Hospital-Acquired Pneumonia (HAP)
Ventilator-Associated Pneumonia (VAP)

BACKGROUND

Hospital-acquired pneumonia (HAP) and Ventilator-associated pneumonia (VAP) are frequent complications of health care and associated with significant morbidity and mortality. Pneumonia in patients from long-term care facilities/nursing homes or with recent healthcare exposure are not included in the category of HAP and should be managed as community-acquired pneumonia (CAP).

DEFINITIONS

Patient admitted in a healthcare setting + new lung infiltrate + clinical evidence that the infiltrate is of infectious origin (new onset of fever, purulent sputum, peripheral leukocytosis, and/or increasing oxygen requirements)

- **HAP:** pneumonia with onset > 48 hours after admission (that did not appear to be incubating at time of admission)
- **VAP:** onset pneumonia > 48 hours after endotracheal intubation/mechanical ventilation

DIAGNOSTIC CONSIDERATIONS

- Obtain blood cultures AND lower respiratory sample by non-invasive methods (sputum, endotracheal aspirate) **prior to initiating antibiotics**
- If severe (e.g. bilateral) pneumonia, send urine for Legionella antigen and **consult ID**
- The use of procalcitonin (PCT) (or other serum markers such as CRP) alone should not be used to decide whether or not to initiate antibiotic therapy. Because of misleading serum PCT results, **clinical criteria alone should be used to guide antibiotic initiation.**

MOST COMMON ETIOLOGIC AGENTS

Early-onset HAP (≤ 5 days after admission)	• *Streptococcus pneumoniae* • *S. aureus* • *Haemophilus influenzae* • Enterobacteriaceae
Late-onset HAP (> 5 days after admission)	• *S. aureus* • ESKAPE pathogens (*E. coli, Serratia, Klebsiella, Acinetobacter, Pseudomonas, Enterobacter*)

MOST COMMON AT MUHC:

- *Pseudomonas aeruginosa*
- *S. aureus* (MSSA >>> MRSA)

[MRSA only 1% of organisms isolated from lower respiratory tract specimens, even from ICU]

No pathogen isolated from 70% of respiratory tract specimens of hospitalized patients

EMPIRIC PHARMACOLOGIC TREATMENT[1]

Early HAP (< 5 d after admission)	**Ceftriaxone** 2 g IV q24h x 7 days[3] *If hypersensitivity to all β-lactams:* Moxifloxacin 400 mg PO/IV q24h Add Vancomycin[2] 15 mg/kg IV q12h ONLY if MRSA colonized/prior infection
Late HAP (> 5 d after admission) ***Hemodynamically stable***	**Piperacillin-tazobactam** 4.5 g IV q8h (extended infusion) x 7 days[3] *If hypersensitivity to penicillin:* Meropenem 1 g IV q8h Add Vancomycin[2] 15 mg/kg IV q12h ONLY if MRSA colonized/prior infection
Hemodynamically unstable	**Meropenem** 1 g IV q8h + **ciprofloxacin** 400 mg IV/PO q12h x 7 days[3] Add Vancomycin[2] 15 mg/kg IV q12h ONLY if MRSA colonized/prior infection
VAP	**Piperacillin-tazobactam** 4.5 g IV q8h (extended infusion) x 7 days[3] *If hypersensitivity to penicillin:* Meropenem 1 g IV q8h Add Vancomycin[2] 15 mg/kg IV q12h ONLY if MRSA colonized/prior infection

[1]Dosing of antibiotics assume normal renal function; adjustments are required if presence of renal dysfunction
[2]See Vancomycin Therapeutic Drug Monitoring guideline; consult pharmacy for dosing adjustments
[3] If bacteremia, or slow improvement (clinical, radiological or laboratory parameters): extend duration

ADDITIONAL COMMENTS

- **If *S. aureus* bacteremia, or if extensively-drug resistant organism, CONSULT ID**
- **Reassess antibiotic and duration of treatment as soon as culture results available**
    - E.g. MSSA: change to cefazolin or cloxacillin IV then step down to PO cefadroxil
- **If MRSA nasal screen negative --> unlikely to be MRSA pneumonia (NPV > 96%)**
- Daptomycin should NOT be used for treatment of pneumonia
- If aspiration suspected: oral anaerobes (e.g. *Peptostreptococcus*) are covered with most β-lactam antibiotics; additional anaerobic coverage (e.g. metronidazole) NOT needed
- Risk factors for multi-drug resistant infection: IV antibiotics in preceding 90 days, prolonged hospitalization, septic shock at the time of HAP/VAP, ARDS preceding VAP

REFERENCES

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. *Clinical Infectious Diseases*. 2016; 63(5): e61-e111.

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