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Area	Pharmacy
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Tier 1: Suggested Empiric Antibiotic Therapy Guidelines

Applicability

Henry Ford Health

Scope

All prescribers in the inpatient setting at Henry Ford Health.

Background

The empiric antibiotic therapy guidelines are intended to serve as a resource for prescribers on suggested empiric antibiotic selection for common infections encountered in the inpatient setting.

Definitions

Empiric antibiotic therapy is defined as therapy directed against the most likely pathogens causing disease, when antimicrobial therapy is given before microbiology results are available.

Severe community-acquired pneumonia (CAP): either 1 major criterion or ≥ 3 minor criteria

- Major criteria:
  - Septic shock with need for vasopressors
  - Respiratory failure requiring mechanical ventilation
- Minor criteria:
  - Respiratory rate ≥ 30 breaths/min
  - Pa_{O2}/Fi_{O2} ratio ≤ 250
  - Multilobar infiltrates
  - Confusion/disorientation
  - Uremia (BUN level ≥ 20 mg/dL)
  - Leukopenia due to infection (WBC < 4,000 cells/mcgL)
  - Thrombocytopenia (platelet count < 100,000 /mcgL)

- Hypothermia (core temperature < 36°C)
- Hypotension requiring aggressive fluid resuscitation

Hospital acquired pneumonia (HAP): pneumonia onset 2 or more days after hospitalization

Ventilator associated pneumonia (VAP): pneumonia onset 2 or more days after requirement for mechanical ventilation

Guideline

These guidelines are intended for assistance in antibiotic selection when the choice has to be empiric. They are not meant to supercede clinical judgment, as individual patient characteristics may dictate alternative treatment. Specimens obtained for culture prior to administering antibiotics are the most reliable. Every attempt should be made to obtain cultures before antibiotics are given. Antibiotic therapy should not be withheld for septic patients, and careful consideration should be given when starting empiric antibiotics in situations where cultures are not obtained, as this may impact definitive treatment.

Empiric antibiotic therapy for patients with sepsis: For patients with sepsis, empiric antibiotic therapy selection should be according to the suspected diagnosis/site of infection and most likely pathogens. For patients with severe sepsis and/or septic shock any intravenous broad spectrum antibiotic delivered within 3 hours of onset time or recognized 'time zero' will qualify for the SEP-1 core measure.

Suggested Empiric Antibiotic Therapy at Henry Ford Health

Diagnosis	Suspected Pathogens	Empiric Therapy	Comments
Bacteremia, catheter related	Staphylococci, *Enterococcus, Enterobacteriaciae*	All patients: • Vancomycin ± cefepime (consider gram negative coverage if femoral access) Hemodialysis Patients: • Vancomycin + cefepime Critically ill or neutropenic patients: • Vancomycin + cefepime ± tobramycin	Add an aminoglycoside[@] for patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained. For MSSA or MRSA, please refer to Staphylococcus aureus treatment guidelines[#]
Brain abscess	Staphylococci, *Streptococci, Enterobacteriaciae,* anaerobes	• Ceftriaxone + metronidazole + vancomycin	
Brain abscess, post-neurosurgical	Staphylococci, *Streptococci, Enterobacteriaciae, P. aeruginosa,* anaerobes	• **Preferred**: Cefepime + metronidazole + vancomycin • Aztreonam + metronidazole + vancomycin (severe β-lactam allergy)	
***Clostridiodes difficile* colitis[#]**	*C. difficile*	• **1st Line**: vancomycin PO • Add IV metronidazole for patients with severe sepsis or septic shock or fulminant *C. difficile* infection • **Recurrent**: ◦ Fidaxomicin PO ◦ Vancomycin PO ◦ Consider bezlotoxumab outpatient infusion	Refer to C. difficile guidelines for details based upon disease recurrence and severity
COPD Exacerbation	*H. influenzae, S. pneumoniae, M Catarrhalis*	• **Preferred**: Doxycycline • Azithromycin (for patients with recent	Exacerbation: Increased sputum volume and/or purulence OR

		exposure to doxycycline or intolerant to doxycycline)	Acute respiratory failure requiring ICU admission
Endocarditis, native valve	Staphylococci, Streptococci	• Vancomycin ± nafcillin • Vancomycin ± cefazolin	
Endocarditis, prosthetic valve	Staphylococci, Streptococci, Enterococci	• Vancomycin + gentamicin ± rifampin ± nafcillin	Some experts suggest to initiate rifampin after blood cultures are clear for 48 hours
Endometritis/ Septic thrombophlebitis, postpartum	Enterobacteriaceae, *Group B Streptococci*	• **Preferred**: Ceftriaxone + metronidazole • Ampicillin + gentamicin + metronidazole • Cefoxitin + doxycycline • Gentamicin + clindamycin (severe β-lactam allergy)	
Febrile Neutropenia[#]	Enterobacteriaceae, *Pseudomonas aeruginosa*, viridans Streptococci	**Preferred:** Cefepime monotherapy Add vancomycin and metronidazole for patients with hemodynamic instability	Refer to febrile neutropenia guidelines for details, and indications for empiric MRSA therapy with vancomycin
Diagnosis	**Suspected Pathogens**	**Empiric Therapy**	**Comments**
Intra-abdominal infection, community-acquired (e.g. cholecystitis, cholangitis, diverticulitis, abscess)	*Enterobacteriaceae, Bacteroides sp.*, Enterococci, Streptococci	• **Preferred**: Ceftriaxone + metronidazole • Ertapenem (prior history of ESBL within 12 months, but low risk for Pseudomonas) • Cefoxitin • Moxifloxacin (severe β-lactam allergy) **Oral options for outpatient therapy**: • Amoxicillin-clavulanate • Cefuroxime + metronidazole • Ciprofloxacin + metronidazole (severe β-lactam allergy) • Moxifloxacin (severe β-lactam allergy)	
Intra-abdominal	Streptococci, Enterobacteriaciae	• **Preferred**: Ceftriaxone	

infection, spontaneous bacterial peritonitis		• Moxifloxacin (beta-lactam allergy)	
Intra-abdominal infection, Pseudomonas suspected	*Enterobacteriaceae, Bacteroides sp., P. aeruginosa,* Enterococci, Staphylococci, Streptococci	• **Preferred**: Piperacillin-tazobactam ± tobramycin • Cefepime + metronidazole ± tobramycin • Aztreonam + metronidazole + vancomycin ± tobramycin (severe β-lactam allergy)	Add tobramycin for patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained.
Meningitis, community-acquired	*S. pneumoniae, N. meningitides, Listeria monocytogenes*	• Ceftriaxone + vancomycin ± ampicillin (if risk factors for Listeria present) Severe β-lactam allergy ONLY: • Moxifloxacin + vancomycin ± trimethoprim-sulfamethoxazole (if risk factors for Listeria present)	Indications for empiric Listeria coverage: Alcohol abuse, age >50, pregnancy
Meningitis, post-neurosurgical	Staphylococci, Gram-negative bacteria	• Cefepime + vancomycin ± tobramycin • Aztreonam + vancomycin ± tobramycin (severe β-lactam allergy ONLY)	Add tobramycin for patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained.
Osteomyelitis	**Staphylococci, Streptococci, anaerobes, Gram-negative bacteria**	• Hold empiric therapy until bone biopsy performed if no cellulitis or systemic symptoms • In cases where empiric therapy is required due to infection that threatens limb or life, antibiotics should be selected according to the source of osteomyelitis (ie. per recommendations for	

		diabetic foot infection, etc).	

Diagnosis	Suspected Pathogens	Empiric Therapy	Comments
Pelvic inflammatory disease	***Enterobacteriaceae*, Group B Streptococci, *Chlamydia, N. gonorrhoeae***	**Preferred Intravenous Therapy** • Ceftriaxone + doxycycline + metronidazole • Cefoxitin + doxycycline **Alternative Intravenous Therapy** • Ampicillin-sulbactam + doxycycline • Gentamicin + clindamycin **Intramuscular/PO Therapy** • Ceftriaxone 500 mg IM once + doxycycline + metronidazole x 14 days	After initial parenteral therapy, perform oral switch after ~24–48 hours of clinical improvement to complete a total course of 14 days
Pneumonia, community-acquired# Standard inpatient therapy is recommended for patients • with no risk factors for resistant organisms OR • with non-severe CAP AND recent hospitalization of 2 or more days within 90 days AND parenteral antibiotics within 90 days	*S. pneumoniae, H. influenzae, Mycoplasma, Chlamydophila, Legionella*	**Preferred** • Ampicillin-sulbactam + either doxycycline OR azithromycin **Alternatives** • Ceftriaxone + either doxycycline OR azithromycin • Moxifloxacin (severe β-lactam allergy) **MRSA CAP suspected**: add vancomycin or linezolid to above regimen Consider MRSA CAP for patients with prior respiratory isolation of MRSA within 12 months, cavitary infiltrate, necrosis, or post-influenza pneumonia	For more information, refer to Tier 1: pneumonia management For patients with confirmed Legionella, moxifloxacin is preferred See below for oral stepdown
Pneumonia, community-acquired# Outpatient therapy/ oral stepdown	*S. pneumoniae, H. influenzae, Mycoplasma, Chlamydophila, Legionella*	**Outpatients who were previously healthy and no recent antibiotics (see note)** • Doxycycline (preferred) • Azithromycin (see note) **Regimens for patients with comorbidities** [chronic heart, lung, liver, or renal disease; diabetes, alcoholism,	**Notes**: Due to the high level of macrolide resistant *S. pneumoniae*, providers should avoid azithromycin monotherapy for most patients. Azithromycin is still appropriate for the coverage of atypical organisms. An antibiotic duration

		malignancy, or asplenia] **or oral step down:** • β-lactam PLUS either doxycycline 100 mg PO BID OR azithromycin 500 mg daily • β-Lactam options: ◦ Amoxicillin-clavulanate XR 2 gm BID ◦ Cefuroxime axetil 500 mg BID ◦ Cefpodoxime 200 mg BID • Moxifloxacin (severe β-lactam allergy) • Levofloxacin 750 mg PO daily (non-formulary at HFH, severe β-lactam allergy)	of 5 days for CAP is recommended for most patients.
Diagnosis	**Suspected Pathogens**	**Empiric Therapy**	**Comments**
Pneumonia, community-acquired# **CAP with risk factors for MRSA and/or Pseudomonas** • Severe CAP or ICU patients with recent hospitalization of 2 or more days within 90 days AND parenteral antibiotics within 90 days • History of MRSA or resistant Gram-negative (e.g. Pseudomonas) colonization of respiratory tract in previous 1 year OR • Patients with severe structural lung disease and baseline oxygen requirement (includes but is not limited to bronchiectasis, pulmonary fibrosis, interstitial lung disease, etc.)	*S. pneumoniae,H. influenzae, Mycoplasma, Chlamydophila, Legionella, Enterobacterales, Pseudomonas aeruginosa, Staphylococcus aureus*	• Cefepime + vancomycin (or linezolid in ICU patients ONLY) + either doxycycline or azithromycin • Piperacillin-tazobactam + vancomycin (or linezolid in ICU patients ONLY) + either doxycycline or azithromycin • Aztreonam (severe β-lactam allergy) + vancomycin (or linezolid in ICU patients ONLY) + either doxycycline or azithromycin	For more information, refer to Tier 1: pneumonia management

Pneumonia, HAP or VAP#	*Enterobacterales, Pseudomonas aeruginosa, Staphylococcus aureus*	**One of the following** • Cefepime • Piperacillin-tazobactam • Aztreonam (severe β-lactam allergy) **PLUS** • Vancomycin	Refer to hospital and/ or unit specific antibiograms to determine appropriate Gram-negative coverage
Pneumonia, with lung abscess or empyema (Addition of metronidazole is not routinely recommended for aspiration as supported by national CAP guidelines from ATS/IDSA)	Gram positive oral flora, anaerobes	**CAP associated** • Ampicillin-sulbactam • Ceftriaxone ± metronidazole • Moxifloxacin (severe β-lactam allergy) **HAP or VAP associated** • Piperacillin-tazobactam + vancomycin • Cefepime + metronidazole + vancomycin • Aztreonam + metronidazole + vancomycin (severe β-lactam allergy)	For HAP or VAP: add an aminoglycoside in patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained.
Septic arthritis, no history/ contact with gonococcus	**Staphylococci**	• Vancomycin	
Septic arthritis, suspected gonococcus	***N. gonorrhea***	• Ceftriaxone	
Septic arthritis, prosthetic joint	**Staphylococci**	• Vancomycin + rifampin	For bacteremic patients: some experts suggest to initiate rifampin after blood cultures are clear for 48 hours
Skin and skin structure infections, cellulitis with abscess or purulence	Staphylococci, **MRSA coverage suggested empirically with presence of abscess or purulence**	• Vancomycin **Oral options for mild infection or outpatient therapy** • Trimethoprim-sulfamethoxazole • Doxycycline	Approximately 25-30% of Staphylococcus aureus are resistant to clindamycin at Henry Ford Health.

Diagnosis	Suspected Pathogens	Empiric Therapy	Comments
Skin and skin structure infections, cellulitis non-purulent	Streptococci, Staphylococci	**Mild cellulitis** • Cephalexin 500 to 1000 mg PO every 6 hours (1000 mg if BMI 35 or more) • Dicloxacillin PO • Clindamycin PO (β-lactam allergy ONLY. Not reliable empirically vs. *S. aureus* at HFH) **Moderate cellulitis, no history of MRSA** • Cefazolin • Nafcillin **Moderate-severe cellulitis OR After failure of IV beta-lactam therapy** • Vancomycin	
Skin and skin structure infections, community-acquired necrotizing fasciitis	Streptococci, Staphylococci, Clostridium, Gram-negative bacteria	• Vancomycin + ertapenem + clindamycin	Discontinue clindamycin when *S. pyogenes* ruled out or when source control obtained
Skin and skin structure infections, necrotizing fasciitis, Pseudomonas suspected	Streptococci, Staphylococci, Clostridium, Gram-negative bacteria	• Vancomycin + piperacillin-tazobactam + clindamycin ± tobramycin	Add tobramycin[@] in patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained. Discontinue clindamycin when *S. pyogenes* ruled out or when source control obtained
Skin and skin-structure infections, community-acquired, diabetic foot infection or vascular insufficiency with	*Staphylococcus aureus,* Streptococci	**Mild infection:** • Ampicillin-sulbactam • Cefazolin **Moderate to severe infection**: • Vancomycin	

intact skin			
Skin and skin-structure infections, community-acquired polymicrobial infection (e.g. **open wounds** with vascular insufficiency, pressure sore, or severe diabetic foot ulcer)	*Staphylococcus aureus,* Streptococci, *Enterobacteriaceae,* anaerobes	**PO options for mild infection** (Gram-positives most likely): • Trimethoprim-sulfamethoxazole PO • Doxycycline PO **Moderate to severe infection**: • Ceftriaxone + metronidazole + vancomycin • Ceftaroline + metronidazole • Moxifloxacin + doxycycline (severe β-lactam allergy)	

Diagnosis	Suspected Pathogens	Empiric Therapy	Comments
Skin and skin-structure infections, polymicrobial, Pseudomonas suspected (e.g. **open wounds** with vascular insufficiency, pressure sore or severe diabetic foot ulcer)	*Staphylococcus aureus*, Streptococci, *Enterobacteriaceae*, anaerobes	• Piperacillin-tazobactam + vancomycin ± tobramycin • Cefepime + metronidazole + vancomycin ± tobramycin • Aztreonam + metronidazole + vancomycin ± tobramycin (severe β-lactam allergy)	Add tobramycin in patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if a beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained.
Skin and skin-structure infections, cat/dog/human bite	*Pasteurella multocida*, Staphylococci, Streptococci, anaerobes	• Ampicillin-sulbactam • Amoxicillin-clavulanate PO • Moxifloxacin (severe β-lactam allergy) • Doxycycline (severe β-lactam allergy)	
Urinary tract infection#, uncomplicated cystitis	*Enterobacteriaceae*, Enterococci	• **Preferred**: Nitrofurantoin (ONLY for CrCl > 30 ml/min) x 5 days • Trimethoprim-sulfamethoxazole x 3 days • Fosfomycin PO x 1 dose (less effective than above options) • Oral beta-lactam x 7 days ◦ Cephalexin 500 mg PO every 6 hours ◦ Cefuroxime axetil 250 mg PO every 12 hours Preferred in pregnancy or when other	Please refer to guidelines on asymptomatic bacteriuria and urinary tract infection for details

		options are unable to be used • Ciprofloxacin PO x 3 days (due to risk of major side effects, reserve for patients with no other treatment options)	
Urinary tract infection#, oral options for management of pyelonephritis treated in the outpatient setting	*Enterobacteriaceae,* Enterococci Due to local high rates of *E.coli* resistance, it is recommended to obtain a urine culture and **follow up with susceptibility data**	• Ciprofloxacin PO x 7 days • Trimethoprim-sulfamethoxazole x 7 days (alternative if recent quinolone exposure) • Cephalexin 500 mg PO every 6 hours (preferred in pregnancy) x 7 days • Fosfomycin 3 gram PO every 48 hours x 3 doses (ONLY if prior history of ESBL UTI)	Please refer to guidelines on asymptomatic bacteriuria and urinary tract infection for details **Emergency department settings**: at clinician discretion, consider a single dose of ceftriaxone IV or aminoglycoside IV pharmacy to dose, prior to discharge on oral

Diagnosis	Suspected Pathogens	Empiric Therapy	Comments
Urinary tract infection#, intravenous management of pyelonephritis	*Enterobacteriaceae,* Enterococci	• Ceftriaxone • Ertapenem (Prior history of ESBL or AmpC within 12 months, but low risk for Pseudomonas) • Aztreonam (severe β-lactam allergy ONLY) • Cefepime +/- vancomycin[@] (if Pseudomonas suspected) • Gentamicin	Add an aminoglycoside[@] in patients **with suspected Pseudomonas and severe sepsis or septic shock**. Stop after 1 to 3 days if beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained. Consider adding ampicillin or vancomycin for enterococcal UTI in patients at high risk (history of prior enterococcal UTI). Please refer to guidelines on asymptomatic bacteriuria and urinary tract infection for details
Ventricular assist device infection	*Enterobacteriaceae,* Staphylococci	• Cefepime + vancomycin +/- tobramycin • Aztreonam + vancomycin +/- tobramycin (severe	Add an aminoglycoside[@] in patients **with severe sepsis or septic shock**. Stop after 1 to 3 days if beta-lactam/ monobactam resistant organism is not isolated or if cultures were not obtained.

		β-lactam allergy)	

@ Gentamicin or amikacin are the preferred combination therapy drugs to empirically cover a suspected extended spectrum beta-lactamase producer. Tobramycin is the preferred combination therapy drug to empirically cover suspected *Pseudomonas aeruginosa*.

# Denotes that a tier 1 guideline is available for this specific diagnosis

Risk factors for MRSA and Pseudomonas for immunocompromised and disease states other than pneumonia (e.g. urinary tract infection, intra-abdominal infection, skin and skin structure infection) **are not well defined**. Treatment for these organisms should be individualized on the basis of clinical presentation and previous cultures. Immuncompromised is defined as HIV/AIDS with CD4 count < 200, neutropenia (ANC ≤ 500), Cystic Fibrosis, solid organ and bone marrow transplant recipients, receiving 2 or more immunosuppressive agents, AND/OR congenital or acquired immunodeficiency (except HIV positive with CD4 > 200)

For patients with a history of multiple drug-resistant organisms within 90 days, perform a careful evaluation of microbiology and antimicrobial administration history to determine optimal empiric therapy. Infectious Diseases consultation recommended.

Related Documents

Tier 1: Guideline for the Management of Infections Caused by Staphylococcus aureus

Tier 1: Treatment of Clostridioides difficile Infection

Tier 1: Febrile Neutropenia

Tier 1: Pneumonia Management Guidelines

Tier 1: Asymptomatic Bacteriuria and Urinary Tract Infection Management in Adult Patients

Related EHR Impact

Order Sets: Multiple Order Sets, diagnosis specific

Sepsis order sets contain a link to empiric therapy guidelines

References / External Regulations

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Approval Signatures

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Chair of MMC	David Lanfear: SecHd-AdvHeartFailure/TransCar [SL]	5/18/2023
VP-Pharmacy Shared Svcs	Rox Gatia: VP-Pharmacy Shared Svcs	4/26/2023
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Standards

No standards are associated with this document