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Resolution of Clinical Signs of Ventilator-Associated Pneumonia in Trauma Patients

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Resolution of Clinical Signs of Ventilator-Associated Pneumonia in Trauma Patients

Abstract

Objectives: The ATS/IDSA Ventilator-Associated Pneumonia (VAP) guidelines suggest that clinical improvement of VAP should be apparent within 3–6 days. This study evaluated resolution of clinical signs of VAP in trauma patients after diagnosis.

Methods: Critically injured adults admitted to the trauma intensive care unit (ICU) from June 1, 2006, to December 31, 2007, and subsequently given a diagnosis of VAP were retrospectively assessed. Clinical signs, including derangements of maximum temperature (T_{max}), white blood cell (WBC) count, and PaO₂/FiO₂, were evaluated on days 1–16 after VAP diagnosis. Data are presented as mean ± SD unless otherwise stated. Clinical parameters after VAP were compared using repeated-measures ANOVA with the Tukey test for multiple comparisons.

Results: A total of 82 patients were identified. Data for the 34 patients without concurrent infections are presented. Demographic data include: Age 46 ± 17 years; 71% men; 94% blunt trauma; median (IQR) Injury Severity Score 29.5 (24–38); duration of mechanical ventilation 33 ± 27 days; ICU length of stay (LOS) 39 ± 25 days; hospital LOS 53 ± 33 days. Clinical signs following VAP diagnosis: T_{max} (°F): Day 1=101.8 ± 1.3, Day 3=101.1 ± 1.1, Day 6=101.1 ± 1.4, Day 16=100.1 ± 3. Compared to Day 1, there was a significant reduction in T_{max} at days 10, 11, 12, 13, 14, and 16 (p<0.05 for all). WBC count (cells per microliter): day 1 = 12.9 ± 5, day 3 = 13.7 ± 5, day 6 = 14.4 ± 5, and day 16 = 13.8 ± 6. There was no significant difference in WBC on days 1–16 (p=0.42). PaO₂/FiO₂: day 1 = 232 ± 108, day 3 = 200 ± 87, day 6 = 218 ± 104, day 16 = 246 ± 126. Differences in PaO₂/FiO₂ on days 1–16 did not reach statistical significance (p=0.06).

Conclusion: Improvement of clinical parameters after a VAP diagnosis is delayed in trauma patients. Alternative methods for determining resolution should be investigated. Published in *To be published in Critical Care Medicine's December 2009 supplement.*

Disciplines

Pharmacy and Pharmaceutical Sciences

Comments

Presented at the American College of Clinical Pharmacy Spring Practice and Research Forum, Charlotte, North Carolina, April 2010.

RESOLUTION OF CLINICAL SIGNS OF VENTILATOR-ASSOCIATED PNEUMONIA IN TRAUMA PATIENTS

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ACCP Spring Meeting; April 2010; Charlotte, NC

VENTILATOR-ASSOCIATED PNEUMONIA (VAP)

- Most frequent ICU-acquired infection among mechanically ventilated patients
- ↑ morbidity
- ↑ costs
 - ~ \$40,000 per patient
- ~30-70% mortality

Am J Respir Crit Care Med, 2005; 388-416

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VAP GUIDELINES

- Clinical parameters used to define normal pattern of resolution
 - White blood cell (WBC) count
 - Normal – 5 to 10 cells/ μ L
 - Temperature
 - Normal – 98.6° F
 - PaO₂:FiO₂
 - Normal – 380 to 475
- Clinical improvement: 48-72 hours
- Recommended therapy: 7-14 days

Am J Respir Crit Care Med, 2005; 388-416

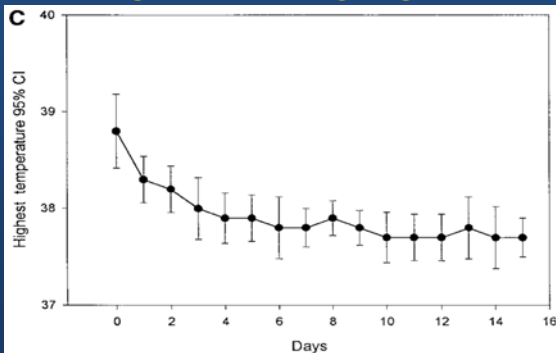
CHARACTERIZATION OF VAP RESOLUTION IN MIXED ICU

- Describe clinical response
 - Patients with VAP
 - Receiving appropriate antimicrobial therapy
- 27 patients with VAP
- Described changes over time:
 - Temperature
 - WBC
 - PaO₂:FiO₂

Am J Respir Crit Care Med, 2001;163:1375

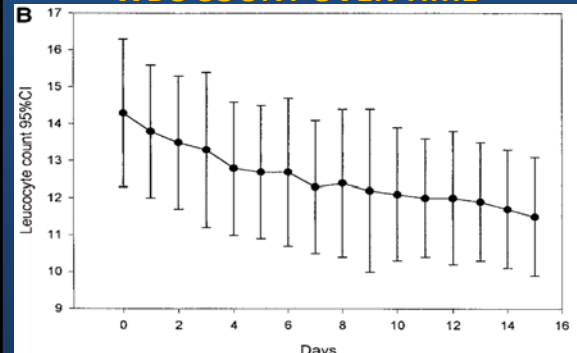
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MAXIMUM TEMPERATURE OVER TIME



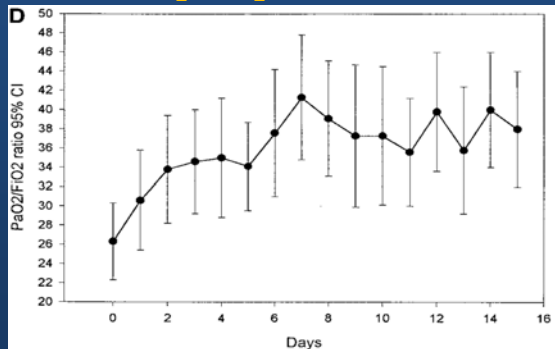
Am J Respir Crit Care Med, 2001;163:1375

WBC COUNT OVER TIME



Am J Respir Crit Care Med, 2001;163:1375

PaO₂/FiO₂ OVER TIME



Am J Respir Crit Care Med. 2001;163:1375

Dennesen *et al*

- Mean (median) duration of resolution
 - Temperature – 5 (3) days
 - WBC – 8 (6) days
 - PaO₂:FiO₂ – 6 (2) days
 - Combined – 6 (6) days
- Conclusions
 - Clinical response to therapy for VAP occurs w/in first 6 days of therapy

1. Am J Respir Crit Care Med. 2001;163:1375.

DIFFERENCES IN TRAUMA PATIENTS

- VAP incidence 2-3x greater than other populations¹
- 90% systemic inflammatory response syndrome (SIRS) in 1st week²
 - Same parameters
 - VAP response
 - SIRS

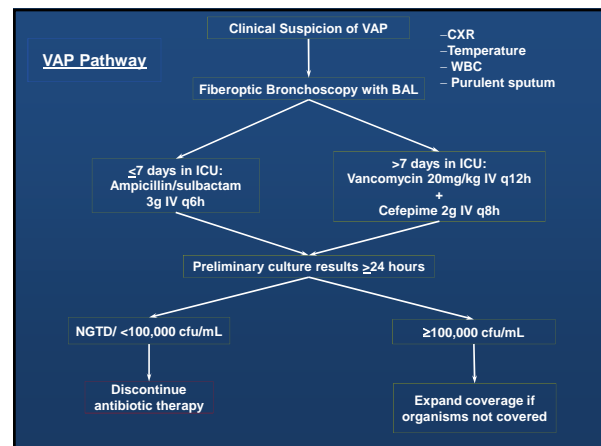
1. Am J Infect Cont. 2008; 36(9):609-626.
2. J Trauma. 2006;61:310 -317.

CURRENT STUDY PURPOSE

- Specific Aim
 - To describe resolution of clinical signs of VAP in trauma pts
- Hypothesis
 - Trauma pts have delayed resolution of clinical signs of VAP

METHODOLOGY

- Design
 - Retrospective review from pre-existing database
 - January 1, 2007 through December 31, 2007
- Inclusion
 - Critically injured trauma pts diagnosed with VAP
 - All pts diagnosed using unit-specific clinical pathway
- Exclusion
 - Age <18 years
 - Pregnant
 - Immunocompromised state
 - Corticosteroids, chemotherapy, malignancy



METHODOLOGY

- Clinical Endpoints
 - Improvement or resolution
 - Temperature
 - WBC count
 - PaO₂: FiO₂
- Statistical analysis
 - Descriptive Statistics
 - ANOVA
 - Tukey Test for multiple comparisons

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PATIENT DEMOGRAPHICS

All Patients (n = 82)

Age, years (mean ± SD)	44 ± 17
Males, number (%)	60/23 (72)
Blunt Injury %	86
Injury Severity Score, median (IQR)	34 (25 to 42)
Duration of mechanical ventilation, days (mean ± SD)	32 ± 32
ICU LOS, days (mean ± SD)	37 ± 31
Hospital LOS, days (mean ± SD)	51 ± 38
Mortality, %	16/67 (19)

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PATIENT DEMOGRAPHICS

	Patients without Concurrent Infections (n = 34)	Patients with Concurrent Infections (n = 48)	P value
Age, years (mean ± SD)	46 ± 17	43 ± 17	0.39
Males, number (%)	24/10 (71)	36/13 (73)	0.97
Blunt Injury %	32/2 (94)	39/10 (80)	0.11
Injury Severity Score, median (IQR)	29.5 (24 to 38)	34 (26 to 42)	0.19
Duration of MV, days (mean ± SD)	33 ± 27	32 ± 36	0.49
ICU LOS, days (mean ± SD)	39 ± 25	36 ± 34	0.21
Hospital LOS, days (mean ± SD)	53 ± 33	49 ± 42	0.11
Mortality, %	4/30 (12)	12/37 (25)	0.25

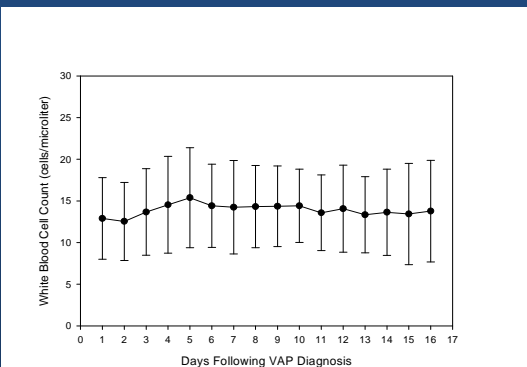
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ORGANISMS CAUSING VAP

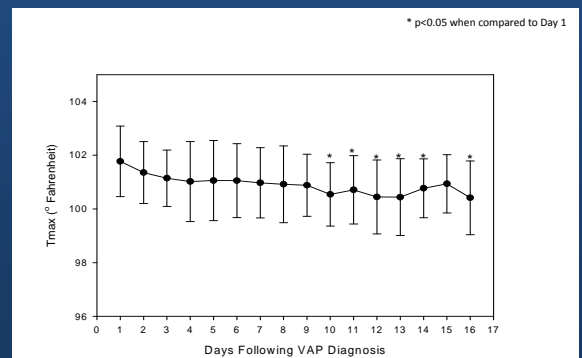
Organism	Number of Infections
<i>Streptococcus pneumoniae</i>	13
<i>Haemophilus influenzae</i>	10
Other	9
<i>Aeromonas Hydrophilia/Caviae</i>	1
<i>Staphylococcus aureus NOS</i>	1
<i>Neisseria species</i>	1
Diphtheroids	3
<i>Branhamella Catarrhalis</i>	2
MRSE	1
MSSA	7
<i>Acinetobacter species</i>	6
MRSA	5
<i>Enterobacter species</i>	4
<i>Pseudomonas aeruginosa</i>	3
<i>Escherichia Coli</i>	2
<i>Stenotrophomonas maltophilia</i>	2
<i>Klebsiella pneumoniae</i>	2
<i>Proteus mirabilis</i>	1

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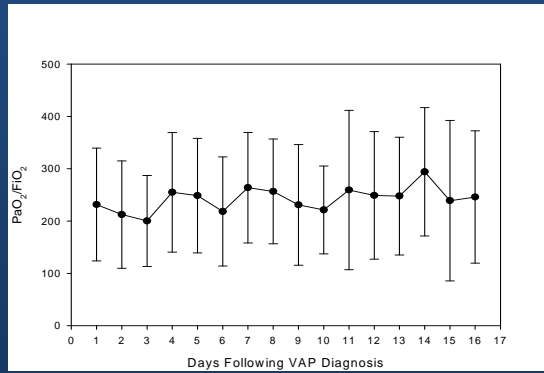
WBC COUNT OVER TIME



MAXIMUM TEMPERATURE OVER TIME



PaO₂/FiO₂ OVER TIME



CLINICAL PARAMETERS OVER TIME

Parameter	Day 1	Day 3	P Value
WBC (cells/ μ L)	12.9 \pm 5	13.7 \pm 5	NS
Tmax ($^{\circ}$ F)	101.8 \pm 1.3	101.1 \pm 1.1	NS
PaO ₂ /FiO ₂	231.6 \pm 107.9	200 \pm 87	NS

Parameter	Day 1	Day 6	P Value
WBC (cells/ μ L)	12.9 \pm 5	14.4 \pm 5	NS
Tmax ($^{\circ}$ F)	101.8 \pm 1.3	101.1 \pm 1.4	NS
PaO ₂ /FiO ₂ (l)	231.6 \pm 107.9	218 \pm 104	NS

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CONCLUSION

- Clear, rapid resolution of clinical signs of VAP not seen in critically injured trauma patients
- Future studies should explore other methods to determine clinical response to VAP in trauma patients

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