New Equipment and Techniques for Diagnosing VAP

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KOL Biomedical
Chantilly, VA
Disclosure Statement

I have over 26 years of critical care and management background in the field of respiratory care. With that, I have developed a number of personal and professional biases and opinions, many of which are not so humble. This presentation is designed to provide the attendee with a wide array of information to take back to their clinical practice, apply their own personal opinions and bias, and make an informed decision. This presentation attempts to back up all statements with appropriate evidence based research. Information retrieved from manufacturer websites is quoted and is the responsibility of the product manufacturing company. Any similarity between products displayed in this presentation and any real person, living or dead, is purely coincidental and is not the responsibility of this fantastic speaker or this presentation. The Ohio State Buckeyes are the greatest college football team EVER! Go Buckeyes, Beat Michigan! I can say all this down here because the font is so small right now you can’t even read it. Now I’m just adding some gibberish in a really tiny tiny font just to fill up some space because I think it is funny. It probably isn’t funny and you probably don’t care, but I think it’s funny and this is MY presentation so TOUGH!
Agenda

VAP
  • CPIS Scores
  • ICU Bundle
  • Research

Diagnostic Tools
  • Tracheal Aspirates
  • Bronchoscopy
  • “mini- BAL”
  • Research

VAP Prevention
  • Evidence
  • Bundle

Equipment
  • BAL Cath™
  • Combicath™
    • Procedure
  • CAM Rescue Cath™
  • Mallincrodt™ ETT
  • Gibeck Humid-Flo HME Kit
Are Ventilators getting a bad rap?

I’m a BAAAD Dude!

What? Me Worry?

EES not my fault, mon.
VAP

Ventilator *Associated* Pneumonia

- Sub-Type of HAP (Hospital *Acquired* Pneumonia)
- 48-72 hours
- *Pseudomonas aeruginosa*

*S. Pneumoniae, H. Influenzae, S. Aureus* are the most common causes of *Community Acquired Pneumonia*
“The incidence of VAP within US hospital varies according to the type of environment, the geographical location and also the prevention measures adopted by each specific hospital. Nationwide, a large retrospective survey was conducted in the late 1990s. According to that study, of the 9080 patients meeting study entry criteria, VAP developed in 842 patients (9.3 percent). The mean interval between intubation, admission to the ICU, hospital admission, and the identification of VAP was 3.3 days, 4.5 days, and 5.4 days, respectively.”

Stefano Nava, MD
Diagnosing VAP (currently)

New or changing infiltrate on CXR

Fever

Leukocytosis or Leukopenia

Purulent secretions

From ATS Guidelines on Hospital-acquired Pneumonia, February, 2005
Diagnosing VAP (currently)

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CPIS Score > 6 can be indicative of pneumonia
ATS Recommendations

- Although a lower respiratory tract culture should be collected from all patients before starting antibiotics, culture collection should not delay the initiation of therapy in critically ill patients.
- Either semi quantitative or quantitative culture data are appropriate for the management of patients with HAP.
- Lower respiratory tract cultures can be obtained by bronchoscopy or by other means and can be cultured quantitatively or semi quantitatively.
- Quantitative cultures increase specificity of the diagnosis of HAP without harmful consequences. Local expertise and experience should influence the choice of specific quantitative technique.

*Am J Respir Crit Care Med. 2005;171:388-416*
Diagnosing VAP (in 2013)

National Healthcare Safety Network (CDC)

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New Approach

• Develop a surveillance definition algorithm to detect VAE (Ventilator Associated Events)
• Focused on definition criteria that are objective
• Readily available clinical data across the spectrum

• Algorithm
  • Patients > 18 y/o
  • Intubated and ventilated 3 days
  • Acute, LTAC, Inpatient Rehab inclusive
NHSN Algorithm

Baseline period of stability on the vent defined by ≥ 2 days of stable or decreasing FiO2 or PEEP

1. Minimum daily FiO2 ≥ 20 points over baseline and remains for > 2 days
2. Minimum daily PEEP ≥ 3 cmH2O over baseline and remains for ≥ 2 days

On or after day 3 of mechanical ventilation & within 2 days before/after onset of worsening oxygenation, patient meets both:
1. Temp > 38c or < 36c, OR WBC ≥ 12,000 or ≤ 4,000 AND
2. A new microbial agent is started, and is continued for ≥ 4 days
NHSN Algorithm

Baseline period of stability on the vent defined by \( \geq 2 \) days of stable or decreasing FiO2 or PEEP

1. Minimum daily FiO2 \( \geq 20 \) points over baseline and remains for \( \geq 2 \) days
2. Minimum daily PEEP \( \geq 3 \) cmH2O over baseline and remains for \( \geq 2 \) days

On or after day 3 of mechanical ventilation & within 2 days before/after onset of worsening oxygenation, patient meets both:

1. Temp \( > 38^\circ C \) or \( < 36^\circ C \), OR WBC \( \geq 12,000 \) or \( \leq 4,000 \)
   AND
2. A new microbial agent is started, and is continued for \( \geq 4 \) days

And Then…….
NHSN Algorithm

On or after day 3 of mech. Vent. And within 2 days before or after onset of worsening oxygenation, ONE of the following is met:

1. Purulent Secretions
2. Positive Culture

POSSIBLE VAP

On or after day 3 of mech vent and within 2 days before/after onset of worsening oxygenation, ONE of the following is met:

1. Purulent Secretions
   AND one of the following:
   • + Endotracheal aspirate culture $\geq 10^5$ CFU/ml
   • + BAL Culture $\geq 10^4$ CFU/ml
   • + PSB culture $\geq 10^3$ CFU/ml

2. One of the following (if no purulent secretions)
   • + pleural fluid culture
   • Positive lung histopathology
   • Positive dx test for Legionella
   • Positive dx test on secretions for influenza virus, RSV, adenovirus, parainfluenza virus

Not Public Reportable Internal Quality Improvement

PROBABLE VAP
Do you notice something missing????

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Source: UCLA Health System
Diagnostic Tools

Tracheal Aspirates

“the presence of aspirated material near the endotracheal tubes in critically ill patients might increase the amount of secretions, without necessarily indicating pneumonia”

Richard G. Wunderink. Chest 2000;117;191-194

“All patients with suspected HAP should undergo sampling of secretions from the lower respiratory tract. Quantitative cultures of secretions offer better data on which to make treatment decisions than qualitative or semiquantitative cultures.”

American Thoracic Society Updates Guidelines on Hospital-Acquired Pneumonia

Qualitative Data “describes”

Quantitative Data “defines”
Bronchoscopic BAL

• “Gold Standard”

“Detecting intracellular organisms in BAL cultures is a quick, specific test and has a high positive predictive value.”  *Torres and Mustafa. Chest 2000;117;198S-202S*

• Time
• Volume
• Expense
# Non-bronchoscopic BAL

## COMPARISON OF DIAGNOSTIC TECHNIQUES FOR VENTILATOR ASSOCIATED PNEUMONIA

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<th>Technique</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
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<td>BR-BAL</td>
<td>56–94</td>
<td>71–100</td>
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<td>NB-BAL</td>
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<td>69–100</td>
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*Barksdale and Ochoa. Contemporary Surgery Vol. 59 No. 4 Apr. 2003*

*Sensitivity = the proportion of patients with the disease to test Positive +*  

*Specificity = the proportion of patients without the disease to test Negative -*
Kimberly Clark BAL Cath™

- 16FR outer / 12 FR inner catheter
- “Mushroom” Tip
- Directional Tip for right or left lung insertion

(www.kchealthcare.com)
Non-bronchoscopic BAL

Combicath™

- 13fr. 85cm dual catheter
- Protected Tip!!!
- Small lavage volume (20 – 40 ml)
- Relatively short procedure time
- Safe and effective

KOL Biomedical
Dual Lumen Catheter

13Fr outer catheter
10Fr inner catheter

KOL Biomedical
The Only Plugged Tip Catheter

The Protected Tip of the Catheter Helps Avoid Upper Airway Contamination
Why is the Plugged Tip Important?

“Samples contaminated by upper airway secretions as reflected by a high percentage of squamous epithelial cells should be used with caution.”

Safety Profile of the CombiCath

Many, many studies have stated that the CombiCath is a safe product (Casetta, Pham, Campbell, Ost)

No absolute contraindications

Relative Contraindications

• Platelet count > 50,000 (some use 100,000)

Keys to Safety

• Short procedure time (8-10 minutes)
• Short dwell time in lung (30-90 seconds)
• Small lavage volume (20-40 mls)
• Small catheter size (13 French)
Directionality of NB-BAL

“Bilateral nature of VAP and predominance in dependent lung sections make blind BAL as accurate as bronchoscopic sampling.”

Directionality – The Carina

Not a Perfectly Symmetrical Bifurcation

Bacteria has been shown to flow to the gravity dependent part of the lung (Rouby)
Localized Infiltrate on Radiograph

1. USE A BRONCHOSCOPE!!

2. Reduce the threshold - in almost every case the organism should be identified
Combicath Procedure
Confirm Physician Order

Date: Today  Time: Anytime

Please obtain blind, mini-BAL now.

Dr. I. Knowitall, MD

* May also be done as part of a standardized ICU protocol *
Preoxygenate the Patient

Increase FiO₂ to 1.0 at least three minutes prior to performing procedure
Assemble Equipment

- Sterile Gloves
- Sterile Towel
- Sterile Saline
- Specimen Container
- Syringe
- Airway Adapter
- CombiCath™

Include equipment necessary to conform with Universal Precautions (Mask, eye protection, gown, etc.)
Assemble Equipment

Don’t Forget:

- Laboratory Requisition
- Equipment necessary to conform with Universal Precautions
- Use Non-Bacteriostatic Normal Saline
Draw lavage volume

- Use Non-Bacteriostatic Saline
- One 60 cc syringe or two 20cc syringes
- Ideal lavage volume is 40 ml
- May use multiple aliquots if more sample is desired
Suction the Patient
Insert the Airway Adapter
Create a sterile field
Prepare Equipment
Advance CombiCath™ from protective sheath
Protective sheath is opened on the distal end and sealed proximally
Introduce CombiCath™ through airway adapter.

Catheter may be slowly advanced from the sheath and the sheath removed after resistance is felt (wedging catheter), or the entire sheath may be removed prior to inserting the catheter, being careful not to contaminate the catheter during insertion.
Gently advance CombiCath™ until resistance is met.

Typical Adult ET tubes are 31 cm in length. Usually, the CombiCath™ should be advanced beyond 40 cm to pass the carina.
Withdraw the CombiCath™ about 3 cm to allow room for the inner catheter to be advanced.
Remove the spacer
Gently advance the inner catheter
Connect syringe with lavage volume
Lavage should be briskly administered.
Consider drawing an extra 5 cc of air at the top of the syringe in order to clear the catheter of all of the lavage fluid.
Lavage administration
Aspirate specimen

Use same syringe used to administer the lavage. Begin aspiration as soon as lavage administration is complete.
Aspirate specimen

Excessive backpressure may indicate presence of thick sputum in the catheter, catheter tip against the airway, or a kink in the catheter. Actions include: rotating the catheter (while continuing negative pressure), force 5-10 cc of air through the catheter (resistance here may indicate a kink), and lastly withdrawing the catheter slightly (while maintaining negative pressure).
Aspirating the specimen

Many patients will cough during the lavage administration. It is important to briskly administer the lavage and immediately begin aspiration of the specimen. Perfect “wedging” of the catheter is uncommon and with a strong cough, some of the lavage volume may enter the upper airway (you may see it in the ET tube). It is important to obtain the specimen before any volume from the upper airway has time to track back down the catheter and be aspirated with the specimen (potentially contaminating the specimen).
Aspirating the specimen

Consult with your Microbiology lab to determine the minimum specimen volume necessary to properly process the specimen (most labs state 1 cc as a minimum). The catheter may be removed once the desired volume is aspirated. Prolonged aspiration time increases the risk of contaminating the specimen. There is seldom a benefit of retrieving more than 5 cc of specimen.
Remove the CombiCath™
Carefully place specimen in container
Be careful to avoid touching the specimen container with the tip of the syringe.
Suction the patient
Return FiO₂ to previous value
Properly label specimen
Complete micro requisition
Prepare specimen for transport to the micro lab
Ship specimen
Typical position of the catheter = Right middle or lower lobe
EVIDENCE BASED GUIDELINES

- Orotracheal Intubation
- Change ventilator circuits only if soiled
- Closed suction systems (changed as needed)
- HME (in the absence of contraindications)
- Semi-recumbent positioning (30-45 degrees)
- Consider subglottic secretion drainage and kinetic bed

Evidence-Based Clinical Practice Guideline for the Prevention of Ventilator-Associated Pneumonia.

2004 American College of Physicians
VAP Prevention

The Ventilator “Bundle”
The Institution for Healthcare Improvement (IHI)

HOB elevated 30-45 degrees
DVT Prophylaxis
Peptic ulcer Disease Prophylaxis
Daily Sedation Vacation
  • Including daily weaning assessment

Evans, B. Best Practice Protocols: VAP Prevention
Nursing Management, December, 2005 Vol. 36 #12 p.10-16
Preventive Equipment

Mallincrodt™ SealGuard™ Evac Endotracheal tube

- “Reduces microaspiration by at least 95% compared to the Mallincrodt™ Hi-Lo™ basic, barrel shaped PVC Cuff”
- “Shown to reduce the incidence of VAP by up to 75%”

http://www.nellcor.com/prod/Product.aspx?S1=AIR&S2=&id=326

Internal Testing, Athlone, 8/08

FDA 510(k) clearance

Preventive Equipment

Endotracheal intubation is only the first step in airway control.
Preventive Equipment

The Gibeck® Humid Flo® 72 hour Passive Humidification Kit

Advances patient safety by reducing the frequency of ventilator circuit breaks. Studies have shown this reduces the risk for cross-contamination and VAP.

Maximizes clinical outcomes by eliminating the need to interrupt ventilation, allowing PEEP to be maintained.

Reduces potential of caregiver exposure to depressurizing circuits by reducing the frequency of ventilator circuit breaks.

http://www.hudsonrci.com/
Conclusion