**Purpose of Guideline**
- To assist in guiding appropriate diagnostic workup, initial antibiotic selection, and follow-up treatment for patients with HAP or VAP.
- This guideline is for hospital-acquired infection. Patients with healthcare-associated pneumonia, including those admitted from a long term care or skilled nursing facility may require alternative management.

**Key Points**
- Triple antibiotic coverage should be used for patients at risk for multi-drug resistant Gram Negative infection (Page 2).
- Seven days is the recommended treatment duration in most cases (Page 3).
- Do not delay antimicrobial administration if cultures cannot be obtained.

**Clinical Features of Pneumonia**
- **HAP**
  - Fever, leukocytosis
  - Rigors, sweats, chest discomfort
  - New cough with/without sputum production
  - Change in color/consistency of sputum
  - Dyspnea, increased oxygen requirements

- **VAP (in addition to list above)**
  - Increased suctioning and/or ventilator demand

**Evaluation and Testing**
- **History with compatible symptoms**
- **Physician examination**
- **Pulse oximetry**
- **CBC**
- **Chemistry panel**
- **Chest X-ray demonstrating new infiltrates**

**Signs and symptoms consistent with pneumonia**
* Review previous culture prior to selecting empiric antibiotic therapy

**Antibiotics not indicated – search for other causes**

**Hospitalized < 48 hours?**
- **Refer to CAP Guideline**

**Hospitalized ≥ 48 hours**
- **Hospital-Acquired**

**Ventilated ≥ 48 hours?**
- **Ventilator-Associated**

**Non-Ventilated**
- **Diagnostics**
  - Blood cultures (before antibiotics given, if possible)
  - Consider sputum culture
  - MRSA PCR nasal swab
  - Consider procalcitonin trending

**Ventilated**
- **Diagnostics**
  - Blood cultures (before antibiotics given, if possible)
  - Order BAL consult lab prior to performing a Bronchoalveolar lavage (BAL), blind bronchial sampling (mini-BAL). If unable to obtain BAL, obtain MRSA PCR Nasal Swab
  - Consider procalcitonin trending

**Empirical therapy**
* (Table 1, Page 2)
Empiric Antibiotic Selection for Hospital-Acquired and Ventilator-Associated Pneumonia

*Dosing guidance can be found within the Adult Antimicrobial Dosing Guideline.*

**Table 1: Hospital-Acquired and Ventilator-Associated Pneumonia Therapy**

All patients should receive coverage against MRSA and *Pseudomonas.*

*Note: Review previous cultures prior to selecting therapy.*

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>FIRST Antibiotic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order MRSA-Directed /</td>
<td>Vancomycin</td>
<td>A loading dose may be needed.</td>
</tr>
<tr>
<td>Gram Positive Therapy</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 2</th>
<th>SECOND Antibiotic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order ONE Pseudomonas-</td>
<td>Piperacillin/Tazobactam</td>
<td></td>
</tr>
<tr>
<td>Directed/</td>
<td></td>
<td>OR</td>
</tr>
<tr>
<td>Gram Negative Therapy</td>
<td>Cefepime</td>
<td>Indication:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ If non-anaphylactic penicillin allergy or febrile neutropenia, use cefepime.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ If aspiration suspected, add anaerobic coverage with metronidazole or clindamycin.</td>
</tr>
<tr>
<td></td>
<td>Aztreonam</td>
<td>Indication:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ If anaphylactic penicillin allergy and/or cephalosporin allergy, use Aztreonam*.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ If aspiration suspected, add anaerobic coverage with metronidazole or clindamycin.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 3</th>
<th>THIRD Antibiotic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order Third Agent ONLY if patient is at risk for multi-drug resistant (MDR) gram negative infection based on indications below</td>
<td>Tobramycin</td>
<td>Polymyxin B therapy should be considered over Tobramycin in patients with a history of multidrug-resistant (MDR) gram negative respiratory infections or residence at a long-term care or extended-care facility.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>Polymyxin B</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Indications for Third Antibiotic**

*(If patient meets one or more indication below add a third antibiotic)*

**Hospital-Associated**

- Septic shock
- Prior broad-spectrum IV antibiotic use within 90 days (e.g. cefepime, piperacillin/tazobactam)
- History of *Pseudomonas* or MDR gram negative pathogen
- Respiratory failure requiring ventilator support
- Structural lung disease: e.g. bronchiectasis, cystic Fibrosis
- If Aztreonam* selected due to penicillin allergy add second gram negative agent. (See Step 3)

**Ventilator-Associated**

- Septic shock
- Prior broad-spectrum IV antibiotic use within 90 days (e.g. cefepime, piperacillin/tazobactam)
- History of *Pseudomonas* or MDR gram negative pathogen
- Acute respiratory distress syndrome (ARDS) preceding VAP
- ≥ 5 days of hospitalization prior to VAP
- Acute renal replacement therapy prior to VAP
- If Aztreonam* selected due to penicillin allergy add second gram negative agent. (See Step 3)
De-escalation and Duration of Therapy

- **De-escalate and direct therapy based on the following culture results:**
  - If a quantitative BAL is obtained, therapy should be reserved for organisms with >10^4 colony-forming units.
  - If MRSA PCR Nasal Swab is negative consider discontinuing empiric MRSA coverage.

- **Indications for transition to oral antibiotic therapy (see IV to PO Conversion Policy).**
  - Attention should be given to interactions with food and tube feedings. The following criteria are proposed based on national and institutional guidelines:
    - Eating solid/oral food or tolerating tube feedings at goal
    - Absence of intractable nausea/vomiting, malabsorption syndrome, or significant vasopressor support which may impact enteral absorption
    - Hemodynamically stable

- **Seven days is the recommended duration for most patients.** Longer therapy should be considered in the following situations:
  - Delayed clinical response
  - Empiric therapy resistance
  - Empyema
  - Recurrence
  - Extrapulmonary manifestations
  - Severely immunocompromised

Clinical Considerations

- **Review previous cultures prior to selecting therapy.** Patients with a recent history of respiratory infections secondary to *Stenotrophomonas, Acinetobacter, Burkholderia, ESBL-producing organisms, or pathogens otherwise resistant to one or more of the options listed should have their empiric treatment tailored to known susceptible agents.

- **Consider Infectious Diseases consult** if lack of clinical response or evidence or history of resistant pathogen(s) (e.g. MDR *Pseudomonas*), or Immunocompromised patients.
  - Refer to the MDRO Treatment Table for further guidance on resistant pathogens.

- **Administer appropriate antibiotics within one hour, particularly for patients in septic shock.** See Initial Sepsis Management Guideline and Infection by Site Antibiotic Grid. Evaluate response to antibiotics after 48 hours and tailor accordingly.

References


Quality Measures

- Percentage of HAP/VAP patients with respiratory cultures
- Percentage of HAP/VAP patients without respiratory cultures with MRSA Nasal Swab
- Orderset use

Authors

- Bruce Doepker, PharmD, BCPS
- Jessica Elefritz, PharmD, BCCCP
- Matthew Exline, MD, MPH
- Daniel Martin, MD
- Kurt Stevenson, MD, MPH
- Lynn Wardlow, PharmD, MBA, BCPS-AQ ID

Order Sets and Resources

- OSU IP MED: Nosocomial Pneumonia (HAP/VAP) [2557], order set under revision
- Initial Sepsis Management Guideline
- Blood Culture Indication Guideline (pending)
- OSUMC Drug Formulary
- Hospital Antibiogram
- Antimicrobial Stewardship Resources: Infection by Site, MDRO Treatment Table

Guideline Approved


Disclaimer: Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

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