

Respiratory Tract: Pneumonia

START HERE Does the patient presenting with pneumonia have **any risk factors for multidrug resistant organisms (MDROs)**:

- Hospitalized for ≥ 2 days within previous 90 days
- Resides in a nursing home **OR** long-term care facility, **OR** skilled nursing facility
- Received recent antibiotic therapy (previous 90 days), chemotherapy, **OR** wound care within previous 30 days
- Chronic hemodialysis
- Have immunosuppressive disease **OR** receiving immunosuppressing medications

CLINICAL CONSIDERATIONS

- Infiltrate on chest x-ray required for pneumonia diagnosis
- Collect BAL **OR** PSB **OR** Sputum **AND** blood cultures prior to starting antimicrobial therapy
- Re-assess antibiotic therapy on day 2 or 3 when cultures return from microbiology lab
- Specific isolated pathogens should prompt clinicians to de-escalate treatment based on the pathogen's susceptibility pattern

NO RISK FACTORS FOR MDROS

INPATIENT NON-ICU

Ceftriaxone 1 gm IV Q24H

AND

Azithromycin 500 mg PO/IV for 1 day, then 250 mg PO/IV Q24H for 4 days

OR

Moxifloxacin 400 mg IV/PO Q24H

INPATIENT ICU

Ceftriaxone 2 gm IV Q24H

AND

Moxifloxacin 400 mg IV Q24H

OR

Ampicillin/sulbactam 3 gm IV Q6H

AND

Moxifloxacin 400 mg IV Q24H

OR

Penicillin-allergic patients:

Aztreonam 2 gm IV Q8–12H

AND

Moxifloxacin 400 mg IV Q24H

RISK FACTORS FOR MDROS

INPATIENT ICU

Beta-lactam/beta-lactamase inhibitor:

Piperacillin-tazobactam 3.375 gm IV Q4H[†]

OR

Piperacillin-tazobactam 4.5 gm IV Q6H

OR

Cephalosporin:

Cefepime 2g IV Q8H

OR

Antipseudomonal carbapenem:

Meropenem 1 gm IV Q8H

PLUS

If at risk for resistant gram-negative:^{††}

Antipseudomonal fluoroquinolone:

Levofloxacin 750 mg IV Q24H

Ciprofloxacin 400 mg IV Q8H

PLUS

If at risk for MRSA:

Vancomycin 15 mg/kg IV[‡]

OR

Linezolid 600 mg IV/PO Q12H (*See Criteria for Use*)

Treat accordingly based on risk factors and microbiologic history

BAL= Bronchoalveolar Lavage; BP= blood pressure; bpm= beats or breaths per minute; CrCl= Creatinine Clearance; H= hour(s); IBW= ideal body weight; IV= intravenous; MDRO= multi-drug resistant organism; MRSA= Methicillin-Resistant S. aureus; PO= by mouth; PSB= Protected Specimen Brush; Q= every

[†]Suspect *P. aeruginosa*: CrCl >50 ml/min = 3.375 gm q4h; CrCl 50-10 ml/min = 3.375 gm IV Q6H; CrCl < 10 ml/min = 3.375 gm Q8H.

^{††}If hospital-acquired or ventilator-associated and 1) had IV antibiotics in previous 90 days, or 2) if ventilator-associated with hospitalization for ≥5 days prior to pneumonia, in septic shock, has acute respiratory distress syndrome, or in requiring acute renal replacement.

[‡]Refer to Table of Contents for section on vancomycin and aminoglycoside dosing and monitoring

Note: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function.

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| NO RISK FACTORS FOR MDROS | RISK FACTORS FOR MDROS |
|---|--|
| <p>OUTPATIENT <u>Previously healthy AND no antibiotic use in previous 90 days:</u></p> <p>Doxycycline 100 mg PO Q12H for 5 days OR Azithromycin 500 mg PO for 1 dose, then 250 mg PO Q24H for 4 days</p> | <p>OUTPATIENT Treat accordingly based on risk factors and microbiologic history</p> <p>Consider paging Infectious Diseases</p> |
| <p>OUTPATIENT <u>Presence of ≥ 1 co-morbidities* OR antibiotic use in previous 30 days:</u></p> <p>Amoxicillin/clavulanate 875 mg PO Q12H for 5 to 7 days AND Azithromycin 500 mg PO for 1 dose, then 250 mg PO Q24H for 4 days</p> <p>OR Moxifloxacin⁺⁺ 400 mg PO Q24H for 5 to 7 days</p> | |

THERAPY CONSIDERATIONS

- Cough and chest X-ray may take 4 to 6 weeks to improve/change
- Duration of therapy
 - Community-acquired pneumonia: 5–7 days
 - Hospital-acquired pneumonia, ventilator-associated pneumonia: 7–8 days; provided that the targeted pathogen is identified based on bronchoscopy and the etiologic pathogen is not *P. aeruginosa*, and that the patient is: afebrile for 48 to 72 hours
AND ≤ 1 of the following:
 HR >100 bpm, RR >24 bpm, BP < 90 mmHg (systolic), O₂ sat <90%, altered mental status

BP= blood pressure; bpm= beats or breaths per minute; H= hour(s); HR= heart rate; IV= intravenous; MDRO= multi-drug resistant organism; PO= by mouth; Q= every; RR= respiratory rate

*Presence of comorbidities: chronic heart, lung, liver or renal disease; diabetes; alcoholism; malignancies; asplenia; immunosuppressing conditions or medications

++Although fluoroquinolones are frequently used, their use is discouraged in ambulatory patients without comorbid conditions or recent antimicrobial use unless an alternative regimen is not feasible. The risk of adverse effects (including the risk of *Clostridium difficile* infection) and the risk of selection for resistance in colonizing organisms, are generally thought to be greater with fluoroquinolones

Note: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function.

References:

1. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007 Mar 1;44 Suppl 2:S27-72
2. American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med*. 2005 Feb 15;171(4):388-416.
3. Kalil AC, Metersky ML, Klompas M, et al. Management of Adults With Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. *Clin Infect Dis* 2016;63:1-51.