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| **Guidelines for Management of Community-Acquired Pneumonia (CAP), Hospital-Associated Pneumonia (HAP), and Ventilator-Associated Pneumonia (VAP)** |
| **(GLA November 2019)** |
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| *Guidelines should not be viewed as rules of practice that require 100% compliance. Rather, they should be used to assist in clinical decision-making.  Furthermore, guidelines may not be applicable to all patients. If questions or problems arise, then an Infectious Diseases consultant should be contacted.*    *These guidelines represent modifications of the Infectious Diseases Society of America and American Thoracic Society guidelines for the treatment of pneumonia.  They are based on the antimicrobial susceptibility patterns and clinical epidemiology of patients seen at VA Greater Los Angeles Healthcare System and are not necessarily applicable to patients seen at other local or distant medical care facilities.* |
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| [**Diagnostic evaluation**](#_Chest_x-ray:_Diagnosis)  [Determination of outpatient vs. inpatient management](#_Determination_of_Outpatient)  [Determination of inpatient pneumonia severity](#_Determination_of_Inpatient)  [Microbiological assessment](#_Microbiological_Assessment)  [Other diagnostic considerations](#otherdxconsid) |
| [**Recommendations for empiric antimicrobial therapy**](#recempiric)  [Outpatient treatment of community-acquired pneumonia](#outptrx)  [Inpatient treatment of community-acquired pneumonia AND ward-onset hospital-acquired pneumonia](#inptcaprx)  [Treatment of hospital-acquired pneumonia in ICU or ventilator-associated pneumonia (VAP)](#inpthapvaprx)  [**Recommendations for de-escalation of anti-MRSA and broad-spectrum Gram-negative coverage**](#deesc)  [**Evaluation of patients with pneumonia who fail to respond to therapy**](#fail)  [**References**](#refs) |
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| **DIAGNOSTIC EVALUATION** | | | | | | | |
| **Chest x-ray**: Diagnosis of pneumonia requires demonstration of an infiltrate on chest x-ray | | | | | | | |
| Pneumonia is present in only 10% of patients presenting to urgent care and emergency rooms with cough and respiratory symptoms. | | | | | | | |
| Scoring systems are most useful for determining when a chest x-ray should be performed; at best they predict a 50% probability of pneumonia. | | | | | | | |
|  | **Score** | | | | | |  |
|  | **0** | **1** | **2** | **3** | **4** | **5** |  |
| Probability of pneumonia | <1% | 1% | 3% | 10% | 25% | 50% |  |
| One point each for **absence** of asthma and for **presence** of each of decreased breath sounds, T > 37.8°C, crackles (rales) or heart rate >100  (Heckerling et al. Ann Intern Med.  1990; 113:664) | | | | | | | |
| **Determination of Outpatient vs. Inpatient Management** | | | | | | | |
| The [Pneumonia Severity Index](https://www.mdcalc.com/psi-port-score-pneumonia-severity-index-cap) (PSI) should be used in determining whether outpatient or inpatient management of pneumonia is most appropriate: **Score Risk Disposition**≤70 Low risk Outpatient care71-90 Low risk Outpatient vs. observation admission91-130 Moderate risk Inpatient admission >130 High risk Inpatient admission If enough information to calculate the PSI are not available, decisions regarding initial triage can be made using the CURB-65 score. The **CURB-65** score assigns one point to each of the following:          **C**onfusion that is new, and manifested by disorientation to person, place or time           **U**remia (BUN > 20mg/dL)           **R**espiratory rate ≥ 30           low **B**lood pressure (<90 systolic or < 60 diastolic)           age ≥ **65** years CURB-65 scores of 0 or 1:  patient is at low risk for serious outcomes and can be treated on an outpatient basis CURB-65 scores ≥ 2:  patient should be evaluated for hospital admission | | | | | | | |
| **Determination of Inpatient Pneumonia Severity** | | | | | | | |
| Once the patient is admitted, determination of the severity of presentation is useful in determining empiric antimicrobial therapy and need for blood and lower respiratory cultures. Severe inpatient pneumonia can be defined by meeting either one major criterion or three or more minor criteria of the following:**Major criteria**         Septic shock requiring vasopressors         Respiratory failure requiring mechanical ventilation**Minor criteria**         Respiratory rate ≥ 30 breaths/min         PaO2/FiO2 ratio ≤ 250         Multilobar infiltrates         Confusion/disorientation         Azotemia (BUN > 20mg/dL)         Leukopenia (WBC < 4000 cells/µL)         Thrombocytopenia (platelets < 100,000/ µL)         Hypothermia (core temperature < 36°C)         Hypotension requiring aggressive fluid resuscitation | | | | | | | |

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| **Microbiological Assessment** |
| Blood cultures and respiratory tract cultures:  Blood cultures and lower respiratory tract specimens (sputum, tracheal aspirate or bronchoscopic specimen) should be obtained for gram-stain and culture in the following scenarios *(NOTE: Sputum gram stain must be evaluated in order to properly interpret sputum culture results)*:         Severe presentation (see major/minor criteria immediately above)         Hospital onset or ventilator-associated pneumonia suspected         Empiric anti-MRSA or antipseudomonal therapy is being prescribed         Patient has prior history of infection with MRSA or Gram-negative rods resistant to ceftriaxone         Hospitalization or residence in skilled nursing facility in the last 90 days |
| *Legionella* urine antigen testing: Testing for *Legionella* urinary antigen is recommended in the following scenarios:         Severe presentation of pneumonia (see major/minor criteria above): also send *Legionella* culture from BAL if bronchoscopy done         Intensive care unit admission: also send *Legionella* culture from BAL if bronchoscopy done         Clinical features suggesting *Legionella* (e.g., high fever, rigors, hyponatremia, CNS manifestations, LDH levels >700 U/ml)         Failure of outpatient antibiotic therapy         *Legionella* outbreaks         Recent travel requiring overnight stayInfluenza testing: Influenza testing (via nasopharyngeal swab) should be performed for patients with suspected pneumonia when influenza viruses are circulating in the community. |
| **Other diagnostic considerations in pneumonia management** |
| * Obtain epidemiological history:  travel, exposures to birds, other animals and persons with tuberculosis, incarceration, drug use, sexual activity (HIV risk factors), illnesses in family or other close contacts. |
| * Medical history:  prior PPD/quantiferon positivity, vaccine history (pneumovax, influenza vaccine), HIV status, use of immunomodulatory agents (corticosteroids, tumor necrosis factor antagonists, cytotoxic chemotherapy, anti-organ rejection agents) * Procalcitonin testing may be useful when used serially to determine if antimicrobial therapy can be discontinued for ICU patients with suspected lower respiratory tract infections; its use in other settings is less clear. At our facility, procalcitonin should NOT be ordered as a one-time test to determine whether or not a patient has a bacterial infection.   [[back to top](#_top)] |
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| **RECOMMENDATIONS FOR EMPIRIC ANTIMICROBIAL THERAPY** |

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| **Outpatient Rx of Community-Acquired Pneumonia** | | | | |  | |  | |
| No comorbidities (chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancies; asplenia; immunosuppressing conditions or use of immunosuppressing drugs; or use of antimicrobials within the previous 3 months) | | | | |          Amoxicillin 1gm PO TID x 5d **OR**           Doxycycline 100mg PO BID x 5d        (inform patients of 2.8% phototoxicity risk) | |  | |
| Comorbidities present:  Mild penicillin allergy (e.g. urticaria)  Severe penicillin allergy (e.g. anaphylaxis, severe rash) | | | | |           Amoxicillin-clavulanate 875/125mg PO BID x 5d **PLUS** doxycycline 100mg PO BID x 5d OR            Cefuroxime 500mg PO BID x 5d **PLUS** doxycycline 100mg PO BID x 5d            Levofloxacin 750mg PO QD x 5d | |  | |
| [[back to top](#_top)] | | | | | | |  | |
| **Inpatient Rx of Community-Acquired Pneumonia (regardless of severity) AND**  **Ward-Onset Hospital-Acquired Pneumonia (HAP)** | | | | | | |  | |
| EMPIRIC THERAPY:  Standard regimen (no risk factors):  Severe penicillin allergy (e.g., anaphylaxis, severe rash)  --------------------------------------------------------------------------------------------------  Considerations for adding vancomycin:              Isolation of MRSA from respiratory culture/nares within past year              Severe disease (see major/minor criteria above)  PLEASE OBTAIN RESPIRATORY CULTURES TO ASSIST IN  DE-ESCALATION  --------------------------------------------------------------------------------------------------  Considerations for broadened Gram-negative coverage:           Isolation of non-*Pseudomonas* ceftriaxone-resistant, but carbapenem-susceptible, Gram-negative rods from respiratory cultures within past year           Isolation of *Pseudomonas* from respiratory cultures within past year (choose agent based on susceptibilities) OR receipt of broad-spectrum Gram-negative therapy in the past 90 days OR residence in skilled nursing facility  PLEASE OBTAIN RESPIRATORY CULTURES TO ASSIST IN  DE-ESCALATION  --------------------------------------------------------------------------------------------------  Concern for empyema or lung abscess:           Low concern for Gram-negative resistance           High concern for Gram-negative resistance (PLEASE OBTAIN RESPIRATORY CULTURES TO ASSIST IN DE-ESCALATION) | | | |            Ceftriaxone 1gm IV q24h AND azithromycin 500mg IV q 24h              Levofloxacin 750mg IV/PO q 24h (non-severe disease only)            Vancomycin 15mg/kg IV q12h (pharmacy adjusts dose)  IN LIEU OF CEFTRIAXONE             Ertapenem 1gm IV q24h              Cefepime 2g IV q8h              Piperacillin tazobactam 4.5gm IV q6h              Meropenem 1g q8h  IF SEVERE DISEASE ADD:              Amikacin 7.5 mg/kg IV q12h (pharmacy adjusts dose)   * Goal trough <5 ug/mL   IN LIEU OF CEFTRIAXONE + AZITHROMYCIN             Ampicillin-sulbactam 3gm IV q6h    Piperacillin-tazobactam 4.5gm IV q8h OR  meropenem 1gm IV q8h | | |  | |
| [[back to top](#_top)] | | | | | | |  | |
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| **Inpatient Rx of HAP (ICU patient critically ill due to pneumonia) or Ventilator-Associated Pneumonia (VAP)** | | | | | | |  | |
| Patient should meet criteria for severe disease (see major/minor criteria above)  PLEASE OBTAIN RESPIRATORY CULTURES TO ASSIST IN DE-ESCALATION | | Standard therapy  ONE OF THE FOLLOWING:              Cefepime 2gm IV q8h              Piperacillin tazobactam 4.5gm IV q8h (extended infusion)              Meropenem 1gm IV q8h  **PLUS**              Amikacin 7.5 mg/kg IV q12h (pharmacy adjusts dose)   * Goal trough <5 ug/mL   **PLUS**            Vancomycin 15mg/kg IV q12h (pharmacy adjusts dose) | | | | |  | |
| [[back to top](#_top)] | | | | | | |  | |
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|  | **RECOMMENDATIONS FOR DE-ESCALATION OF ANTI-MRSA AND BROAD SPECTRUM GRAM-NEGATIVE COVERAGE IN INPATIENT PNEUMONIA MANAGEMENT FOR PATIENTS WHO HAVE CLINICALLY IMPROVED** Check culture results, temperature, WBC, CXR, pO2, sputum purulence, hemodynamics, organ function, ability to take oral medication | | | | | |  | |
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|  | Respiratory culture negative or no culture performed | | Consider stopping antibiotics if clinical picture no longer consistent with pneumonia **OR**  De-escalate therapy:            Replace empiric broad spectrum Gram-negative therapy with ceftriaxone 1gm IV q24h plus azithromycin 500mg IV q24h (if cannot take PO) or amoxicillin-clavulanate 875mg/125mg po q12h and/or doxycycline 100mg po q12h (if can tolerate PO); **treat for 5-7 days TOTAL**            Discontinue vancomycin (can substitute with doxycycline 100mg PO q12h if MRSA nares positive and no culture performed) | | | |  | |
|  | Culture positive | | Modify therapy to target identified pathogen              **Treat for 5-7 days** | | | |  | |
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|  | [[back to top](#_top)] | | | | | |  | |
|  | **EVALUATION OF PATIENTS WITH PNEUMONIA WHO FAIL TO RESPOND TO THERAPY** | | | | | |  | |
|  | Consider local complication | | Consider other site of infection | | | |  | |
|  |             Empyema              Lung abscess | |             *C. difficile* colitis              Vascular catheter infection | | | |  | |
|  | Consider alternative pathogen | |  | | | |  | |
|  |             Viral pneumonia, e.g. influenza              Legionella              Nocardia              Tuberculosis | |             Fungi              Aspergillus              Coccidioidomycosis and other endemic mycoses              *Pneumocystis jiroveci* pneumonia (i.e., PCP) | | | |  | |
|  | Consider alternative diagnoses | |  | | | |  | |
|  |             Atelectasis              Pulmonary embolus              Pulmonary hemorrhage              Underlying disease              Drug fever | |             Neoplasm              Bronchiolitis obliterans and organizing pneumonia (BOOP)              ARDS              Pulmonary vasculitis, eosinophilic pneumonia | | | |  | |
|  | [[back to top](#_top)]  **+++++++++++++++** | | | | | |  | |
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| [[back to top](#_top)] | | | | | |
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