C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

EMPIRIC ANTIBIOTIC GUIDELINES FOR SKIN AND SOFT TISSUE INFECTIONS IN PATIENTS ON PEDIATRIC SERVICES

This guideline is designed to provide guidance in pediatric patients with a primary skin and soft tissue infection (SSTI). Management of skin and soft tissue infections in patients <2 months of age, or presenting with sepsis or septic shock not related to necrotizing fasciitis is beyond the scope of these guidelines. For sepsis or septic shock, refer to the Pediatric Sepsis Guidelines.

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Setting	Empiric Therapy	Duration/Comments
Minor Skin Infections • Localized impetigo (non-bullous or bullous) • Secondarily infected skin lesions such eczema, ulcers, or lacerations • Folliculitis (small follicular abscess in epidermis) *Topical therapy:* Generally preferred over oral therapy *Oral therapy:* Indicated instead of topical therapy for patients with numerous impetigo lesions or in outbreak settings to reduce transmission *Target Pathogens:* *Staphylococcus aureus,* group A *Streptococcus*	Topical Therapy **Mupirocin 2%** topical ointment applied BID Oral Therapy *1st line:* **Cephalexin*** 25 mg/kg/DOSE PO TID (max: 1 g/DOSE) If MRSA coverage needed[1] ADD **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) Alternative to TMP-SMX[2] if sulfa allergy **Doxycycline**[3] 2.2 mg/kg/DOSE PO BID (max: 100 mg/DOSE) *Alternative for low/medium-risk allergy[4] to cephalexin[5], OR high-risk allergy[6]/contraindication[7] to beta-lactams:* **Clindamycin** 10 mg/kg/DOSE PO TID (max: 450 mg/DOSE)	Duration: 5 days *S. aureus* isolates from impetigo are commonly methicillin susceptible (MSSA). Michigan Medicine *S. aureus* resistance rates are lowest for TMP-SMX[2] (2%) and doxycycline (3%), compared to clindamycin (28% in 2018). Methicillin-susceptible *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) exhibit similar rates of clindamycin resistance. If worsening or not improving after 48 hours of oral antibiotic therapy, consider adding or changing to an agent with anti-MRSA activity (i.e., TMP-SMX[2] or doxycycline).
Non-Purulent Cellulitis Absence of purulent drainage or exudate, ulceration, and no associated abscess. Includes erysipelas. *Target Pathogens:* Group A *Streptococcus, Staphylococcus aureus* (the role of community-acquired MRSA is unknown)	Outpatient or Step-down (from IV to PO) Therapy: *1st Line:* **Cephalexin*** 25 mg/kg/DOSE PO TID (max: 1 g/DOSE) If MRSA coverage needed[1] ADD **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) Alternative to TMP-SMX[2] if sulfa allergy **Doxycycline**[3] 2.2 mg/kg/DOSE PO BID (max: 100 mg/DOSE) *Alternative for low/medium-risk allergy[4] to cephalexin[5], OR high-risk allergy[6]/contraindication[7] to beta-lactams:* **Clindamycin** 10 mg/kg/DOSE PO TID (max: 450 mg/DOSE) Inpatient (IV) Therapy *1st Line:* **Cefazolin*** 33 mg/kg/DOSE IV q8h (max: 2 g/DOSE) *Alternative for low/medium-risk allergy[4] to cefazolin, OR high-risk allergy[6]/contraindication[7] to beta-lactams (in patients without risk for MRSA):* **Clindamycin** 10 mg/kg/DOSE IV q8h (max: 600 mg/DOSE) *Alternative if need for MRSA coverage[1]:* **Vancomycin** IV*	Duration: 5 days • May extend therapy up to 7-10 days if lack of symptom resolution at 5 days. Cephalexin and cefazolin provide coverage for group A *Streptococcus* and MSSA. If lack of improvement or clinical worsening on >48 hours of initial antibiotic therapy, consider adding or changing to an agent with anti-MRSA activity. (i.e., TMP-SMX[2] or doxycycline).

Setting	Empiric Therapy	Duration/Comments
<u>Purulent Cellulitis or Abscesses including Folliculitis, Furuncles, Carbuncles</u> *Abscess:* Collection of pus within the dermis and deeper skin tissues *Furuncle:* Infection of the hair follicle with suppuration extending through the dermis into subcutaneous tissue *Carbuncle:* Confluence of furuncles with wider infiltration *Target Pathogen:* *Staphylococcus aureus* (including MRSA)	*<u>Incision and drainage (I&D) is recommended as primary management for abscesses. Antibiotics** are (at a minimum) recommended if patient meets one of the following criteria:</u>* • Substantial surrounding cellulitis • Abscess >2 cm in diameter; >1 cm in infants and young children • Inability to adequately drain the abscess • Signs or symptoms of systemic illness (e.g., fever ≥38° C) • Immunodeficiency • Multiple sites <u>Outpatient Therapy or Step-down (from IV to PO) Therapy</u> *1st Line:* **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) *Alternative for Sulfa Allergy:* **Doxycycline**[3] 2.2 mg/kg/DOSE PO BID (max: 100 mg/DOSE) <u>Inpatient (IV) Therapy</u> *1st Line:* **Vancomycin** IV* *Alternative for vancomycin allergy (not vancomycin infusion reaction):* **Linezolid**[8] PO/IV (PO preferred): <12 years: 10 mg/kg/DOSE TID (max: 600 mg/DOSE) ≥12 years: 10 mg/kg/DOSE BID (max: 600 mg/DOSE)	<u>Duration:</u> 5 days • May extend therapy up to 7-10 days if lack of symptom resolution at 5 days. Cultures and susceptibilities are recommended when I&D is performed. Blood cultures are also recommended for patients with fever, rapidly progressive cellulitis, and systemic illness. Michigan Medicine *S. aureus* resistance rates are lowest for TMP-SMX[2] (2%) and doxycycline (3%), compared to clindamycin (28% in 2018). Methicillin-susceptible *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) exhibit similar rates of clindamycin resistance. *Tailor antibiotic therapy* to results of Gram stain, culture and sensitivities. **Although ~70% of abscesses may resolve with I&D alone, an additional 10% are more likely to resolve with the addition of antibiotics. Clinical context should be taken into account when deciding if antibiotics are appropriate.

Setting	Empiric Therapy	Duration/Comments
Staphylococcal Scalded Skin Syndrome (SSSS) Results in loss of keratinocyte cell adhesion and leads to blistering of upper layer of the skin *Common pathogens:* *Staphylococcus aureus* (MSSA predominantly reported in the literature)	1st Line: **Cefazolin*** 33 mg/kg/DOSE IV q8h (max: 2 g/DOSE) + **Clindamycin** 13 mg/kg/DOSE IV q8h (max: 900 mg/DOSE) Alternative if need for MRSA coverage[1] or alternative for low/medium-risk allergy[4] to cefazolin, OR high-risk allergy[6]/contraindication[7] to beta-lactams: **Vancomycin IV*** + **Clindamycin** 13 mg/kg/DOSE IV q8h (max: 900 mg/DOSE) Step-down (from IV to PO) Therapy *1st Line:* **Cephalexin*** 25 mg/kg/DOSE PO TID (max: 1 g/DOSE) *Alternative if need for MRSA coverage, or for low/medium-risk allergy[4] to cephalexin[5], OR high-risk allergy[6]/contraindication[7] to beta-lactams:* **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE)	Duration: 10 days Consider discontinuing clindamycin when patient is clinically stable (e.g., vital signs within normal limits, no vasopressor requirements) for 24-48 hours and rash no longer progressing (usual duration of 3-5 days). Staphylococcal Scalded Skin Syndrome (SSSS) is usually diagnosed in children <5 years of age. Clindamycin is recommended as adjunct therapy in the setting of toxin production associated with SSSS.
Necrotizing Fasciitis Early and aggressive surgical exploration and debridement is critical. Emergent surgical consultation and ID consult are strongly recommended. *Common pathogens:* Group A β-hemolytic *Streptococcus*, *S. aureus,* *E. coli,* *Pseudomonas* spp., *Enterobacter* spp., *Klebsiella* spp., *Proteus* spp., *Bacteroides* spp., *Clostridia* spp., *Peptostreptococcus* spp.	1st Line: **Piperacillin-tazobactam*** 100 mg of piperacillin/kg/DOSE IV q6h (max: 4 g piperacillin/DOSE) + **Vancomycin IV*** + **Clindamycin** 13 mg/kg/DOSE IV q8h (max: 900 mg/DOSE) Alternative for low/medium-risk allergy[4] to penicillins: **Cefepime*** 50 mg/kg/DOSE IV q8h (max: 2 g/DOSE) + **Vancomycin IV*** + **Clindamycin** 13 mg/kg/DOSE IV q8h (max: 900 mg/DOSE) ADD **Metronidazole** 10 mg/kg/DOSE PO/IV (PO preferred) TID (max: 500 mg/DOSE) if perineum or groin involved *Alternative for low/medium-risk allergy[4] to cefepime, ceftriaxone, cefotaxime, cefpodoxime, OR high-risk allergy[6]/contraindication[7] to beta-lactams:* REPLACE cefepime with **Aztreonam*** 50 mg/kg/DOSE IV q8h (max: 2 g/DOSE) Alternative for vancomycin allergy (not vancomycin infusion reaction): **Piperacillin-tazobactam*** 100 mg of piperacillin/kg/DOSE IV q6h (max: 4 g piperacillin/DOSE) + **Linezolid**[8] PO/IV (PO preferred): ≤11 years: 10 mg/kg/DOSE TID (max: 600 mg/DOSE) ≥12 years: 10 mg/kg/DOSE BID (max: 600 mg/DOSE)	Duration: Empiric antibiotics should be continued until the following criteria are met: • Debridement no longer needed, • Clinical improvement, and • Minimum of 48-72 hours after completion of surgical debridement Clindamycin is initiated for anti-toxin activity for *Streptococcal* and *Staphylococcal* infections, and can be stopped after 24-72 hours if infection has improved and patient is stable. *Tailor antibiotic therapy* to results of deep tissue Gram stain, culture and sensitivities. Linezolid has in-vitro data that demonstrates suppression of toxin production with *S. aureus* and group A streptococcus. Clinical success against toxic shock syndrome is reported in case reports.

Setting	Empiric Therapy	Duration/Comments
<u>Traumatic Wound Infections *WITHOUT* water exposure</u> Usually polymicrobial from environmental contamination. See section above if concern for necrotizing fasciitis. For animal/human bites, refer to Animal Bite Guidelines on antimicrobial stewardship webpage. Evaluate tetanus immunization status, and if indicated, administer tetanus immunization +/- tetanus immune globulin. *Target pathogens:* *Staphylococcus aureus*, *Clostridia* spp., *Bacteroides* spp., *Prevotella* spp., *Porphyromonas* spp., *Peptostreptococcus* spp.	Traumatic wounds without evidence of local infection or systemic signs of infection typically do not need antimicrobial therapy. <u>Outpatient (PO) Therapy</u> *1st Line:* **Amoxicillin-clavulanate*** 25 mg amoxicillin/kg/DOSE PO BID (max: 875 mg amoxicillin/DOSE) If MRSA coverage needed[1] ADD **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) *Alternative for low/medium risk allergy[4] to penicillins:* **Cephalexin*** 25 mg/kg/DOSE PO TID (max: 1 g/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO TID (max: 500 mg/DOSE) *Alternative for low/medium risk allergy[4] to penicillins plus need for MRSA coverage[1], for low/medium-risk allergy[4] to cephalexin[5], OR for high-risk allergy[6]/contraindication[7] to beta-lactams:* **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO TID (max: 500 mg/DOSE) <u>Inpatient (IV) Therapy</u> *1st Line:* **Ampicillin-sulbactam*** 50 mg of ampicillin/kg/DOSE IV q6h (max: 2 g ampicillin/DOSE) *Alternative for low/medium-risk allergy[4] to penicillins:* **Cefazolin*** 33 mg/kg/DOSE IV q8h (max: 2 g/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO/IV (PO preferred) TID (max: 500 mg/DOSE) *Alternative if need for MRSA coverage[1], for low/medium-risk allergy[4] to cefazolin, OR for high-risk allergy[6]/contraindication[7] to beta-lactams:* **Vancomycin IV*** + **Metronidazole** 10 mg/kg/DOSE PO/IV (PO preferred) q8h (max: 500 mg/DOSE)	<u>Duration:</u> 7 days • May extend to 10-14 days if lack of symptom resolution at 7 days Debridement of devitalized tissues and contaminating debris is critical to source control and successful healing. Empiric therapy should take into account site of wound and prior cultures and colonization. *Tailor antibiotic therapy* to results of deep tissue Gram stain, culture and sensitivities.

Setting	Empiric Therapy	Duration/Comments
Traumatic Wound Infections *WITH* water exposure Usually polymicrobial from environmental contamination. See section above if concern for necrotizing fasciitis. For animal/human bites, refer to Animal Bite Guidelines on antimicrobial stewardship webpage. Evaluate tetanus immunization status, and if indicated, administer tetanus immunization ± tetanus immune globulin. *Target pathogens:* *Staphylococcus aureus*, *Clostridia* spp., *Bacteroides* spp., *Prevotella* spp., *Porphyromonas* spp., *Peptostreptococcus* spp. Consider *Aeromonas* and *Pseudomonas* spp., other gram negatives if significant water exposure	Outpatient (PO) Therapy for Patients: **Levofloxacin*** PO: ≤4 years: 10 mg/kg/DOSE PO BID (max: 375 mg/DOSE) ≥5 years: 10 mg/kg/DOSE PO daily (max: 750 mg/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO TID (max: 500 mg/dose) If MRSA coverage needed[1] ADD **TMP-SMX**[2,*] 6 mg of TMP/kg/DOSE PO BID (max: 320 mg TMP/DOSE) Inpatient (IV) Therapy for Patients: *1st Line:* **Cefepime*** 50 mg/kg/DOSE IV q8h (max: 2 g/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO/IV (PO preferred) q8h (max: 500 mg/DOSE) If MRSA coverage needed[1] ADD **Vancomycin** IV* *Alternative for low/medium-risk allergy[4] to cefepime, ceftriaxone, cefotaxime, or cefpodoxime OR high-risk allergy[6]/contraindication[7] to beta-lactams:* **Levofloxacin** IV/PO (PO preferred): ≤4 years: 10 mg/kg/DOSE PO BID (max: 375 mg/DOSE) ≥5 years: 10 mg/kg/DOSE PO daily (max: 750 mg/DOSE) + **Metronidazole** 10 mg/kg/DOSE PO/IV TID (PO preferred) (max: 500 mg/DOSE) If MRSA coverage needed[1] ADD **Vancomycin** IV*	Duration: 10 days • May extend to 14 days if lack of symptom resolution at 10 days Debridement of devitalized tissues and contaminating debris is critical to source control and successful healing. Empiric therapy should take into account site of wound and prior cultures and colonization. *Vibrio vulnificus* wound infections require extensive debridement and mortality can be high. Consider combination therapy with ceftazidime and doxycycline. *Tailor antibiotic therapy* to results of deep tissue Gram stain, culture and sensitivities.

Footnotes:

* Renal adjustment may be necessary. See Pediatric Antimicrobial Dosing Guidelines.

[1] Consider MRSA coverage if any of the following are present: severe sepsis or septic shock, immunocompromised status, personal or household contact with MRSA infection or colonization in the past 12 months

[2] TMP-SMX = trimethoprim-sulfamethoxazole

[3] CDC and Indian Health Service (IHS) study demonstrated short courses (7-10 days) of doxycycline can be used in children without causing tooth staining or weakening of tooth enamel. Todd SR et al. J Pediatr. 2015;166(5):1246-1251.

[4] Low-risk allergies include: pruritus without rash, remote (>10 years) unknown reaction, patient denies allergy but is on record, mild rash with no other symptoms (mild rash: non-urticarial rash that resolves without medical intervention). Medium-risk allergies include: urticaria/hives with no other symptoms, severe rash with no other symptoms (severe rash: requires medical intervention [corticosteroids, anti-histamines] and/or ER visit or hospitalization). See β-lactam allergy evaluation and empiric guidance for further information.

[5] This also includes allergy to cephalosporins with a similar side-chain to cephalexin, which includes cefaclor, cefadroxil, or cefprozil. See β-lactam allergy evaluation and empiric guidance for further information.

[6] High-risk allergies include: respiratory symptoms (chest tightness, bronchospasm, wheezing, cough), angioedema (swelling, throat tightness), cardiovascular symptoms (hypotension, dizzy/lightheadedness, syncope/passing out, arrhythmia), anaphylaxis. If a patient has a high-risk allergy to penicillins, cephalosporins, or carbapenems, the only beta-lactam antibiotic that can be safely used without Allergy consult is aztreonam (**if the allergy is to ceftazidime or aztreonam, aztreonam should be avoided as well**). See β-lactam allergy evaluation and empiric guidance for further information.

[7] Previous reactions that are contraindications to further beta-lactam use (**except aztreonam, which can be used unless the reaction was to ceftazidime or aztreonam**) unless approved by Allergy: organ damage (kidney, liver), drug-induced immune-mediated anemia/thrombocytopenia/leukopenia, rash with mucosal lesions (Stevens Johnson Syndrome/Toxic Epidermal Necrosis), rash with pustules (acute generalized exanthematous pustulosis), rash with eosinophils and organ injury (DRESS – drug rash eosinophilia and systemic symptoms), rash with joint pain, fever, and myalgia (Serum Sickness). See β-lactam allergy evaluation and empiric guidance for further information.

[8] Serotonin Syndrome and Linezolid: Education and Recommendations

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Revision History:

04/2020: Reduced some clindamycin doses to align with adult SSTI and animal bite guideline dosing; updated allergy wording
09/2020: Adjusted aztreonam dosing.
03/2021: Updated vancomycin hyperlinks
09/2021: Updated vancomycin infusion reaction terminology