FROM VAP TO VAE: A NEW DIRECTION

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Introduction

- History and facts
- Problems with VAP
- Solutions
- VAE Definitions
- VAE Algorithms
- Examples
- Interventions
- Conclusion

Introduction

- 300,000 in US receive mechanical ventilation yearly (1-3)
  - ↑ risk of complications/poor outcomes (1-5)
    - VAP, sepsis, ARDS, PE, barotrauma, pulmonary edema
      - Longer duration MV
      - Longer ICU/hospital days
      - Increased costs
      - Increased risk of disability/death

Introduction

- VAE Surveillance limited to VAP to date
  - 2010 NHSN reported over 3,525 VAPs
    - VAP incidence for various type hospital units:
      - Range of 0.0-5.8 per 1,000 vent days (6)
  - No reliable, valid definition for VAP
    - Current criteria/definitions neither sensitive nor specific (7-10)
    - No Gold Standard

Problems with VAP

- Require CXR findings of PNA
  - Do not accurately ID VAP
  - Subjectivity/variability in technique/interpretation/reporting
- Rely on specific clinical signs/symptoms
  - Subjective/inconsistent/poor documentation
- Complex NHSN PNEU protocol
  - Multi-definition pathways
  - Special criteria for certain population

Problems with VAP

- Surveillance definitions limited
- Prevention is implicated

Solution?

- 2011 CDC convened Working Group
  - Addressed the limitations of VAP definitions
  - Proposed new approach to surveillance of VAP

VAE Surveillance Definition Algorithm

- Objective, streamlined
- Easy implementation
- Automatable
  - Use EMR to automate detection
  - ID a broad range conditions/complications during MV

VAE Surveillance Definition Algorithm

- 3 Definition Tiers:
  - 1. Ventilator Associated Condition (VAC)
  - 2. Infection-related Ventilator Associated Complication (IVAC)
  - 3. Possible and Probable VAP
- NOT a clinical definition algorithm
  - Not intended for clinical mgmt of pt's
  - ONLY used for surveillance

VAE Surveillance Algorithm

- When?
  - Surveillance must be done in at least 1 inpatient location in a healthcare institution for at least 1 calendar month.
- Where?
  - Inpatient locations in acute care hospitals
    - Long term acute care
    - Inpatient rehab facilities
      - Data collected for patients > or = 18yo

VAE Surveillance Algorithm

- Who's included?
  - MV patients > or = 18yo
  - Conventional MV
    - Prone, nitric oxide, epoprostenal
  - APRV
- Who's NOT included?
  - HFV
  - Extracorporeal life support

VAE Definitions

- VAE- deterioration in respiratory status after a period of stability/improvement on MV, evidence of infection/inflammation, and lab evidence of respiratory infection.
- VAE requirements:
  - Pt. on MV≥ 2 calendar days (day 1= intub/MV)
    - Earliest day criteria fulfilled is day 4
    - Earliest date of event for VAE is day 3
  - VAE is defined by 14 day period.
    - New VAE can not be ID'd until 14 day period elapses.

VAE Definitions

- Baseline period of stability/improvement:
  - 2 calendar days immediately preceding the 1st day of increased daily minimum PEEP or FiO2
    - Must be characterized by a ≥ 2 calendar days of stable or decreasing daily minimum FiO2 or PEEP values.

VAE Definitions

- Date of Event:
  - Date of onset of worsening oxygenation
  - 1st calendar day which daily minimum PEEP or FiO2 increases above thresholds of algorithm
  - Day 1 of required ≥ 2 day period of worsening oxygenation following a ≥ 2 day period of stability/improvement on MV

VAE Definitions

- VAE Window Period:
  - Period of days around the date of event
  - Includes:
    - Date of event, 2 days prior, and 2 days after
  - Exception:
    - If date of event is on day 3 (Can't include 1st 2 MV days)

VAE Definitions

- PEEP:
  - Must have sustained increase in daily minimum PEEP of ≥ 3 cmH2O following period of stability/improvement.
    - One of 2 criteria used to meet VAC definition

VAE Definitions

- FiO2:
  - Sustained increase in daily minimum FiO2 of ≥ .20 following a period of stability/improvement on MV
    - 2nd of 2 criteria used to meet VAC definition

VAE Definitions

- Episode of Mechanical Ventilation:
  - Period of days pt was on MV for some portion of each consecutive day
    - Break of at least 1 full calendar day followed by re-intubation/MV = new episode

VAE Definitions

- New Antimicrobial Agent:
  - Any agent listed
  - Initiated on/after 3rd calendar day MV and in VAE Window Period
  - Given by following routes of admin:
    - IV, IM, digestive tract, respiratory tract
  - Must be continued for at least 4 calendar days (QAD= qualifying antimicrobial day)

VAE Definitions

- Qualifying Antimicrobial Days (QAD):
  - Days on which pt is administered a new antimicrobial agent within the VAE Window Period
  - 4 consecutive QADs to meet IVAC definition
    - Day 1 starts within VAE Window Period
    - Days between administration also count as long as gap is ≤ 1 calendar day.
  - Days between administrations of different agents do not count

VAE Definitions

- Location of Attribution:
  - Inpatient location where patient is assigned on date of event
    - Exception: Transfer Rule
      - If VAE develops on day of transfer or day following transfer, event is attributed to transferring location.

VAE ALGORITHMS

VAE Algorithms

- VAC- ventilator associated condition:
  - Patient has a baseline period of stability/improvement for ≥ 2 calendar days:
    - AND
    - 1. Increased FiO2 ≥ .20 over daily minimum sustained ≥ 2 calendar days
      - OR
    - 2. Increased PEEP ≥ 3 cmH2O over daily minimum sustained ≥ 2 calendar days

VAE Algorithms

- IVAC- infection-related ventilator associated complication
  - 1. Meet VAC criteria
  - 2. Meet both of the following within the VAE Window Period:
    - Temperature >38 C or <36 C ……..OR……
    - WBC ≥12.000 cells/mm^3 or ≤ 4,000 cells/mm^3
      - AND
    - ≥ 4 QADs

VAE Algorithms

- Possible VAP
  - Meet criteria for VAC and IVAC
  - Meet the following within the VAE Window Period
    - 1. Purulent respiratory secretions
      - Contains ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field
      - If lab reports semi-quantitative results, must be equivalent to above quantitative thresholds
        - OR
    - 2. Positive culture of sputum
      - Excludes: normal flora, mixed flora or equivalent, candida species or other yeast, coagulase-negative Staphylococcus species, and Enterococcus species

VAE Algorithms

- Probable VAP
  - Meets criteria for VAC and IVAC
  - Meet the following within the VAE Window Period
    - 1. Purulent respiratory secretions AND one of the following positive cultures:
      - Endotracheal aspirate: ≥ 10^5 CFU/ml
      - Bronchoalveolar lavage ≥ 10^4 CFU/ml
      - Lung tissue > 10^4 CFU/g
      - Protected specimen brush ≥ 10^3 CFU/ml

OR

VAE Algorithms

- Probable VAP (continued)
  - 2. One of the following being positive:
    - Pleural fluid culture
      - Obtained during thoracentesis or initial chest tube placement.
    - Lung histopathology
    - Diagnostic test for Legionella spp.
    - Diagnostic test on respiratory secretions for :
      - Influenza virus, RSV, adenovirus
      - Parainfluenza virus, rhinovirus
      - Human metapneumovirus, coronavirus

Example

MV Day	Daily Minimum PEEP	Daily Minimum FiO2	VAE
1	8	1	
2	6	0.5	
3	5	0.4	
4	5	0.4	
5	6	0.7	VAC
6	6	0.7	

Example

MV Day	Daily Minimum PEEP	Daily Minimum FiO2	VAE
1	8	1	
2	6	0.5	
3	5	0.35	
4	5	0.4	
5	6	0.7	No event
6	6	0.7	

Example

MV Day	PEEPmin	FIO2min	TEMPmin	TEMPmax	WBCmin	WBCmax	AMA	Specimen	Polys/Epis	Organism	VAE
1	10	1	37.1	37.6	4.3	4.3	none				
2	5	0.6	36.8	37.2	4.6	4.6	none				
3	5	0.4	37	37.9	5.4	5.4	none				
4	5	0.4	36.5	37.3	9.2	9.2	yes				
5	8	0.5	36.3	36.9	8.4	8.4	yes	ETA	≥ 25/≤ 10	mixed flora	VAC
6	8	0.4	37.2	37.5	8.5	8.8	yes				
7	5	0.4	37.8	37.9	7.6	7.6	yes				

Interventions

- HOB elevated
- Regular daily oral care- chlorhexidine
- Daily sedation interruption
- Daily assessment of readiness to extubate
- Cont. aspiration of subglottic secretions
- Silver coated ETT
- ETT cuff pressure monitoring

Interventions

S31 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY OCTOBER 2008, VOL. 29, SUPPLEMENT 1

SUPPLEMENT ARTICLE: SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals

v. Maintain an endotracheal cuff pressure of at least 20 cm H_2O.[87]

Interventions

Maintenance of cuff pressures ~20-30cm- but studies show:

- 16-73% of ETT Cuffs overinflated regardless of whether 'feel' or manometer maintenance
- 15-45% ETT Cuffs too low pressure
- Automatic Pneumatic controllers shown to maintain pressure range 95-98% of time vs. 45-56% w. manual inflation

Interventions

- 24 hrs continuous cuff pressure monitoring w + w/o alarms
- 52% of pressures out of range, required manual interventions avg. 8x/day
- Cuff pressures decreased 5 cm per 4-5 hours

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Interventions

- Cuff pressure monitoring/maintenance

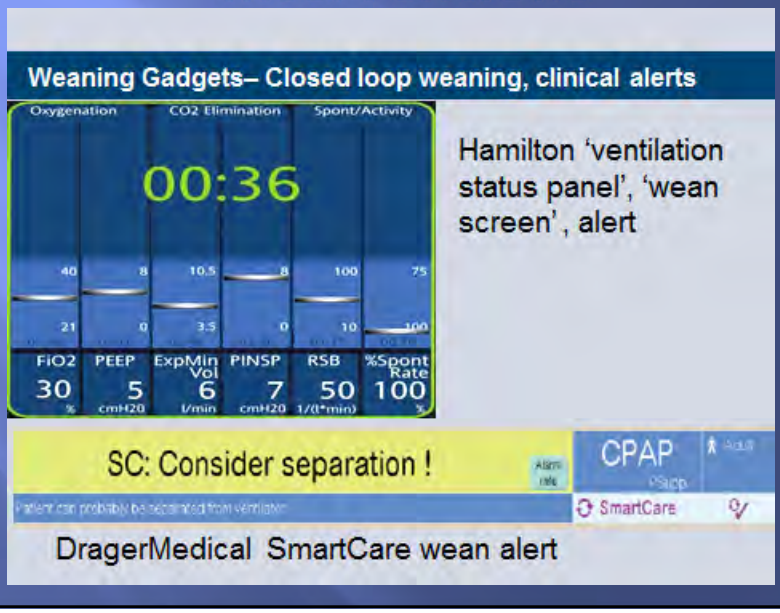
Interventions

- Other cuff pressure controllers

Interventions

- Best intervention?
  - Decrease days on MV
    - Paired SBT with daily sedation interruption
      - Best ICUs failed to provide these interventions 50% time
      - Must be paired for best results!
      - Decrease MV up to 3 days
      - Decrease hosp. stay up to 4 days
    - ASV
      - Allows weaning as soon as spontaneous breath is taken
      - Patient driven!

Interventions



Hamilton 'ventilation status panel', 'wean screen', alert

Conclusion

- New surveillance algorithm
  - More objective
  - Easy to follow pathway
- Prevention measures
  - Continue measures currently used
  - More studies needed

Summary

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Reference:

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