Health PEI

ANTIMICROBIAL STEWARDSHIP SUBCOMMITTEE

Ventilator Associated Pneumonia

Definition

- **Ventilator Associated Pneumonia (VAP):** Pneumonia that develops 48 hours or more after endotracheal intubation.

Most Common Organisms

- *S. aureus* (MSSA or MRSA), Gram-negative bacilli (e.g., *E. coli, K. pneumoniae, Enterobacter spp, Serratia marcescens, H. influenzae, P. aeruginosa, A. baumannii, Stenotrophomonas maltophilia*).
- *Enterococcus* and *Candida* are commonly isolated in sputum cultures of hospitalized patients; however, these organisms are generally considered colonizers and do not warrant antimicrobial therapy

Diagnostic Considerations

- A diagnosis of VAP generally requires:
  - Demonstration of an infiltrate on chest imaging AND
  - Compatible clinical features, such as: fever, tachypnea, increased purulent secretions, increased in oxygen requirements or ventilatory settings, or leukocytosis
- **Microbiological analyses:** Blood cultures x 2 sets PLUS endotracheal suctioning for culture.

Treatment Considerations

- If the patient received an antibiotic in the past 3 months, choose an antibiotic from a different class, regardless of clinical success.
- If MRSA risk factors, consider empiric coverage for MRSA (see empiric treatment table).
- If history of infection or colonization with Gram-negative bacilli producing AmpC or Extended Spectrum beta-lactamases (ESBL), empiric use of meropenem is encouraged (may consider fluoroquinolones if susceptibility known, stable and no risk factors).
- **Empiric double coverage of *Pseudomonas aeruginosa***:
  - Consider for patients who have septic shock, increasing ventilatory support requirements or structural lung disease (e.g., bronchiectasis, cystic fibrosis) (see empiric treatment table)
  - Used to maximize the likelihood of having at least one active antimicrobial (due to increased risk of resistance with *Pseudomonas*).
  - Re-evaluate use after 48 hours. If *Pseudomonas* is isolated, step-down to monotherapy (according to susceptibility data).
    - Maintaining double coverage once susceptibilities are known is not required
  - Use of aminoglycosides (e.g., tobramycin and gentamicin) as monotherapy for the treatment of pneumonia is NOT recommended (even if susceptibility is confirmed).
- DO NOT use DAPTOmycin to treat pneumonia; DAPTOmycin is inactivated by pulmonary surfactant. If MRSA infection, use vancomycin (or linezolid if vancomycin is ineffective or inappropriate).
- **To avoid prolonged use of broad-spectrum antibiotics, it is essential to de-escalate therapy according to the results of microbiologic culture and sensitivity results.**
- Ventilator-associated tracheobronchitis (VAT; defined as fever with no other recognizable cause, with new or increased sputum production, positive ETA culture yielding a new bacteria, and no radiographic evidence of nosocomial pneumonia) should not routinely be treated. Only consider initiating antimicrobial therapy if clinical deterioration (e.g., progressive hypoxemia).

Health PEI

ANTIMICROBIAL STEWARDSHIP SUBCOMMITTEE

Empiric Treatment

Risk Factors	Empiric Treatment Regimen∞
NO Risk Factors	cefTRIAXone 2 g IV q24h If **true immediate allergy** to a beta-lactam at risk for cross-reactivity with cefTRIAXone▲ or **severe delayed reaction to a beta-lactam‡:** levoFLOXacin 750 mg IV q24h*
Presence of ANY of the following risk factors for MDR Gram-negative pathogens or poor outcomes: – Severe sepsis or septic shock – Prior intravenous antibiotic use within 90 days – Immunosuppression – Structural lung disease (e.g., bronchiectasis, cystic fibrosis) – Hospitalization for greater than or equal to 5 days before VAP onset – Acute renal replacement therapy before VAP onset – Acute respiratory distress syndrome (ARDS) before VAP onset – Colonization or recent prior infection with *Pseudomonas spp* or other resistant Gram-negative bacilli (e.g., ESBL or AmpC)	piperacillin-tazobactam 4.5 g IV q6h* **If true immediate penicillin allergy▲ OR history of ESBL or AmpC:** meropenem 500 mg IV q6h* (consider 2 g IV q8h if septic shock) **If severe delayed reaction‡ to a beta-lactam:** levoFLOXacin 750 mg IV q24h* PLUS tobramycin 7 mg/kg IV q24h* PLUS vancomycin IV* (See Health PEI IV manual or Firstline app for dosing)
Evaluate for Modifying Factors:	**Regimen Adjustment**
MRSA Risk Factors: – history of MRSA infection or colonization – household contact with a MRSA colonized individual – IV drug use – crowded living conditions (e.g., homelessness, incarcerated persons) – recent travel to or residing in an MRSA endemic region or community	**If ONE or more MRSA risk factors, then ADD (if not already receiving):** vancomycin IV* (See Health PEI IV manual or Firstline app for dosing)
Consider double coverage for *Pseudomonas aeruginosa* if: – septic shock or increasing ventilatory support requirements – Structural lung disease (e.g., bronchiectasis, cystic fibrosis)	**Consider ADDING a second anti-pseudomonal antimicrobial to either piperacillin-tazobactam or meropenem standard regimen (not necessary if already receiving levoFLOXacin plus tobramycin), options include:** tobramycin 7 mg/kg IV q24h* **OR** ciprofloxacin 400 mg IV q8h*

* Dose adjustment required in renal impairment.

∞ If microbial cause of infection known, treat according to culture and sensitivity.

▲ Immediate, IgE mediated allergies include, but are not limited to, anaphylaxis, urticaria, angiœdema, hypotension, bronchospasm, stridor, and pruritic rash. Refer to the Health PEI Beta-Lactam Allergy guidelines to determine which beta-lactams share similar side chains.

‡ Severe delayed hypersensitivity reactions to beta-lactams are caused by mechanisms that are not well known and require that subsequent use of beta-lactams be avoided. Severe delayed hypersensitivity reactions can include interstitial nephritis, immune hepatitis, hemolytic anemia, serum sickness, severe cutaneous reactions such as Stevens-Johnson syndrome, toxic epidermal necrolysis, and drug rash with eosinophilia and systemic symptoms (DRESS).

Duration of Therapy

- Studies have shown that, compared with standard treatment durations of 10 days or more, 7-day treatment durations were associated with fewer relapses caused by multiresistant pathogens WITHOUT affecting mortality rate.
- **Treat for no more than 7 days if good clinical response, regardless of bacterial etiology.**
- Treatment duration could be prolonged for more than 7 days in certain situations (e.g., empyema, lung abscess, cavitating or necrotizing pneumonia, extrapulmonary infections, *S. aureus* bacteremia, immunosuppression, etc.)

These guidelines are an adaptation of New Brunswick Anti-infective Stewardship Committee
Ventilator Associated Pneumonia in Adults May 2023

References:

1. Kalil AC *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: 1-51
2. Pugh R, Grant C, Cooke RP, Dempsey G. Short-course versus prolonged-course antibiotic therapy for hospital-acquired pneumonia in critically ill adults. Cochrane Database Syst Rev 2015; 8:Cd007577
3. Blondel-Hill E. & Fryters S. (2012). Bugs & Drugs. An Antimicrobial/Infectious Diseases Reference. Alberta Health Services.
4. MSH+UHN Antimicrobial Stewardship Program. Hospital Acquired Pneumonia. Accessed online 12-2016.
5. Management of Penicillin and Beta-Lactam Allergy. NB-ASC. 09-2017
6. Adult Antimicrobial Dosing Tool. NB-ASC. 03 – 2023
7. Torres A *et al*. International ERS/ESICM/ESCMID/ALAT guidelines for the management of hospital-acquired pneumonia and ventilator-associated pneumonia: Guidelines for the management of hospital-acquired pneumonia (HAP)/ventilator-associated pneumonia (VAP) of the European Respiratory Society (ERS), European Society of Intensive Care Medicine (ESICM), European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and Asociación Latinoamericana del Tórax (ALAT). Eur Respir J. 2017 Sep 10;50(3):1700582. doi: 10.1183/13993003.00582-2017. PMID: 28890434.
8. Kumar A, *et al*. A survival benefit of combination antibiotic therapy for serious infections associated with sepsis and septic shock is contingent only on the risk of death: a meta-analytic/meta-regression study. Crit Care Med. 2010 Aug;38(8):1651-64. doi: 10.1097/CCM.0b013e3181e96b91. PMID: 20562695.
9. Firstline Antimicrobial Stewardship App. Nova Scotia Health Authority; Fraser Health; Providence Health Care – Accessed 15/03/2023