Injury Patterns and Risk of Hospital-Acquired Pneumonia among Pediatric Trauma Patients

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• No financial disclosure
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Hospital-Acquired Infections (HAIs)

• Most common complication in hospitalized patients

• Trauma patients at increased risk
  – Disruptions in tissue integrity
  – Impaired host defense mechanisms

• Hospital-acquired pneumonia (HAP)
  – Important and potentially preventable HAI

• Adult trauma patients with HAP shown to have:
  – Increased length of stay
  – Increased inpatient costs
  – Higher risk for mortality
Hospital-Acquired Pneumonia (HAP)

• Second most common HAI
  – 90% of cases occur during mechanical ventilation
  – Incidence of ventilator-associated pneumonia: 6%-52%
  – Mortality rates: 20% to 76%

• Prevention of HAP is a national priority

• Awareness of risk factors essential for prevention

• Lack of research in pediatric populations
Hospital-Acquired Pneumonia (HAP)

- We recently published study examining HAP in pediatric trauma patients

- Identified several risk factors for HAP:
  - Injury severity
  - Days on mechanical ventilation
  - Comorbid conditions
  - Older age group

- Why are older patients at higher risk?

- Due to differences in injury patterns?
Objectives

1. To examine the relationship between injury patterns and risk of HAP in pediatric trauma patients

2. Identify if this relationship is modified by age group
Methods

• Analysis of the National Trauma Data Bank (NTDB)
  – Represents over 700 trauma centers
  – Includes over 95% of all ACS-verified Level I and Level II centers

• Years 2009-2011

• Examined all cases of HAP in patients under 19 years of age

• HAP defined as:
  – ICD-9 code for aspiration, ventilator-associated, or infectious pneumonia
  – Pneumonia listed as a complication
Methods

• Patients excluded if:
  – Transferred, dead on arrival, or died after failed rescue
  – Not admitted, or had a length of stay less than 2 days
  – No information on region of injury

• Injury pattern based on ICD-9 body region codes:
  – Isolated head and neck
  – Isolated extremity
  – Multi-site
Methods

• Multivariable logistic regression used to examine association between injury patterns and HAP
  – Significant interaction between injury pattern and age group (p=0.02)
  – All further analyses stratified by age group
  – <1 year, 2-5 years, 6-10 years, 11-15 years, 16-18 years

• Final regression model adjusted for:
  – race/ethnicity, sex, Injury Severity Score, comorbid conditions, days on a ventilator, days in ICU, length of stay, and insurance status
Results

• 107,044 eligible patients

• Median age = 13 years (IQR = 6-17 years)

• Majority of patients:
  – White (52.4%)
  – Male (66.8%)
  – Not severely injured (77.1% with ISS ≥ 16)

• 1,749 (1.6%) developed HAP
Results

Adolescents with injuries to *multiple body regions* had higher odds of developing HAP compared to adolescents with *isolated head and neck injuries*

- 11-15 years OR=1.65 (95% CI:1.16-2.34)
- 16-18 years OR=1.33 (95% CI:1.07-1.66)
Results

Older adolescents (16-18 years) and preschool aged patients (2-5 years) with *isolated extremity injuries* had *lower* odds of developing HAP compared to adolescents with *isolated head and neck injuries*.

- 16-18 years OR=0.51 (95% CI:0.29-0.91)
- 2-5 years OR=0.43 (95% CI:0.20-0.93)
Limitations

• Possible under-reporting of pneumonia cases by hospitals

• NTDB does not provide time specific information
  – Cannot determine when pneumonia developed
  – Likely hospital-acquired in trauma patients

• No follow-up patient data

• Missing data

• Small number of HAP cases in youngest age groups
  – Could not fully explore all injury regions
  – Future research needed with larger samples
Conclusions

• Found a significant relationship between injury pattern and risk of developing HAP in pediatric trauma patients
  – *Risk higher in patients with multi-site or isolated head and neck injuries compared to isolated extremity injuries*

• Identified heterogeneity in stratum-specific odds ratios
  – *Age group significantly modified relationship between injury pattern and HAP*
Conclusions

• Information on risk of HAP by injury pattern can be used to risk stratify who gets HAP prophylaxis

• Patients with multi-site and isolated head and neck injuries should be treated early and aggressively to avoid HAP development

• More research needed to determine why patients with multiple injuries are at increased risk and whether preventative measures should differ by age group
Questions?
Injury Region by Age Group

- Isolated Head/Neck
- Isolated Extremities
- Multi-site Injuries

Age Groups:
- < 1 year
- 2-5 years
- 6-10 years
- 11-15 years
- 16-18 years
Results

• Injury pattern:
  – Isolated head and neck (27.2%)
  – Isolated extremity (33.5%)
  – Multiple regions (39.3%)
Results

- Visits for isolated head and neck injuries highest in infants and decreased with increasing age group
  - 60.2% of visits in patients < 1 year of age
  - 21.4% of visits in 16-18 year olds

- Opposite found for multi-site injuries:
  - 21.1% of visits in patients < 1 year of age
  - 54.7% of visits in 16-18 year olds
Odds Ratio of Developing HAP by Injury Region and Age Group

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