Pneumonia and Ventilator-Associated Pneumonia Prevention

Last Updated 2018

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Objectives

- Review the epidemiology and pathogenesis of pneumonia (PNEU) and ventilator-associated pneumonia (VAP)
- Discuss evidence-based prevention practices for PNEU, ventilator associated events (VAE), and VAP
- Describe adherence monitoring of prevention practices

Pneumonia and Ventilator-Associated Pneumonia Prevention – What works?

Best sources for **evidence-based pneumonia prevention practice** recommendations

- **CDC/HICPAC** Pneumonia Prevention Guideline**, 2003**
- **SHEA/IDSA** Strategies to Prevent Healthcare Associated Pneumonia in Acute Care Hospitals, **2014**

Healthcare-Associated Pneumonia

- Hospital-associated pneumonia
  - 15% of all HAI
  - 24%-27% of all HAI in medical ICUs
  - 20-33% mortality rate
- VAP account for **60%** of all deaths due to healthcare associated infections (HAI)

CDC/HICPAC Guidelines for Preventing Health-Care Associated Pneumonia, 2003
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Common Pneumonia Pathogens

- Gram negative bacilli
  - *Pseudomonas aeruginosa*
  - *Proteus* spp
  - *Acinetobacter* spp
  - *Staphylococcus aureus*

CDC/HICPAC Guidelines for Preventing Health-Care Associated Pneumonia, 2003
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Pathogenesis of HAI Pneumonia

Bacteria may invade the lower respiratory tract by:

- Aspiration
  - Persons with abnormal swallowing
    - Depressed consciousness
    - Ventilator patients
    - Postoperative patients
- Inhalation of aerosols containing bacteria
- Hematogenous spread from a distant body site

Risk Factors for HAI Pneumonia

1. Factors enhancing colonization of oropharynx or stomach
   - Antimicrobials
   - Admission to ICU
   - Underlying chronic lung disease
2. Patients at risk for aspiration
   - Initial or repeat endotracheal intubation
   - Nasogastric tube insertion
   - Supine positon, coma, post-surgery, immobilization
3. Prolonged mechanical ventilation
4. Host factor extremes
   - Age, malnutrition, severe underlying conditions

Preventing Pneumonia

- Educate staff on pneumonia prevention
- Provide pneumococcal vaccination
- Provide annual influenza vaccination to patients and HCP
- Prevent aspiration
- Ensure regular oral care with an antiseptic agent
- **Encourage post operative coughing, deep breathing, and early ambulation**

CDC/HICPAC Guidelines for Preventing Health-Care Associated Pneumonia, 2003
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Preventing Pneumonia - 2

- Clean respiratory equipment and devices before sterilization or disinfection
  - Clean shortly after use
  - Ensure appropriate rinsing, drying and packaging

CDC/HICPAC Guidelines for Preventing Health-Care Associated Pneumonia, 2003
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Preventing Pneumonia - 3

- Use standard precautions – consistently!
  - Hand hygiene before and after patient care
  - Wear gloves when handling respiratory secretions
  - Change gloves and perform hand hygiene between patients and after touching contaminated equipment

CDC/HICPAC Guidelines for Preventing Health-Care Associated Pneumonia, 2003
https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Ventilator-Associated Pneumonia (VAP)

- Up to 46% of patients with VAP die
  - Varies with patient population and organism type
  - Highest mortality occurs in patients with severe illness and infection with non-fermentative gram-negative bacilli (e.g., *Acinetobacter* or *Burkholderia* species)
- Increases ICU length of stay >6 days
  - $40,000 estimated cost

Institute for Healthcare Improvement (IHI)(2012)
http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx

Etiology of VAP

Early onset

- Occurs in first four days of hospitalization
- More likely associated with non-multidrug-resistant organisms such as *E. coli, Klebsiella spp., Proteus spp., S. pneumoniae, H. influenzae, and S. aureus*

Late onset

- Occurs five or more days into hospitalization
- More often associated with gram-negative bacilli, multidrug resistant Pseudomonas aeruginosa, MRSA, Acinetobacter spp

Guideline for the Prevention of Healthcare Associated Pneumonia, 2003
cdc.gov/infectioncontrol/guidelines/pdf/guidelines/healthcare-associated-pneumonia.pdf

Common VAP Pathogens

- *Staphylococcus aureus* - 24.7%
- *Pseudomonas aeruginosa* - 16.5%
- *Klebsiella pneumoniae/oxy - 10.2%*
- *Enterobacter* spp. - 8.3%
- Acinetobacter spp. - 6.1%

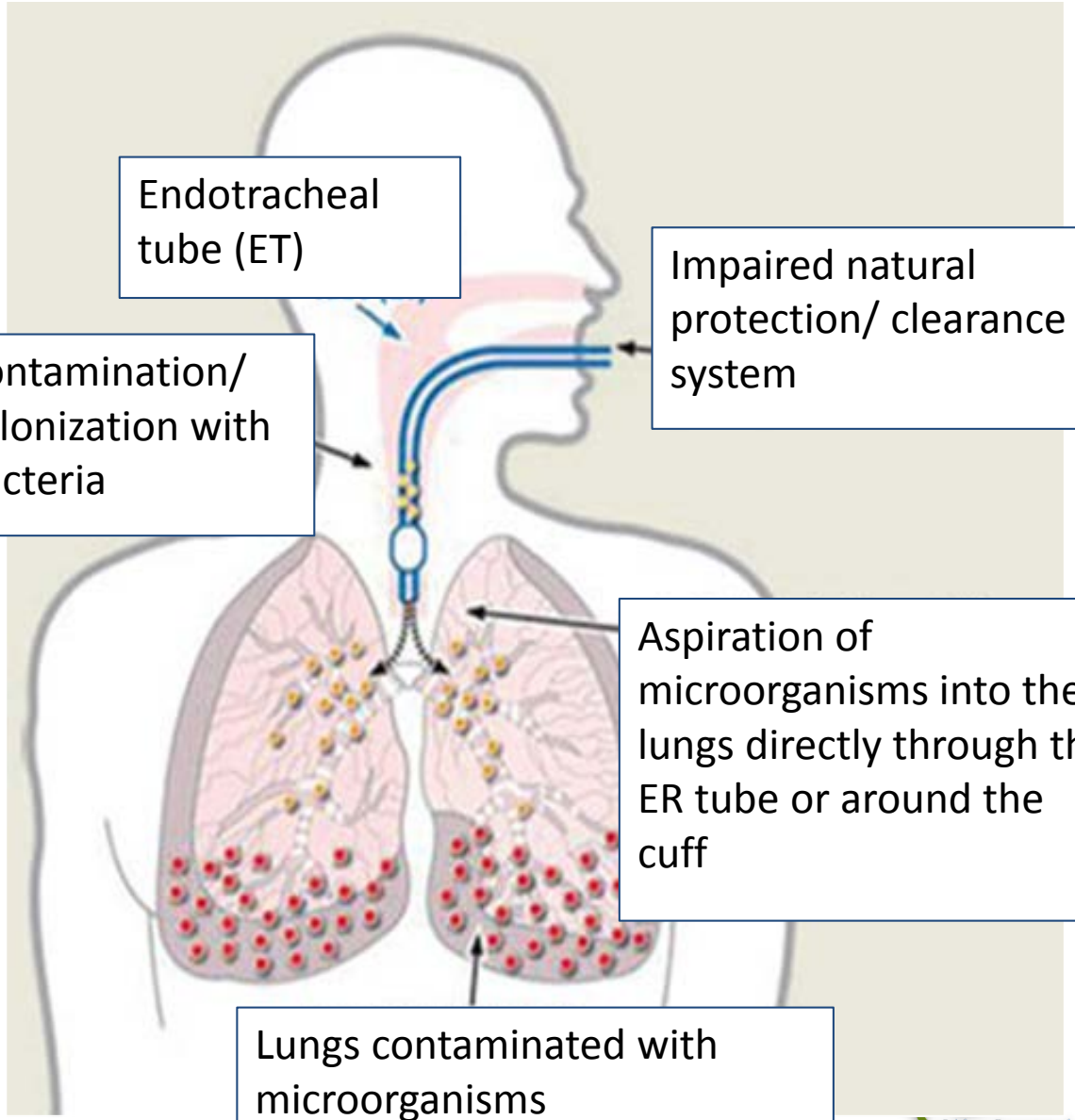
Pseudomonas aeruginosa

NHSN Antimicrobial Resistance Report: Distribution of all Pathogens Reported by HAI Type, Appendix to Table 4, 2011-2014
https://www.cdc.gov/nhsn/xls/reportdatatables/2014-appendix-pathogens.xlsx

Vap Pathogenesis

Results from

- Aspiration of secretions
- Colonization of aero-digestive tract
- Contaminated respiratory or other medical equipment



VAP Prevention Challenges

Pre-existing conditions (**non**-modifiable risk factors):

- Head trauma
- Coma
- Nutritional deficiencies
- Immunocompromised
- Multi organ system failure
- Acidosis
- History of smoking or pulmonary disease

VAP Prevention: Modifiable Risk Factors

1. Prevent aspiration of secretions
2. Reduce duration of ventilation
3. Reduce colonization of airway and digestive tract
4. Prevent exposure to contaminated equip

Prevent Aspiration of Secretions

- Maintain elevation of head of bed (HOB) 30-45 degrees
- Avoid gastric over-distention
- Avoid unplanned extubation and re-intubation
- Use cuffed endotracheal tube with in-line or subglottic suctioning
- Encourage early mobilization of patients with physical/occupational therapy

Reduce Duration of Ventilation

- Conduct “sedation vacations”
- Assess readiness to wean from vent daily
- Conduct spontaneous breathing trials

May not be feasible for patients on long term ventilator support

Reduce Colonization of Airway and Digestive Tract

- Use cuffed Endotracheal Tube (ETT) with inline or subglottic suctioning
  - Minimizes secretions above cuff; prevents contamination of lower airway
- Avoid acid suppressive therapy for patients not at high risk for stress ulcer or stress gastritis
  - Increases colonization of the digestive tract

Reduce Colonization of Airway and Digestive Tract - 2

- Perform regular oral care with an antiseptic agent
- Reduce the opportunities to introduce pathogens into the airway
  - Perform good hand hygiene
  - Use gloves for contact with respiratory secretions or contaminated objects; follow with hand hygiene
  - Educate staff to avoid contaminating the ETT from patient's mouth, HCP hands, introducing pathogens from patient's other body sites or the environment

Prevent Exposure to Contaminated Equipment

- Use sterile water to rinse reusable respiratory equipment
- Remove condensate from ventilatory circuits
- Change ventilatory circuit only when malfunctioning or visibly soiled
- Store and disinfect respiratory equipment effectively

Measure Adherence to VAP Prevention Practices

- California HAI public reporting and prevention laws do require not reporting VAP/VAE to CDPH
- Reporting laws do require hospitals to implement VAP prevention guidelines and process measures (HSC 1288.9)

Adherence Monitoring Tool - VAP Prevention

Ventilator Pneumonia Prevention Observations	Pt 1		Pt 2		Adherence by Task	
					#Yes	# Obs
Head of bed 30-45 degrees	Yes	No	Yes	No		
Sedation vacation documented	Yes	No	Yes	No		
Readiness to wean documented	Yes	No	Yes	No		
Oral care with an antiseptic agent is performed regularly (per policy)	Yes	No	Yes	No		
Hand hygiene performed before providing care	Yes	No	Yes	No		
Sterile water used to rinse reusable respiratory equipment	Yes	No	Yes	No		
Condensate in ventilatory circuit is removed	Yes	No	Yes	No		
Ventilatory circuit is changed only when malfunctioning or soiled	Yes	No	Yes	No		

Yes _____ # Observed_____ #Yes/#Observed = % Adherence _____%

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Preventing Pneumonia: The MOST Important Things

Prevent Pneumonia and Ventilator Associated Events

- ❑ Maintain HOB 30-45 degrees
- ❑ Avoid gastric distention
- ❑ Encourage early mobilization
- ❑ Conduct "sedation vacations"
- ❑ Assess readiness to wean
- ❑ Use cuffed ETT with inline suctioning
- ❑ Avoid acid suppressive therapy if possible
- ❑ Perform regular oral care
- ❑ Perform hand hygiene
- ❑ Prevent exposure to contaminated equipment

Hospital Role in Pneumonia Prevention

- Ensure policies reflect current evidence based practices
  - CDC guidelines
- Ensure staff competency upon hire and at least annually
  - New hire orientation
  - Annual skills fair
  - Return demonstration to ensure competency
- Establish an adherence monitoring program for measuring prevention care practices
  - Use tools to measure adherence
- Provide feedback to frontline staff and leaders
  - Present adherence results to each unit

Pneumonia Prevention Summary

- HAI pneumonia common, especially among ventilated patients, but many are preventable
- Focus on pneumonia prevention care practices
- Regularly monitor adherence of prevention care practices and provide feedback to frontline staff

Legionnaires Disease

- Caused by Gram negative aerobic bacilli, *Legionella pneumophila*
- More than 60 species
  - Most disease *Legionella pneumophila* serogroup 1
- Found naturally in freshwater and man made environments, including drinking water
- Transmitted by
  - Inhalation of contaminated aerosols
  - Aspiration of ingested of contaminated water
  - **Not spread from person to person**

https://www.cdc.gov/vitalsigns/legionella/

Legionella in California

From 2015–2017

- 1554 Legionella cases – 1554
- 125 (8%) healthcare-associated cases
  - 45 (35%) hospital associated
  - 57 (46%) SNF associated

Legionella Sources

- Legionnaires' disease outbreaks often associated with **large or complex water systems** such as those found in
  - Hospitals
  - Long-term care facilities
  - Hotels
  - Cruise ships
- The most likely sources of infection
  - Water used for showering (potable water)
  - Cooling towers (parts of large air conditioning systems)
  - Decorative fountains
  - Hot tubs

http://www.cdc.gov/legionella/downloads/toolkit.pdf

Risk Factors for Legionnaires Disease

- Immunosuppressed hosts
- Solid organ transplant recipients
- Advanced age
- Male gender
- Cigarette smoking
- Alcohol abuse
- Chronic pulmonary disease
- Corticosteroid usage
- Renal failure

APIC Text 2018:
Healthcare Associated Pathogens and Diseases: *Legionella pneumonophila*

Suspect Legionnaires Disease

- Patient failed outpatient antibiotic treatment for community-acquired pneumonia
- Severe pneumonia
- Immunocompromised patient with pneumonia
- Recent traveled away from their home within 10 days before the onset of illness
- Patient with pneumonia in the setting of a Legionnaires' disease outbreak
- Patient at risk for Legionnaires' disease who acquires healthcare-associated pneumonia ≥ 48 hours after admission

cdc.gov/legionella/clinicians/diagnostic-testing.html

CDC Guidance for Confirmed Case of Healthcare-associated Legionnaires Disease

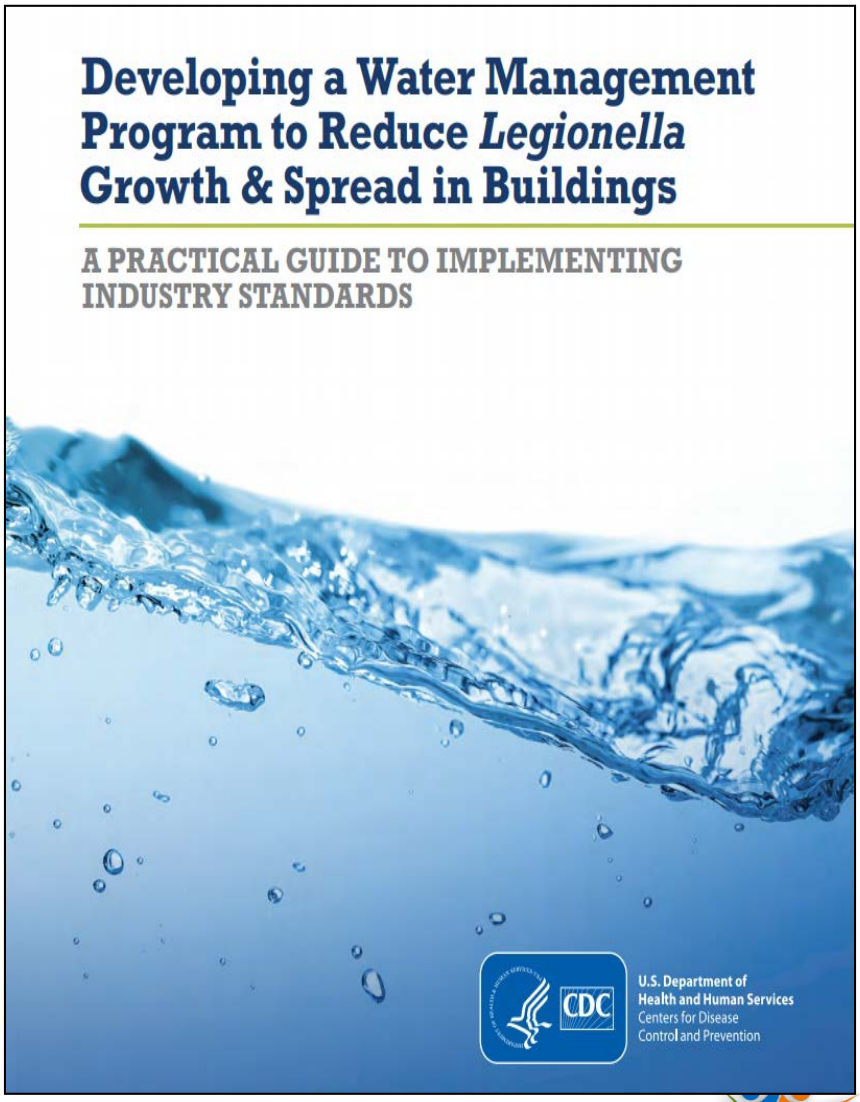
For **1 case**

- Notify local health department and CDPH
- Begin environmental assessment and cultures of the water system
- Consider other vulnerable individuals at facility who may be exposed

Guideline for the Prevention of Healthcare Associated Pneumonia, 2003
cdc.gov/infectioncontrol/guidelines/pdf/guidelines/healthcare-associated-pneumonia.pdf

Water Management to Prevent *Legionella*

All health care facilities must have a *Legionella* Water Management Program



CMS Memo June 02, 2017
https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/Survey-and-Cert-Letter-17-30.pdf

http://www.cdc.gov/legionella/downloads/toolkit.pdf

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Questions?

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