections. In Principles and Practices of Pediatric Infectious Diseases, 87, 506-512.e2

Clinical Pathway Team

Pediatric Skin and Soft Tissue Infection Clinical Pathway

Johns Hopkins All Children's Hospital

Owner(s): Dr. Paola Dees; Dr. Mary Chrisochos

Also Reviewed by:

Infectious Diseases: Dr. Juan Dumois; Dr. Allison Messina; Dr. David Berman

Hospitalists: Dr. Paola Dees

Pediatric Surgery: Dr. Paul Danielson

Emergency Center: Dr. Joseph Perno; Dr. Laleh Bahar-Posey; Dr. Mary Chrisochos

Pharmacists: Katie Namtu,PharmD; Bernie Lee, PharmD

Clinical Pathway Management Team: Joseph Perno, MD; Courtney Titus, PA-C

Adopted from the JHM Guidelines for the Management of Skin and Soft Tissue Infections (SSTI) in Children Guidelines (Rev. 01/05/16)

Approved by ACH JHM Pediatric Antimicrobial Stewardship Committee 03/29/16

Approved by Clinical Practice Council 05/10/16

Revision January 2020

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.

The information and guidelines are provided "AS IS" without warranty, express or implied, and Johns Hopkins All Children's Hospital, Inc. hereby excludes all implied warranties of merchantability and fitness for a particular use or purpose with respect to the information. Johns Hopkins All Children's Hospital, Inc. shall not be liable for direct, indirect, special, incidental or consequential damages related to the user's decision to use the information contained herein.