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Summer 7-23-2017

### Ventilator-Associated Pneumonia

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#### Recommended Citation

Adkins, Brittnay, "Ventilator-Associated Pneumonia" (2017). *Nursing Student Class Projects (Formerly MSN)*. 255.

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# Ventilator-Associated Pneumonia

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## Introduction

There are Intensive Care Units (ICUs) across the United States that are filled with critically-ill mechanically ventilated patients. Many of these patients have multiple co-morbidities and are very ill upon admission to the hospital. These patients are also at high risk for nosocomial infections, prolonged hospital stays, and many other negative health effects that may occur while being mechanically ventilated in the ICU. Healthcare personnel perform daily interventions to assist with the safety and health of all patients, families, and staff. Prevention of pneumonia in the intubated patient is of high importance; thus measures such as oral hygiene, aspiration prevention, early mobilization, and decreased ventilator days have been incorporated as standard practice in many Intensive Care Units.

As a former ICU Travel Nurse, I have had the opportunity to live and work in different facilities across the country. Each facility differs slightly from the other in regards to protocols and practice. Now as a graduate student studying nurse anesthesia, pneumonia prevention is important with all mechanically ventilated patients I care for. One area of practice that always differs amongst facilities is prevention measures such as oral hygiene care. Most oral care techniques are performed every two to four hours on all mechanically ventilated patients according to facility protocol (Hillier, Wilson, Chamberlain, & King, 2013).

## Significance

Pneumonia is an adverse effect of mechanical ventilation. Many hospitals have protocols in place to help prevent infections such as ventilator-assisted pneumonia (VAP) and aspiration pneumonia, which includes the practice of routine oral hygiene care and minimization of total ventilator days. Ventilator-assisted or ventilator-associated pneumonia is known as a hospital-acquired or nosocomial infection. It is a serious, sometimes fatal complication of patients who undergo general anesthesia or experience acute respiratory failure. Hospitals also receive reimbursement as pay-for performance initiatives have begun, but may not receive reimbursement of costs associated with preventable infections (Leasure, Stirlen, & Lu, 2012). The importance of this problem is significant to my daily clinical practice and to many critically-ill patients that could be affected in the future.

## Signs & Symptoms

- Fever
- Leukocytosis
- Purulent secretions
- Ronchi and/or diminished breath sounds upon auscultation
- Increased respiratory rate/effort
- Decreased tidal volume and/or increased minute ventilation
- Worsening gas exchange
- Infiltrate/consolidation on chest xrays (serial)

(Shi et al., 2013)

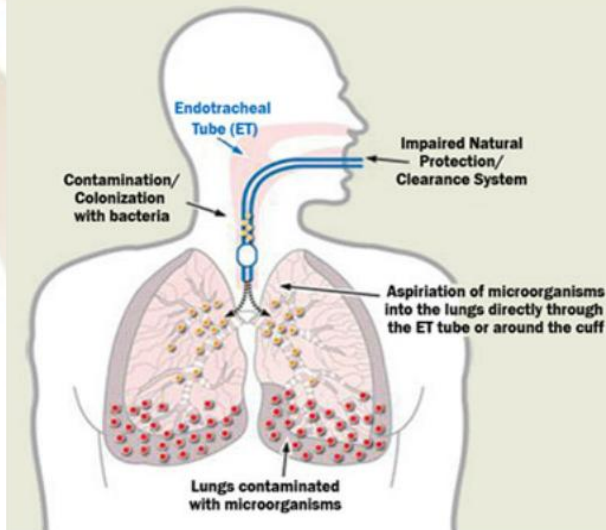


Image retrieved from <http://ventilatorassistedpneumoniamodule.weebly.com/about-vap.html>

## Pathological Process of VAP

### Ventilator-associated pneumonia

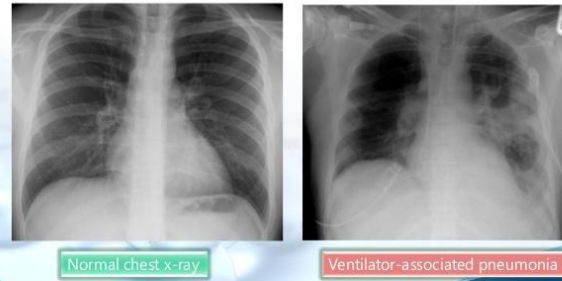


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Pneumonia is an infection of the lower respiratory tract caused by a bacteria, virus, foreign object, or aspiration of other secretions or contents. When a patient has an endotracheal tube placed, bacteria and substances from the environment or the individual's mouth can be pushed into the lungs. The endotracheal tube can become colonized with bacteria from the oral cavity and secretions. Patients are also at risk for aspiration of stomach bile when an endotracheal tube is being placed (Hillier, Wilson, Chamberlain, & King, 2013).

Injury can occur from a chemical aspiration or whether an inflammatory mediator is released from alveolar macrophage recognition causing an inflammatory response. The response occurs with cellular injury and results in neutrophil recruitment, mast cell degranulation, and activation of plasma proteins. Mast cells release histamine, cytokines, and other factors. After inflammation occurs, neutrophils move from the capillaries of the lungs into the alveoli. When bronchial mucous membranes are damaged, bronchioles fill with debris and exudates which can be suctioned from the patient or seen as consolidation/infiltration on a chest xray (Wilke & Grube, 2013).

Pulmonary aspiration is a fairly uncommon complication of general anesthesia as it only leads to pneumonia less than half the time for every occurrence. Nagelhout and Plaus (2013) stated, "18% of respiratory-related claims involved esophageal intubation." This demonstrates the importance of correct placement and confirmation for all endotracheal tubes. Complications of aspiration include bronchospasms, hypoxemia, obstruction of the endotracheal tube, acute respiratory distress syndrome, sepsis, and death (Gaba, Fish, Howard, & Burden, 2015).

Immunocompromised individuals are at risk for developing pneumonia due to their inability to fight infection. Specific organisms are more commonly found within the community or in the hospital. Some common nosocomial infections related to VAP include *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Enterobacter*, and *Klebsiella pneumoniae*. (Wilke & Grube, 2013). The pathogen can be identified by obtaining a sputum culture and analyzing the characteristics of the culture through a Gram stain. After the specific organism is identified, appropriate antibiotics can be given that are specific to that pathogen.

## Implications for Nursing Practice

- Routine oral care for all mechanically ventilated patients with an antimicrobial solution is recommended. Frequencies include every four to six hours although studies remain inconclusive (Li, Ai, Li, Zheng, & Jie, 2015). There is not currently any information regarding oral care for patients undergoing general anesthesia with an endotracheal tube.
- A minimum of daily sedation holiday and spontaneous breathing trials should be performed on all hemodynamically stable patients and those that meet facility specified criteria. A variety of tools are utilized to assess patients who can potentially meet extubation criteria. These tools minimize the number of days a patient is mechanically ventilated (Melnik & Fineout-Overholt, 2015).
- Early mobilization for all mechanically ventilated patients will lead to less total ventilator days and potentially less cases of ventilator-associated pneumonia (Lai, et al., 2017).
- Aspiration precautions such as routine suctioning, keeping head of bed elevated, pharmacologics, and oral antiseptic use can lead to a decreased number of ventilator days and pneumonia cases (Labeau, Van de Vyver, Brusselsaers, Vogelaers, & Blot, 2011).



Image retrieved from <https://www.halyardhealth.com/solutions/respiratory-health/halyard-oral-care-solutions.aspx>

## Conclusion

Acquired hospital infections including ventilator-assisted pneumonia affect millions of patients every year. Health care workers attempt to prevent infections, while also implementing evidence based practice into their daily routine. Medical complications, length of ICU stays, and total patient costs have all been reduced by early mobilization. Early mobilization also suggested a decrease in delirium and nosocomial infections such as ventilator-assisted pneumonia (Hunter, Johnson, & Coustasse, 2014). If combined with other suggested interventions, the potentially fatal infection could be prevented. Routine oral care, spontaneous breathing trials, early mobilization, and aspiration precautions should all be utilized in current practice to prevent ventilator-associated pneumonia.

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