VENILATOR-ASSOCIATED PNEUMONIA CLINICAL PRACTICE MANAGEMENT GUIDELINE

VERSION No. 2

Last Updated: July 30, 2022

GEORGIA QUALITY IMPROVEMENT PROGRAM

VENILATOR-ASSOCIATED PNEUMONIA CLINICAL PRACTICE MANAGEMENT GUIDELINE

Developed by the Georgia Quality Improvement Program (GQIP)

Content:
The content for this publication was developed by GQIP through collaboration with stakeholders within the State of Georgia to optimize the care of our trauma patients. This is a living document that will be reviewed every 2 years or as needed to maintain the standards of care set forth by best evidence and local expert opinion.

Contributors:
Georgia Trauma Program Leaders

Approval:
GQIP Trauma Collaborative Members

Review Dates:
July 2022

I. Purpose:

To decrease the incidence of ventilator-associated pneumonia (VAP) in critically ill trauma patients.

II. Background:

Ventilator-associated pneumonia is the most prevalent infection encountered in the intensive care unit (ICU). This has led to countless studies about diagnosis, management, and prevention due to the associated morbidity, mortality, and cost.[12-14] Ventilator-associated pneumonia occurs in roughly 20% of ICU patients with mortality ranging from 20- 50%.[10-12, 14] To improve upon early diagnosis and management of these patients, the Centers for Disease Control and Prevention (CDC) published a set of guidelines to aid with early detection and management of patients who were at risk for developing VAP.[2-3]

Despite this, the diagnosis of VAP remains elusive, especially in the polytrauma patient. Multiple studies have shown the futility of using scoring systems such as the Clinical Pulmonary Infection Score (CPIS) to diagnose and treat pneumonia in the trauma patient.[16] The triggers used in these scoring systems can also be seen in patients with multiple traumatic injuries secondary to the inflammatory response, chest trauma (*i.e.* pulmonary contusions, atelectasis, lobar collapse), or as a result of resuscitation (*i.e.* pulmonary edema, worsening pulmonary contusions, transfusion-related acute lung injury [TRALI], etc.). Using these methods will result in over-diagnosis of VAP with concomitant over-usage of antimicrobial agents and promote drug resistance.[4-6]

There are now data to support the use of well-defined algorithms based on clinical and objective (via quantitative cultures) data to aid in the diagnosis and management of VAP. Additionally, in 2016, the CDC developed an algorithm entitled 'Ventilator Associated Events'.

III. Goals:

A. To promptly identify patients at risk for developing or who have developed a VAP
B. To standardize the diagnosis of a VAP
C. To outline the management options for VAP
D. To identify preventive measures for VAP

IV. Guideline:

A. <u>Key Principles:</u>

1. *Diagnosis:*
   a. Must be via quantitative method regardless of the process used to obtain the specimen.
   b. No sputum or respiratory cultures
2. *Management:*
   a. Antibiotics should be initiated following positive cultures unless in the setting of sepsis

b. Antibiotics should be discontinued after 7 days unless in the setting of pseudomonas, extended spectrum beta-lactamase (ESBL), stenotrophomonas, or acinetobacter.

3. *Prevention:*
   a. Daily spontaneous breathing trials (SBTs) when appropriate to facilitate liberation from the mechanical ventilator.

B. <u>Details:</u>

1. *Diagnosis:*
   a. A patient with impaired gas exchanged in addition to **THREE** of the findings below should be evaluated for possible VAP:
      1. Abnormal temperature (>38°C or <36°C)
      2. Abnormal WBC (>12,000 cells/mcl or <4,000 cells/mcl) or presence of > 10% bands
      3. Macroscopically purulent sputum
      4. New or changing infiltrate on chest radiograph

      Impaired gas exchange is defined as oxygen desaturations requiring increased oxygen requirements (increased FiO_2) or mechanical ventilator demand. Also includes decreasing P:F ratio (< 240).
   b. Bronchoscopy with bronchoalveolar lavage (BAL) should be performed. Specimen should be sent for quantitative culture only. Respiratory cultures are of no use for diagnosis and should not be obtained.
      1. Procedure should include four aliquots of 10 mL saline injected via the bronchoscope into the most worrisome lobar bronchus with aspiration into a sputum trap.
      2. The bronchoscopic channel needs to be cleared prior to obtaining a sample to decrease the chances of a false positive.
      3. All mucus plugs need to be cleared prior to the procedure.
   c. A diagnosis of VAP is made if the BAL has > 10^5 cfu/mL (> 10^4 cfu/mL for mini-BAL) AND the patient has been on mechanical ventilation for more than **TWO** calendar days, with the day of initiation being day one.[4-5]

2. *Management:*
   a. Antibiotics should not be initiated until confirmed by culture unless in the setting of sepsis. This promotes antibiotic stewardship and decreases the risk of developing drug-resistant bacteria within the institution.[6]
   b. Empiric antibiotics should be dictated by current hospital antibiogram.[6-10]
   c. Antibiotics, once initiated, should be de-escalated as soon as possible.
   d. Antibiotic duration is 7 days.[10]
   e. Repeat BAL (via bronchoscopy or mini-BAL) should be performed on Day #4 of antibiotic therapy if the patient continues to show clinical signs of VAP.
      1. If the BAL shows < 10^4 cfu/mL (10^3 cfu/mL for mini-BAL) of the same organism, antibiotics should be discontinued after 7 days.

2. If the BAL shows > 10^4 cfu/mL (10^3 cfu/mL for mini-BAL) of the same organism, antibiotics should be continued for a total course of 14 days.

f. Quantitative cultures that grow pseudomonas, ESBL, stenotrophomonas or acinetobacter (non-glucose fermenting gram negative bacilli) should be treated for a minimum of 14 days as shorter durations are associated with higher rates of recurrence with these organisms.[10]

g. Empiric antibiotic therapy should be discontinued if the culture results are negative.[6, 10]

3. *Additional Considerations:*

a. The routine involvement of Infectious Disease (ID) in the management of VAP is not recommended.

b. Reference the current NTDS Data Dictionary for the TQIP definition of VAP for purposes of registry capture. Clinically relevant VAP, as determined by the treating clinician, may differ from the TQIP definition. Because both the definition of VAP and the decision to treat are complicated processes, ultimate determination of need for therapy should be left to the discretion of the treatment team.

c. Aspiration of oral and gastro-esophageal contents is a common cause of direct injury in trauma and can lead to the infectious process of aspiration pneumonia. Identification of known aspiration or risk factors is imperative. Prophylaxis with antibiotics is not recommended unless there are signs and symptoms of an acute infectious process occurring at least 48 hours following the witnessed event.

4. *Prevention:*

a. The following table (Table 1.) provides guidance for the prevention of VAP.[8, 15] It includes the ABCDE Bundle which extends the original VAP bundle and was developed to improve the health of ventilated patients by reducing their risk of oversedation, immobility and mental status changes.[19]

Table 1: VAP Preventative Measures.

Subglottic suctioning	**Analgesia and sedation choice**
Frequent rotation	**Early mobility and exercise**
Elevation of head of bed (HOB) at 45^{o} (no lower than 30^{o})	**Assess, manage, and prevent pain and delirium**
Oral care with antiseptic solution e.g., chlorohexidine gluconate	**Humidifier change every 5-7 days**
Use of metered dose inhaler (MDI) vs. nebulizer when indicated	**Closed endotracheal suctioning**
Daily spontaneous awakening and breathing trials (when indicated)	**Changing ventilator circuit only when clinically indicated (soiled or faulty)**
Avoidance of gastric distension	**Maintain ET cuff pressure 20 – 30 cm H_2O**

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. Ventilatory-Associated Pneumonia (VAP) Event. *Device-associated Events*. CDC. January 2013.
3. Ventilatory-Associated Event (VAE). *Device-associated Module*. CDC. January 2016.
4. Croce MA, Fabian TC, Mueller EW, et. al. The Appropriate Diagnostic Threshold for Ventilator- Associated Pneumonia Using Quantitative Cultures. *J Trauma* 2004; 56(5):931-936.
5. 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.
6. Hranjec T, Rosenberger LH, Swenson B, et. al. Aggressive versus conservative initiation of antimicrobial treatment in critically ill surgical patients with suspected intensive care unit acquired infection: a quasi-experimental before and after observational cohort study. *Lancet Infect Dis* 2012; 12:774-80.
7. Koenig SM, Truwit JD. Ventilator-Associated Pneumonia: Diagnosis, Treatment, and Prevention. *Clinical Microbiology Reviews* 2006; 19(4):637-657.
8. Muscedere J, Dodeck P, Keenan S, et. al. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: Prevention. *Journal of Critical Care* 2008; 23:126-137.
9. Croce MA, Swanson JM, Magnotti LJ, et. al. The Futility of the Clinical Pulmonary Infection Score in Trauma Patients. *J Trauma* 2006; 60(3):523-528.
10. 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*.
11. Kalanuria AA, Ziai W, Mirski M. Ventilator-associated Pneumonia in the ICU. *Critical Care* 2014; 18:208-215.
12. Safdar N, Dezfulian C, Collard HR, Saint S. Clinical and Economic Consequences of Ventilator- associated Pneumonia: A Systematic Review. *Critical Care Medicine* 2005; 33(10):2184-2193.
13. Restrepo MI, Anzueto A, Arroliga AC, Afessa B, et. al. Economic Burden of Ventilator-Associated Pneumonia Based on Total Resource Utilization. *Infection Control & Hospital Epidemiology* 2010; 31(5): 509-515.
14. 2013 Annual Hospital-Acquired Condition Rate and Estimates of Cost Savings and Deaths Averted From 2010 to 2013. Agency for Healthcare Research and Quality. October 2015.
15. Klompas M, Branson R, Eichenwald EC, Greene LR, et. al. Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update. *Infection Control*

& Hospital Epidemiology 2014; 35: s133-154.
16. Parks NA, Magnotti LJ, Weinberg JA, Zarzaur BL, 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.
17. Swanson JM, Connor KA, Magnotti LJ, Croce MA, et al. Resolution of Clinical and Laboratory Abnormalities after Diagnosis of Ventilator-Associated Pneumonia in Trauma Patients. Surgical Infections 2013; 14(1): 49-55.
18. Hellyer TP, Ewan V, Wilson P, Simpson AJ. The Intensive Care Society recommended bundle of interventions for the prevention of ventilator-associated pneumonia. Journal of the Intensive Care Society. 2016;17(3):238-243.
19. Marra A, Ely EW, Pandharipande PP, Patel MB. The ABCDE Bundle in Critical Care,Crit Care Clin. 2017 Apr;33(2):225-243.

VAP GUIDELINE