

CLINICAL GUIDELINE FOR DIAGNOSIS, TREATMENT AND PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA

Rondi Gelbard, MD, Department of Surgery
Rachael Lee, MD, Department of Medicine
Kyle Humphrys, PharmD, Department of Pharmacy

Background:

The diagnosis of Ventilator Associated Pneumonia (VAP) is challenging, especially in the multi-trauma patient. While a set of CDC guidelines were updated in 2013 and a second set of guidelines were published in 2016 by IDSA, they can be a challenge to interpret and use with terminology such as “Ventilator Associated Events” and “Probable Ventilator Associated Pneumonia”.¹ In victims of trauma, specifically both the diagnosis of VAP and the response to therapy can be misleading. VAP may be confused with (or even coexist with) existing pulmonary contusions, lobar collapse from atelectasis and other disease processes in trauma patients. Moreover, a trauma patient may have multiple reasons for febrile illnesses, many of which are non-infectious, and do not always have a reliable response in their leukocyte count even in the presence of adequate VAP therapy.² This document provides tangible guidance for physicians in both the diagnosis and response to therapy for trauma patients who are suspected to have VAP.^{3,4}

Management Algorithm

1. **DIAGNOSIS:** If a clinical suspicion of VAP exists, follow the diagnostic algorithm below
 - a. Clinical suspicion of VAP should be prompted by the following:
Mechanical ventilation >48 hours AND
 - i. Abnormal temperature (>38C or <36C)
 - ii. Abnormal WBC count (>12,000 or < 4,000 cells/mcl, or presence of >10% bands)
 - iii. Macroscopically purulent sputum**PLUS**
 - iv. Decline in oxygenation OR
 - v. New or changing infiltrate on CXR
 - b. Quantitative culture should be used to diagnose VAP
 - i. A bronch BAL (or blind BAL performed by a trained respiratory therapist utilizing a standardized technique) should be done prior to empiric therapy initiation when feasible. The aspirate should be sent for **quantitative culture**; >100,000 CFU is considered positive
 - ii. If feasible, or clinically indicated for therapeutic intervention, a bronchoscopy with BAL may be completed. The aspirate should be sent for **quantitative culture**
 - iii. Tracheal aspirates should **NOT** be used to diagnose VAP. If, however, a tracheal aspirate is sent and quantitated, the threshold for therapy should be >100,000

CFU. NON-QUANTITATED TRACHEAL ASPIRATES SHOULD NOT BE TREATED

2. TREATMENT:

- a. A recent study showed no difference in clinical outcomes between immediate and specimen-initiated antibiotic strategies⁶; therefore, the decision to initiate empiric antibiotics prior to Gram stain or culture results is at the discretion of the provider.
- b. Empiric antibiotics are dictated by the patient's risk for healthcare associated organisms:
 - i. Risk factors for healthcare associated organisms include: Prior IV antibiotic use within 90 days (excluding perioperative), neutropenic fever, ARDS preceding VAP, ≥ 5 days of hospitalization prior to the occurrence of VAP, Acute renal replacement therapy prior to VAP onset
 - If no risk factors are present, initiate **Ceftriaxone 2g IV q24h**
 - If any risk factors are present, initiate **Cefepime 2g IV q8h** and **IV Vancomycin** (place consult to pharmacy for pharmacokinetic dosing and monitoring)
 - If recent history of MDR organism (within 90 days), ensure that regimen targets organism; among patients with septic shock at time of VAP, consider adding aminoglycoside (i.e., amikacin) until culture data becomes available
- c. Empiric antibiotics are tailored or discontinued as appropriate once culture results are available. If colony count $< 10,000$ CFU/mL or no growth, discontinue antibiotics.
- d. Based on the 2016 IDSA guidelines, treatment durations for all patients with a diagnosed VAP should be treated with a short course of antibiotics (7-8 days)⁵. Day 1 of this therapy would be the first day of adequate antibiotic coverage according to final sensitivities.
- e. Consider consulting Infectious Disease for *Stenotrophomonas* or MDR pathogens that might require extended treatment.

3. PREVENTION:

- a. While the above is meant to promptly diagnose and treat VAP, the presence of VAP still confers an increase in hospital length of stay and costs. The below guidelines are methods used to prevent the development of VAP.
 - Routine hand hygiene by care team (monitored and reported by Hospital Epidemiology)
 - HOB elevated to 30 degrees unless contraindicated
 - Ventilator circuits are changed every 7 days or if soiled/damaged, circuit changes are documented in EMR
 - All patients admitted to TBICU are assessed for nasal colonization for MRSA and received nasal mupirocin at time of admission
 - Closed suction is used on all ventilators with attempts to limit ventilator disconnections
 - Endotracheal cuff pressure is monitored each shift and documented in EMR
 - SBT/SAT per ICU protocol
 - With transports, suctioning is performed prior to and upon return
- b. In patients with acute traumatic brain injury, GCS < 13 , and expected to require

mechanical ventilation for at least 48 hours, an early, single dose of Ceftriaxone 2g within 12 hours after tracheal intubation is recommended to decrease the risk of early VAP.⁷

REFERENCES

1. Magill SS, Klompas M, Balk R, et al. Developing a new, national approach to surveillance for ventilator-associated events. *Crit Care Med* 2013; 41(11): 2467-75.
2. Swanson JM, Connor KA, Magnott LJ, et al. Resolution of clinical and laboratory abnormalities after diagnosis of Ventilator-Associated Pneumonia in trauma patients. *Surg Infect* 2013; 14(1): 49-55.
3. Sharpe JP, Magnotti LJ, Weinberg JA, et al. Adherence to an established diagnostic threshold for ventilator-associated pneumonia contributes to low false-negative rates in trauma patients. *J Trauma Acute Care Surg* 2015; 78(3): 468-74.
4. Parks NA, Magnotti LJ, Weinberg JA, et al. Use of the clinical pulmonary infection score to guide therapy for ventilator-associated pneumonia risks antibiotic overexposure in patients with trauma. *J Trauma Acute Care Surg* 2012; 73(1): 52-59.
5. 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. *CID* 2016; 63: 1-51.
6. Guidry CA, Beyene RT, Watson CM, et al. Trial of antibiotic restraint in presumed pneumonia: A Surgical Infection Society multicenter pilot. *J Trauma Acute Care Surg*. 2023 Feb 1;94(2):232-240.
7. Dahyot-Fizelier C, Lasocki S, Kerforne T, et al. PROPHY-VAP Study Group and the ATLANREA Study Group. Ceftriaxone to prevent early ventilator-associated pneumonia in patients with acute brain injury: a multicentre, randomised, double-blind, placebo-controlled, assessor-masked superiority trial. *Lancet Respir Med*. 2024 May;12(5):375-385.