MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

SKIN AND SOFT TISSUE INFECTIONS

Clinical Setting	Empiric Therapy	Duration	Comments
Minor Skin Infections Impetigo • Secondarily infected skin lesions such eczema, ulcers, or lacerations	Mupirocin 2% topical ointment BID	7 days	
Abscess, Furuncles, and Carbuncles **Abscesses** - collections of pus within the dermis and deeper skin tissues **Furuncle** - infection of the hair follicle in which purulent material extends through the dermis into the subcutaneous tissue, where a small abscess forms **Carbuncle** - coalescence of several furuncles into a single inflammatory mass	INCISION AND DRAINAGE (I&D) IS RECOMMENDED AS PRIMARY MANAGEMENT, AND ANTIBIOTICS ARE NOT INDICATED UNLESS PATIENT MEETS ONE OF THE FOLLOWING CRITERIA: • Severe, extensive, rapidly progressive cellulitis, or abscess >2 cm • Signs or symptoms of systemic illness • Elderly, immunosuppressed, active neoplasm or diabetes mellitus • Circumstances where abscess is difficult to drain • Associated septic phlebitis • Inadequate response to I&D alone EMPIRIC ORAL ANTIBIOTIC THERAPY FOR OUTPATIENT THERAPY, OR ORAL STEP-DOWN THERAPY MEETING ABOVE CRITERIA: *Preferred:* **TMP-SMX*** 1-2 DS tabs PO BID *Alternative:* **Doxycycline** 200 mg PO x1, then 100 mg PO BID EMPIRIC IV ANTIBIOTIC THERAPY FOR HOSPITALIZED PATIENTS: *Preferred:* **Vancomycin*** IV (see nomogram, AUC goal 400-600)	5-7 days	• Close clinical follow-up is recommended, especially in patients no receiving antibiotic therapy • Cultures and susceptibility are recommended when I&D is performed • Renal dose adjustment may be required for vancomycin and trimethoprim-sulfamethoxazole • *Staphylococcus aureus* resistance rates are lowest for TMP-SMX (3%) and doxycycline (4%), compared to clindamycin (43%). • Empiric therapy should target MRSA until susceptibilities are known, and then therapy should be tailored. For patients with MSSA, preferred oral step-down therapy is cephalexin, TMP-SMX, or doxycycline if patient has severe beta-lactam allergy

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Non-Purulent Cellulitis (Absence of purulent drainage or exudate, ulceration, and no associated abscess) **Empiric therapy for β-hemolytic streptococcus is recommended.** **If there is a concern for necrotizing fasciitis, please see treatment recommendations listed under that section**	EMPIRIC IV ANTIBIOTIC THERAPY FOR HOSPITALIZED PATIENTS: *Preferred:* **Cefazolin***2 g IV q8h *Alternative for patients with life-threatening penicillin allergy (in patients with or without risk for MRSA)* **Clindamycin** 600 mg IV q8h *Alternative for patients at risk for MRSA non-purulent cellulitis:* **Vancomycin*** IV (see nomogram, AUC goal 400-600) if MRSA coverage is indicated Patients at risk for MRSA: • Cellulitis worse on >48 hours of IV β-lactam therapy • Known MRSA colonization • Prior history of MRSA infection • Recent intravenous drug use • Severe sepsis or septic shock EMPIRIC ORAL ANTIBIOTIC THERAPY FOR OUTPATIENT THERAPY, OR ORAL STEP-DOWN THERAPY: *Preferred* **Cephalexin*** 500 mg PO QID or 1000 mg PO TID + **TMP-SMZ*** 1-2 DS BID to cephalexin, if patient presents with risk factors for MRSA (listed above) ALTERNATIVE FOR PATIENTS WITH LIFE-THREATENING PENICILLIN ALLERGY (IN PATIENTS WITH OR WITHOUT RISK FOR MRSA): **Clindamycin** 450 mg PO TID	5 days for patients with rapid clinical response. Longer duration of therapy is indicated if infection has not improved	• Blood cultures and cultures from purulent SSTI are recommended for patients with fever, rapidly progressive cellulitis, or signs of systemic illness • Adjust antimicrobial therapy based on culture results • Consider initial aggressive dosing of antibiotics if severe sepsis or morbidly obese patient

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Purulent Cellulitis **(Purulent drainage or exudate without a drainable abscess)** **Empiric therapy for CA-MRSA is recommended** **Therapy for β-hemolytic streptococci is likely to be unnecessary**	EMPIRIC IV ANTIBIOTIC THERAPY FOR HOSPITALIZED PATIENTS: *Preferred:* **Vancomycin*** IV (see nomogram, AUC goal 400-600) *Alternative for vancomycin, if documented allergy or intolerance:* **Linezolid**** 600 mg IV/PO BID EMPIRIC ORAL ANTIBIOTIC THERAPY FOR OUTPATIENT THERAPY, OR ORAL STEP-DOWN THERAPY: *Preferred:* **TMP-SMX*** 1-2 DS tabs PO BID *Alternative:* **Doxycycline** 200 mg x1, then 100 mg PO BID	5-10 days Longer duration of therapy is indicated if infection has not improved	• Blood cultures and cultures from purulent SSTI are recommended for patients with fever, rapidly progressive cellulitis, or signs of systemic illness • *Staphylococcus aureus* resistance rates are lowest for TMP-SMX (3%) and doxycycline (4%), compared to clindamycin (43%). • Empiric therapy should target MRSA until susceptibilities are known, and then therapy should be tailored. For patients with MSSA, preferred oral step-down therapy is cephalexin, or TMP-SMX or doxycycline if patient has severe beta-lactam allergy

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Necrotizing Fasciitis **Early and aggressive surgical exploration and debridement is critical** **Emergent surgical consultation is recommended**	PREFERRED: **Piperacillin-tazobactam*** 4.5 g IV q6h + **Clindamycin** 900 mg IV q8h + **Vancomycin*** (see nomogram, AUC goal 400-600) ALTERNATIVE FOR PATIENTS WITH PENICILLIN ALLERGY: *Mild Allergy- Rash:* **Cefepime*** 2 g IV q8h + **Clindamycin** 900 mg IV q8h + **Vancomycin*** (see nomogram, AUC goal 400-600) *Anaphylaxis:* **Aztreonam*** 2 g IV q8h + **Clindamycin** 900 mg IV q8h + **Vancomycin*** (see nomogram, AUC goal 400-600)	Optimal duration is unknown but should be continued for a minimum of 2-3 days after completion of surgical debridement	• Emergent surgical and infectious disease consultation is recommended • Clindamycin is initiated for anti-toxin activity for Streptococcal and Staphylococcal infections, and could be discontinued after 1-3 days if infection has improved and patient is stable (assuming another antibiotic with anti-anaerobic activity is also administered).

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Superficial Surgical Site Infections
 	
Infections involving the subcutaneous tissue within 30 days of operation
 	
For SSI involving deep tissue or organ space or complicated by sepsis/septic shock, see below or organ specific guidelines (Intra-abdominal, Gynecology, Meningitis, Endocarditis, Bone and Joint)
 	
Suture removal plus incision and drainage should be performed
 	
If there is a concern for necrotizing fasciitis, please refer to that section
	All systemic antimicrobial therapy should be used in combination with opening the incision and evacuation of infected material
	
	PREFERRED EMPIRIC INPATIENT THERAPY FOR SUPERFICIAL SSI, WITHOUT RISK FOR MRSA OR GNR (SEE BELOW):
	Cefazolin* 2 g IV q8h
	OR
	Cephalexin 500 mg PO QID or 1000 mg PO TID for mild-moderate infection, or oral step-down therapy
	
	ALTERNATIVE EMPIRIC INPATIENT THERAPY FOR PATIENTS WITH HIGH RISK OF MRSA OR PCN/CEPHALOSPORIN ALLERGY:
	Vancomycin* IV (see nomogram, AUC goal 400-600)
	
	EMPIRIC INPATIENT THERAPY FOR PATIENTS WITH HIGH RISK OF MRSA AND VANCOMYCIN ALLERGY (NOT VANCOMYCIN INFUSION REACTION):
	Linezolid** 600 mg IV/PO q12h
	OR
	TMP-SMX* 1-2 DS tabs PO BID for mild-moderate infection, or oral step-down therapy
	
	EMPIRIC THERAPY FOR PATIENTS WITH SUPERFICIAL SSI FOLLOWING OPERATIONS OF THE AXILLA, GASTROINTESTINAL TRACT, PERINEUM, OR FEMALE GENITAL TRACT:
	Cefazolin* 2 g IV q8h
	+ **Metronidazole** 500 mg PO/IV q8h
	+ **Vancomycin*** IV (see nomogram, AUC goal 400-600), if risk for MRSA
	OR
	Amoxicillin-clavulanate 875 mg PO BID for mild-moderate infection, or oral step-down therapy
	
	CEPHALOSPORIN/PCN ANAPHYLAXIS:
	Aztreonam* 2 g IV q8h
	+ **Metronidazole** 500 mg PO/IV q8h
	+ **Vancomycin*** IV (see nomogram, AUC goal 400-600)
		5 -7 days
		
		Therapy may need to be extended based on severity of infection and response to treatment
			• Risk factors for MRSA include:
			  ○ nasal colonization
			  ○ prior MRSA infection
			  ○ recent hospitalization
			  ○ recent antibiotics
			
			• Adjunctive systemic antimicrobial therapy is not routinely recommended unless associated with significant systemic response
			
			• Indications for systemic antimicrobials include: erythema and induration extending >5 cm from wound edge, fever >38.5°C, HR >110 beats/minute, WBC >12,000
			
			• Antibiotics should be adjusted based on Gram stain, cultures and sensitivities obtained from I&D
			
			• Wound infection and systemic illness in the first 4 days (especially the first 48 hours) should prompt close wound examination for evidence of streptococcal or clostridial necrotizing infection. See necrotizing fasciitis section if concern exists.
			
			• Consider initial aggressive dosing of antibiotics in morbidly obese patient

Clinical Setting	Empiric Therapy	Duration	Comments
Deep tissue Surgical Site Infections or any SSI complicated by sepsis/septic shock Infections involving the deep fascia or muscle within 30 days of operation For SSI with organ space involvement, see specific guidelines for Intra-abdominal, Gynecologic, Meningitis, Endocarditis, and Bone and Joint for specific recommendations For necrotizing infections, see Necrotizing Fasciitis section	**All systemic antimicrobial therapy should be used in combination with opening the incision and evacuation of infected material** EMPIRIC INPATIENT THERAPY FOR DEEP TISSUE SSI OR COMPLICATED BY SEPSIS/SEPTIC SHOCK: **Piperacillin-tazobactam*** 4.5 g IV q6h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE WITH PCN ALLERGY WITHOUT ANAPHYLAXIS, ANGIOEDEMA OR URTICARIA: **Cefepime*** 2 g IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE WITH PCN ANAPHYLAXIS: **Aztreonam*** 2 g IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) VANCOMYCIN ALTERNATIVE WITH NON-VANCOMYCIN INFUSION REACTIONS: **Linezolid**** 600 mg IV/PO q12h + **Piperacillin-tazobactam*** 4.5 g IV q6h	7-10 days Therapy may need to be extended based on severity of infection and response to treatment	• Consider initial aggressive dosing of antibiotics if severe sepsis or morbidly obese patient

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Traumatic Wound Infections of Extremity Usually polymicrobial from environmental contamination If there is a concern for necrotizing fasciitis, please refer to that section Please see separate guidelines for bite wounds or for wounds complicated by osteomyelitis or open fracture	PREFERRED INPATIENT THERAPY FOR HEMODYNAMICALLY STABLE PATIENTS WITH ACUTE INFECTION (<5 DAYS FROM INJURY), AND NO RISK FOR MRSA: **Ampicillin-sulbactam*** 3 g IV q6h ALTERNATIVES FOR PCN ALLERGY WITHOUT ANAPHLAXIS, ANGIOEDEMA OR URTICARIA: **Cefazolin*** 2 g IV q8h + **Metronidazole** 500 mg PO/IV q8h PREFERRED INPATIENT THERAPY FOR PATIENTS WITH HIGH RISK OF MRSA OR PCN/CEPHALOSPORIN ALLERGY: **Metronidazole** 500mg PO/IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE INPATIENT THERAPY FOR PATIENTS WITH HIGH RISK OF MRSA AND VANCOMYCIN ALLERGY (NOT VANCOMYCIN INFUSION REACTION): **Linezolid**** 600 mg IV/PO BID + **Metronidazole** 500 mg PO/IV q8h PREFERRED THERAPY IN PATIENTS WITH ANY OF THE FOLLOWING: • Sepsis and traumatic wound infection • Development of infection >5 days after injury • Significant water exposure **Piperacillin-tazobactam*** 4.5 g IV q6h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE FOR PATIENTS WITH PCN ALLERGY WITHOUT ANAPHYLAXIS: **Cefepime** *2 g IV q8h + **Metronidazole** 500 mg PO/IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE FOR PATIENTS WITH PCN ANAPHYLAXIS: **Aztreonam*** 2 g IV q8h + **Metronidazole** 500 mg PO/IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE FOR PATIENTS WITH VANCOMYCIN ALLERGY (NOT VANCOMYCIN INFUSION REACTION): **Linezolid**** 600 mg IV/PO BID + **Piperacillin-tazobactam*** 4.5 g IV q6h	7-14 days Therapy may need to be extended based on severity of infection and response to treatment	• **Risk factors for MRSA include**: ○ nasal colonization ○ prior MRSA infection ○ recent hospitalization ○ recent antibiotics • Traumatic wounds without evidence of local infection or systemic signs of infection typically do not need antimicrobial therapy beyond appropriate surgical prophylaxis • Empiric therapy should take into account site of wound, prior cultures and colonization • Debridement of devitalized tissues and contaminating debris critical to source control and successful healing • Antibiotic therapy should be tailored to results of deep tissue Gram stain, culture and sensitivities • Consider initial aggressive dosing of antibiotics if severe sepsis or morbidly obese patient • Osteomyelitis would require 6-8 weeks of therapy- please see osteomyelitis guidelines

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Diabetic Foot Infections	INPATIENT TREATMENT FOR HEMODYNAMICALLY STABLE PATIENT PRESENTING WITH ACUTE DIABETIC FOOT INFECTION, WITHOUT RELAPSE OR REINFECTION: **Vancomycin*** IV (see nomogram, AUC goal 400-600) No gram-negative coverage is needed for acute diabetic foot infection, unless: • wound was exposed to fresh water (i.e., lake or river) • patient received broad-spectrum antibiotic therapy in the previous 90 days • recent hospitalization >2 days in the previous 90 days IF PATIENT MEETS ANY OF THE ABOVE CRITERIA, OR IF HEMODYNAMICALLY UNSTABLE: **Piperacillin-tazobactam*** 4.5 g IV q6h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVE FOR PATIENTS WITH PENICILLIN ALLERGY: *Mild Allergy- Rash* **Cefepime*** 2 g IV q8h + **Metronidazole** 500 mg IV/PO q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) *Life-threatening penicillin allergy* **Aztreonam*** 2 g IV q8h + **Metronidazole** 500 mg IV/PO q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600)	7-14 days Therapy may need to be extended based on severity of infection and response to treatment	• Treatment should be modified to cover previously isolated pathogens for patients with recurrent or relapse infection of the same site • Tailor therapy according to culture data • Consider ID consult • Surgical debridement is an important component in management • Documented osteomyelitis may require longer duration and a higher antibiotic dosing regimen • Consider initial aggressive dosing of antibiotics if severe sepsis or morbidly obese patient • Osteomyelitis would require 6-8 weeks of therapy- please see osteomyelitis guidelines

Clinical Setting	Empiric Therapy	Duration	Comments
Complicated SSTI without Osteomyelitis Decubitus or sacral wound infection	**Obtain deep tissue culture prior to starting antibiotic therapy if patient is hemodynamically stable** PREFERRED EMPIRIC INPATIENT THERAPY: **Vancomycin*** IV (see nomogram, AUC goal 400-600) + **Piperacillin-tazobactam*** 4.5 g IV q6h (when gram-negative organisms are suspected) ALTERNATIVE ANTIMICROBIALS WHICH CAN BE SUBSTITUTED FOR PIPERACILLIN-TAZOBACTAM IN THE SETTING OF PENICILLIN ALLERGY: *Mild Allergy- Rash* **Cefepime** *2 g IV q8h + **Metronidazole** 500 mg PO/IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) *Life-threatening penicillin allergy* **Aztreonam*** 2 g IV q8h + **Metronidazole** 500 mg PO/IV q8h + **Vancomycin*** IV (see nomogram, AUC goal 400-600) ALTERNATIVES FOR VANCOMYCIN RESISTANCE, INTOLERANCE, OR ALLERGY (IN COMBINATION WITH GRAM-NEGATIVE AND ANAEROBIC COVERAGE, PER ABOVE): **Linezolid**** 600 mg PO BID	Minimum of 14 days Duration may be longer in the setting of poor clinical response	• Blood cultures are recommended • When clinically indicated, evaluate for underlying osteomyelitis • Cultures of purulent drainage or deep tissue cultures when feasible are recommended • Tailor therapy according to culture data • Consider ID consult • Surgical debridement is an important component in management • Baseline CBCP and weekly CBCP are recommended with Linezolid therapy due to risk of cytopenia, especially thrombocytopenia. Alternative therapy should be considered in patients with thrombocytopenia • Consider initial aggressive dosing of antibiotics if severe sepsis or morbidly obese patient • Osteomyelitis would require 6-8 weeks of therapy- please see osteomyelitis guidelines

*Adjustment in dose is necessary with renal insufficiency
**Complete information regarding drug interactions with linezolid

References

1. Stevens DL, Bisno AL, ChamberHF, et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. Clinical Infectious Diseases 2014;59(2):e10-52.
2. Lipsky BA, Berendt RA, Cornia PB, et al. 2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections. Clinical Infectious Diseases 2012;54(12):132–173.
3. Liu C, Bayer A, Cosgrove SE, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant *Staphylococcus Aureus* Infections in Adults and Children. Clin Infect Dis 2011:52;1-38.

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