ANTIBIOTIC PROTOCOL FOR ADULT NOSOCOMIAL PNEUMONIA EMPIRIC THERAPY

This pathway is to be used in adult (>18 yo), immunocompetent patients only. An Infectious Diseases consult is recommended when dealing with complicated patients or immunocompromised patients (e.g., hematopoetic stem cell or solid organ transplant). All dosages are based on normal renal and hepatic function.

A. No known Risk Factors for Multidrug-Resistant (MDR; see table below) Pathogens and Early Onset Disease (< 5 d of hospital admission)
   - Ceftriaxone 1 gram (2 grams if > 80 kg) IV qday OR
   - Moxifloxacin\(^a\) 400 mg PO/IV qday OR
   - Ampicillin/sulbactam 1.5 grams (3 grams if > 80 kg) IV q6h

B. Known Risk Factors for MDR Pathogens (see table below) or Late Onset Disease (≥ 5 d of hospital admission)
   - Vancomycin 15 mg/kg q12h\(^b\) OR
   - Linezolid 600 mg IV q12h
   - Cefepime 1 gram IV q6h\(^c\) OR
   - Piperacillin/tazobactam 3.375 grams IV q8h, infused over 4 hours OR
   - Meropenem 500 mg q6h
   - **Penicillin allergy:** aztreonam 2 grams IV q6h plus clindamycin 900 mg IV q8h
     - Gentamicin 5-7 mg/kg IV qday\(^e\) OR
     - Tobramycin 5-7 mg/kg IV qday\(^e\) OR
     - Ciprofloxacin\(^*\) 400 mg IV q8h

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\(^a\)Not recommended for use during pregnancy.
\(^b\)Trough levels for vancomycin should be approximately 15 mg/L – Consult the pharmacist for pharmacokinetic evaluation. If meticillin-resistant *Staphylococcus aureus* (MRSA) with a vancomycin MIC of ≥ 2 mg/L is isolated, use of an alternative agent (linezolid) is recommended.
\(^c\)Cefepime 2g IV q8h if neutropenia
\(^d\)If Legionella is suspected, use an aminoglycoside plus azithromycin 500 mg IV qday.
\(^e\)Trough level for gentamicin and tobramycin once-daily dosing should be 0 mg/L – Consult the pharmacist for pharmacokinetic evaluation.

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**RISK FACTORS FOR MULTIDRUG-RESISTANT ORGANISMS**

- Antimicrobial therapy in preceding 90 d
- Current hospitalization of 5 d or more
- High frequency of antibiotic resistance in the community or in the specific hospital unit (antibiogram can be found on the intranet)
- Presence of risk factors for HCAP:
  - Hospitalization for 2 d or more in the preceding 90 d
  - Residence in a nursing home or extended care facility
  - Home infusion therapy (including antibiotics)
  - Chronic dialysis within 30 d
  - Home wound care
  - Family member with multidrug-resistant pathogen
- Immunosuppressive disease and/or therapy

Check pneumococcal and influenza vaccination eligibility and status.
Give vaccinations if indicated.
Hospital, Ventilator and Health Care Associated Pneumonia Pathway

PURPOSE:
To provide a framework for the initial evaluation and management of the immunocompetent, adult patient with bacterial causes of HAP, VAP, or HCAP based on recent literature and guidelines. Delays in the initiation of appropriate antibiotic therapy can increase mortality, and therapy should not be postponed for the purpose of performing diagnostic studies in patients who are clinically unstable.

DEFINITIONS:
**Hospital Acquired Pneumonia** (HAP) is defined as pneumonia that occurs 48 hours or more after admission, which was not incubating at the time of admission.
**Ventilator Acquired Pneumonia** (VAP) is defined as pneumonia that arises more than 48–72 hours after endotracheal intubation.
**Healthcare Associated Pneumonia** (HCAP) includes pneumonia within 48 hours of hospital admission in any patient who was hospitalized in an acute care hospital for two or more days within 90 days of the infection; resided in a nursing home or long-term care facility; received recent intravenous antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current infection; or attended a hospital or hemodialysis clinic.

DIAGNOSIS:
The clinical diagnosis of HAP, VAP and HCAP can be made if the patient has a new radiographic infiltrate PLUS at least two of the following: fever > 38°C, leukocytosis or leucopenia, or purulent secretions. Etiologic diagnosis generally requires a lower respiratory tract culture, but rarely may be made from blood or pleural fluid cultures.
To facilitate etiologic diagnosis, early bronchoalveolar lavage (BAL) sampling, either by mini-BAL technique plus semi-quantitative culture or conventional bronchoscopy with lavage and semi-quantitative culture, should be considered. The probability for a specimen with high yield is highest when the specimen is obtained early (before empiric antimicrobial therapy is started).

MANAGEMENT:
All patients with suspected HAP/VAP/HCAP should have a lower respiratory tract sample and blood sent for culture, and patients with HAP and HCAP should have sputum samples sent whenever possible before the administration of antibiotic therapy. Extrapulmonary infection should be excluded as part of the evaluation.
Unless there is low clinical suspicion for lower respiratory tract infection, empiric antibiotics should be initiated.

ANTIBIOTIC SELECTION:
The key decision in initial empiric therapy is whether the patient has risk factors for multidrug resistant (MDR) organisms (see above risk factors for MDR organisms table).

CONTINUATION OF THERAPY:
Broad-spectrum empiric antibiotic therapy should be accompanied by a commitment to de-escalate antibiotics, on the basis of serial clinical and microbiologic data, to limit the emergence of resistance in the hospital.
All patients with HAP, VAP and HCAP should initially receive therapy intravenously, but conversion to oral/enteral therapy may be possible in certain responding patients. Clinical improvement usually becomes apparent after the first 48–72 hours of therapy, and therefore, the selected antimicrobial regimen should not be changed during this time unless progressive deterioration is noted or initial microbiologic studies so dictate. Clinical parameters including the white blood cell count and measures of oxygenation and core temperature have been used in several studies to define the normal pattern of resolution of HAP. The responding patient should have de-escalation of antibiotics, narrowing therapy to the most focused regimen possible on the basis of culture data.
The nonresponding patient should be evaluated for noninfectious mimics of pneumonia, unsuspected or drug-resistant organisms, extrapulmonary sites of infection, and complications of pneumonia and its therapy. Diagnostic testing should be directed to whichever of these causes is likely.

Efforts to reduce the duration of therapy are justified by studies of the natural history of the response to therapy. Data support the premise that most patients with VAP, who receive appropriate antimicrobial therapy, have a good clinical response within the first 6 days. Prolonged therapy simply leads to colonization with antibiotic resistant bacteria, which may precede a recurrent episode of VAP.

**ALGORITHM:**

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HAP, VAP, or HCAP Suspected

Obtain lower respiratory tract sample (and blood if VAP) for culture & microscopy if patient is clinically stable.

Begin empiric antimicrobial therapy using local antibiogram unless there is low clinical suspicion for pneumonia and a negative lower respiratory tract culture.

Days 2 & 3: Check cultures & Assess Clinical Response

Clinical Improvement at 48-72 hours

Cultures -
Search for Other Pathogens, Complications, Other Diagnoses or Other Sites of Infection.

Cultures +
Adjust Antibiotic Therapy, Search for Other Pathogens, Complications, Other Diagnoses or Other Sites of Infection

Cultures -
Consider Stopping Antibiotics

Cultures +
De-escalate Antibiotics, If Possible. Treat Selected Patients for 7-8 Days & Reassess.
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