



앞선 의술 더 큰 사랑  서울아산병원

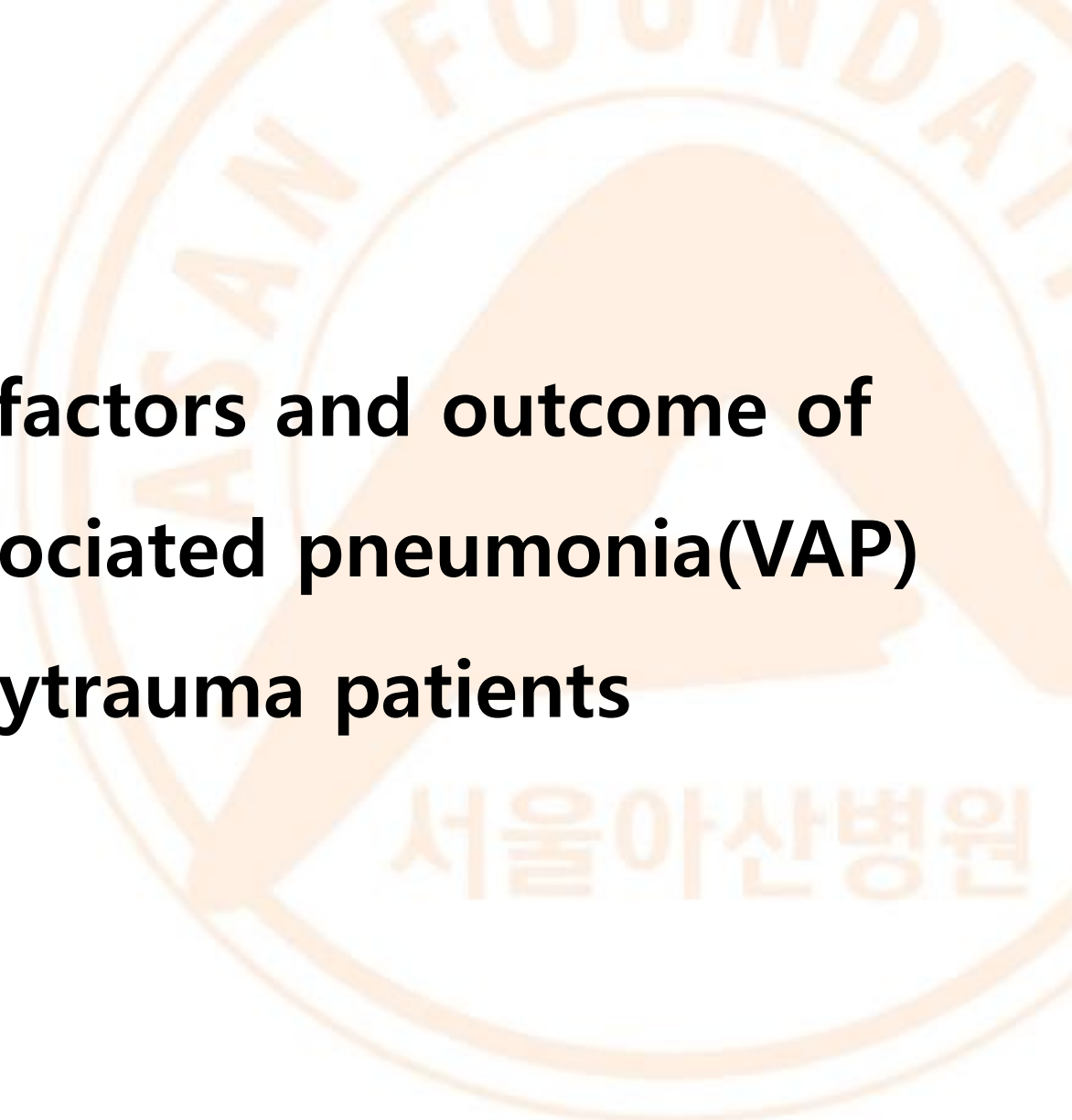
Division of Trauma and Surgical Critical Care, Department of Surgery,  
University of Ulsan College of medicine, Asan medical center  
Min Ae Keum, M.D



서울아산병원



울산대학교 의과대학

The background features a large, faint, circular logo of Seoul Asan Hospital. The logo contains the text 'ASAN FOUNDATION' at the top and '서울아산병원' at the bottom, with a stylized figure in the center.

**Clinical risk factors and outcome of  
Ventilator-associated pneumonia(VAP)  
in polytrauma patients**

# Introduction



# VAP and polytrauma patients

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- Intensive cardiopulmonary support depending on the **damaged organ** and **intensity of the injury**.
- Polytrauma patients who are unconscious, shock state or underwent brain or chest injury need **long-term mechanical ventilator support**.

# VAP and polytrauma patients

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- Pneumonia that develops **48hrs or longer after mechanical ventilation** is given by means of an endotracheal tube or tracheostomy.
- **Most common** health care associated infection in the ICUs.

# VAP and polytrauma patients

## National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004

A report from the NNIS System\*

Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services  
Atlanta, Georgia

Type of ICU	No. of units	Ventilator-associated pneumonia rate <sup>‡</sup>		Percentile				
		Ventilator-days	Pooled mean	10%	25%	50% (median)	75%	90%
Coronary	59	76,145	4.4	0.0	1.9	4.0	6.8	9.8
Cardiothoracic	47	98,358	7.2	1.2	2.9	6.3	12.6	15.5
Medical	92	268,518	4.9	0.5	2.1	3.7	6.2	8.9
Medical-surgical								
Major teaching	99	320,916	5.4	1.2	2.6	4.6	7.2	9.9
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Trauma	22	63,137	15.2	4.3	8.0	11.4	16.6	25.3
Burn	14	23,117	12.0	—	—	—	—	—
Respiratory	6	18,838	4.9	—	—	—	—	—

<sup>‡</sup>  $\frac{\text{Number of ventilator-associated pneumonias}}{\text{Number of ventilator-days}} \times 1000$

# VAP and polytrauma patients

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- The aim of this study was to assess the **incidence and outcome** of VAP, to analyze **most attributable risk factors** in polytrauma patients.

# Methods





# Methods Design and patients

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- Retrospective, observational, single center study
- January 2011~December 2013
- Polytrauma patients who admitted in surgical ICU and were required mechanical ventilation for >48hrs
- VAP-positive groupVs. VAP-negative group

# Methods Diagnosis of VAP



Table 2: Specific Site Algorithms for Clinically Defined Pneumonia (PNU1)

Radiology	Signs/Symptoms/Laboratory
<p>Two or more serial chest radiographs with at least <b>one</b> of the following<sup>1,2</sup>:</p> <ul style="list-style-type: none"> <li>• New or progressive <u>and</u> persistent infiltrate</li> <li>• Consolidation</li> <li>• Cavitation</li> <li>• Pneumatocoles, in infants <math>\leq 1</math> year old</li> </ul>	<p>For ANY PATIENT, at least <b>one</b> of the following:</p> <ul style="list-style-type: none"> <li>• Fever (<math>&gt;38^{\circ}\text{C}</math> or <math>&gt;100.4^{\circ}\text{F}</math>)</li> <li>• Leukopenia (<math>&lt;4000 \text{ WBC}/\text{mm}^3</math>) or leukocytosis (<math>\geq 12,000 \text{ WBC}/\text{mm}^3</math>)</li> <li>• For adults <math>\geq 70</math> years old, altered mental status with no other recognized cause</li> </ul> <p><b>and</b></p> <p>at least <b>two</b> of the following:</p> <ul style="list-style-type: none"> <li>• New onset of purulent sputum<sup>3</sup>, or change in character of sputum<sup>4</sup>, or increased respiratory secretions, or increased suctioning requirements</li> <li>• New onset or worsening cough, or dyspnea, or tachypnea<sup>5</sup></li> <li>• Rales<sup>6</sup> or bronchial breath sounds</li> <li>• Worsening gas exchange (e.g., <math>\text{O}_2</math> desaturations (e.g., <math>\text{PaO}_2/\text{FiO}_2 \leq 240</math>)<sup>7</sup>, increased oxygen requirements, or increased ventilator demand)</li> </ul>

# Methods Quantitative culture

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Broncheal aspirate  $\geq 10^5$ CFU/ml

Endotracheal aspirate

Bronchoalveolar lavage

# Methods Data

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- Considered clinical factors
  - ✓ Demographics, cause of injury,
  - ✓ Injury severity score (ISS), regional abbreviated injury scale (AIS), pulmonary contusion score, rib fracture, flail chest, unconsciousness on arrival, shock state, level of lactate,, massive transfusion in 24hrs, traumatic brain injury, spinal cord injury
- Clinical outcome
  - ✓ Hospital & ICU length of stay, day of mechanical ventilation
  - ✓ Mortality, rate of tracheostomy

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## Methods Pulmonary contusion score

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# A chest trauma scoring system to predict outcomes

Jennifer Chen, MD,<sup>a</sup> Elan Jeremitsky, MD,<sup>b</sup> Frances Philp, MS,<sup>a</sup> William Fry, MD,<sup>c</sup> and  
R. Stephen Smith, MD,<sup>c</sup> Pittsburgh, PA, Lowell, MA, and Columbia, SC

*(Surgery 2014;156:988-94.)*

# Methods Pulmonary contusion score

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**Table I.** Chest scoring system

Age score	
<45 y	1
45–65 y	2
>65 y	3
<b>Pulmonary contusion score</b>	
None	0
Unilateral minor	1
Bilateral minor	2
Unilateral major	3
Bilateral major	4
Rib score	
<3 RIBFX	1
3–5 RIBFX	2
>5 RIBFX	3
Bilateral RIBFX	
No	0
Yes	2

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# Methods Statistics

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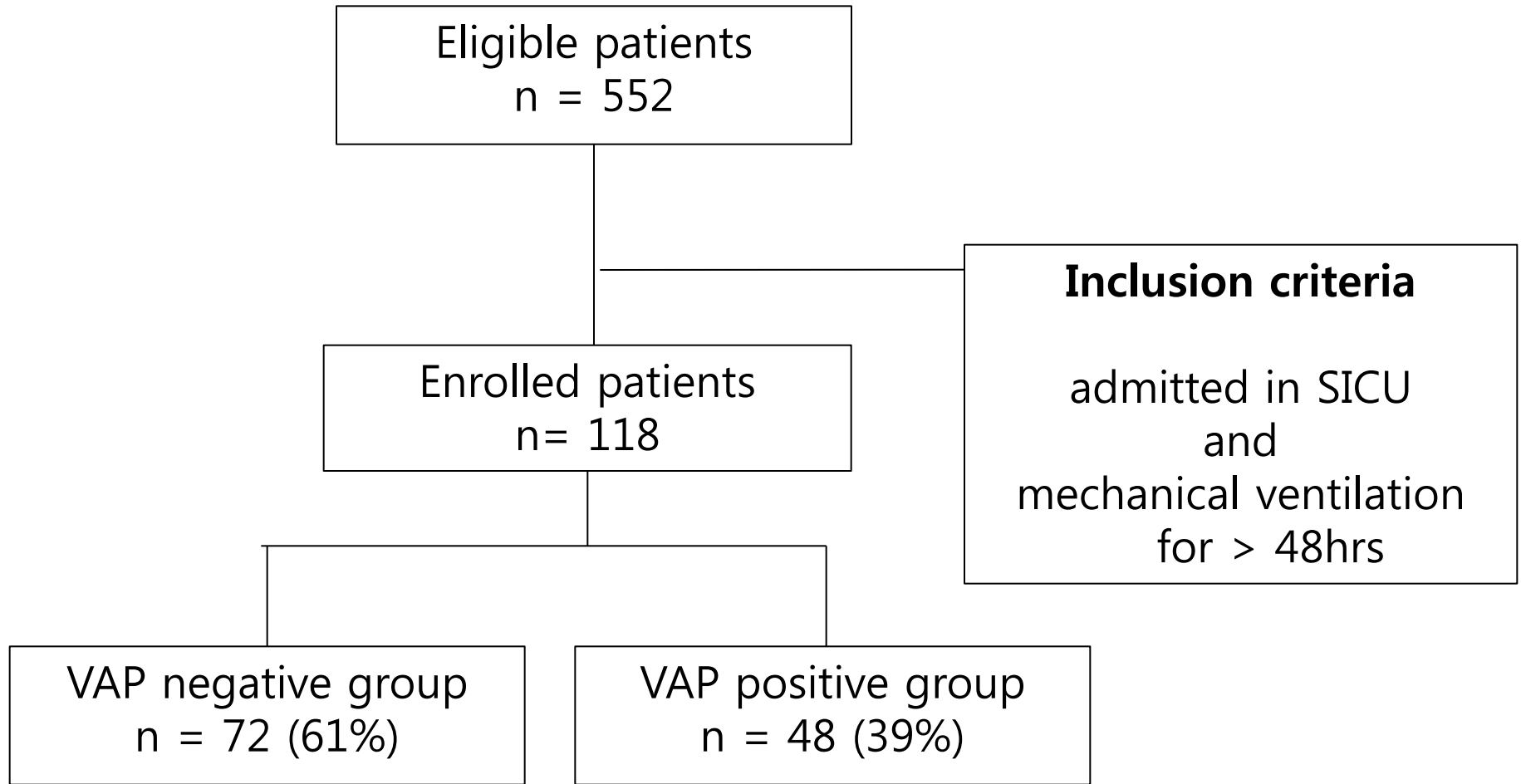
- Descriptive statistics like mean  $\pm$  SD for continuous variables
- Frequency and percentage for discrete/categorical variables
  
- Independent sample t-test
- Chi-square test
- Cox regression

# Results



# Results

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# Results

**Table 1. Demographic data of polytrauma patients (n=118)**

Age (year, mean $\pm$ SD)	48 $\pm$ 19.7
Sex (n, M:F)	92 : 26
Past medical history (n, %)	30 (25.4)
Cause of Injury	
Traffic accident (n, %)	76 (64.4)
Pedestrian (n, %)	27 (22.9)
Driver (n, %)	16(13.6)
Passenger (n, %)	9 (7.6)
Bicycle (n, %)	5 (4.2)
Motorcycle (n, %)	19 (16.1)
Fall (n, %)	23 (19.5)
Industrial disaster (n, %)	12 (10.2)
Assault (n, %)	3 (2.5)
Miscellaneous (n, %)	4 (3.4)
ISS score ( mean $\pm$ SD)	28.93 $\pm$ 13.17

# Results

**Table 2. Clinical factors and VAP (n=118)**

	VAP (-) n=72	VAP (+) n=46	<i>P</i> value
Age	43.8 ± 18.4	54.6 ± 20.1	0.03
Sex	55 : 17	37 : 9	0.655
Presence of past medical history	16 (22%)	14 (30.4%)	0.387
ISS score	28.53 ± 14.39	29.57 ± 11.12	0.678
Head or neck	1.47 ± 1.88	2.22 ± 1.97	0.042
Face	0.78 ± 1.27	0.67 ± 1.07	0.647
Chest	1.79 ± 1.59	2.85 ± 1.48	0.000
Abdominal or pelvic contents	1.93 ± 1.92	1.48 ± 1.14	0.143
Extremities or pelvic girdle	2.25 ± 1.56	2.11 ± 1.51	0.628
Unconsciousness on arrival at ER	22 (30.6%)	28 (60.9%)	0.002
Pulmonary contusion score	0.88 ± 1.32	2.17 ± 1.65	0.000
Presence of flail chest	3 (4.2%)	7 (15.2%)	0.046
Presence of shock <24hrs	29 (40.3%)	25 (54.3%)	0.185
Level of lactate	4.58 ± 3.13	4.32 ± 3.42	0.676
Massive transfusion <24hrs	23 (31.9%)	8 (17.4%)	0.06

# Results

**Table 3. Clinical outcome and VAP (n=118)**

	VAP (-) n=72	VAP (+) n=46	<i>P</i> valvue
Hospital LOS	27.78 ± 19.98	36.57 ± 18.65	0.18
ICU LOS	11.15 ± 10.98	22.39 ± 14.9	0.00
Days of mechanical ventilation	9.43 ± 10.72	19.83 ± 15.62	0.00
Tracheostomy	19 (26.4%)	35 (76.1%)	0.000
Death	12 (16.7%)	3 (6.5%)	0.157

# Results

**Table 4-1. Risk factor of VAP by univariate analysis**

	Odds ratio	95% CI	<i>P</i> - value
Age	1.019	1.004 – 1.035	0.014
Unconsciousness on arrival at ER	1.804	0.996 – 3.269	0.052
Flail chest	2.595	1.150 – 5.856	0.022
Pulmonary contusion score	1.432	1.195 – 1.715	0.000
Massive transfusion	0.462	0.215 – 0.992	0.048

# Results

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**Table 4-2. Risk factor of VAP by multivariate analysis**

	Odds ratio	95% CI	<i>P</i> - value
Age	1.032	1.014 – 1.050	0.000
Pulmonary contusion score	1.609	1.310 – 1.976	0.000



# Conclusion



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- Inability to control oro-pharyngeal secretions associated with **traumatic brain injury**
- Direct **chest trauma** with pulmonary contusion
- **Immuno-compromised state**

# Conclusion

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- Most attributable risk factors  
in polytrauma patients who had various risk factors ?

# Conclusion

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- Most attributable risk factors  
in polytrauma patients who had various risk factors ?
- ➡ Age, pulmonary contusion score (range of contusion)

# Conclusion

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- The VAP of polytrauma patients showed significant increase of **ICU LOS, day of mechanical ventilation, and rate of tracheostomy.**
- Because of the **age, pulmonary contusion score** were relevant with VAP incidence, those who have these risk factors should be monitored and treated carefully.

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**Thank you for your attention**