

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

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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 \geq 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

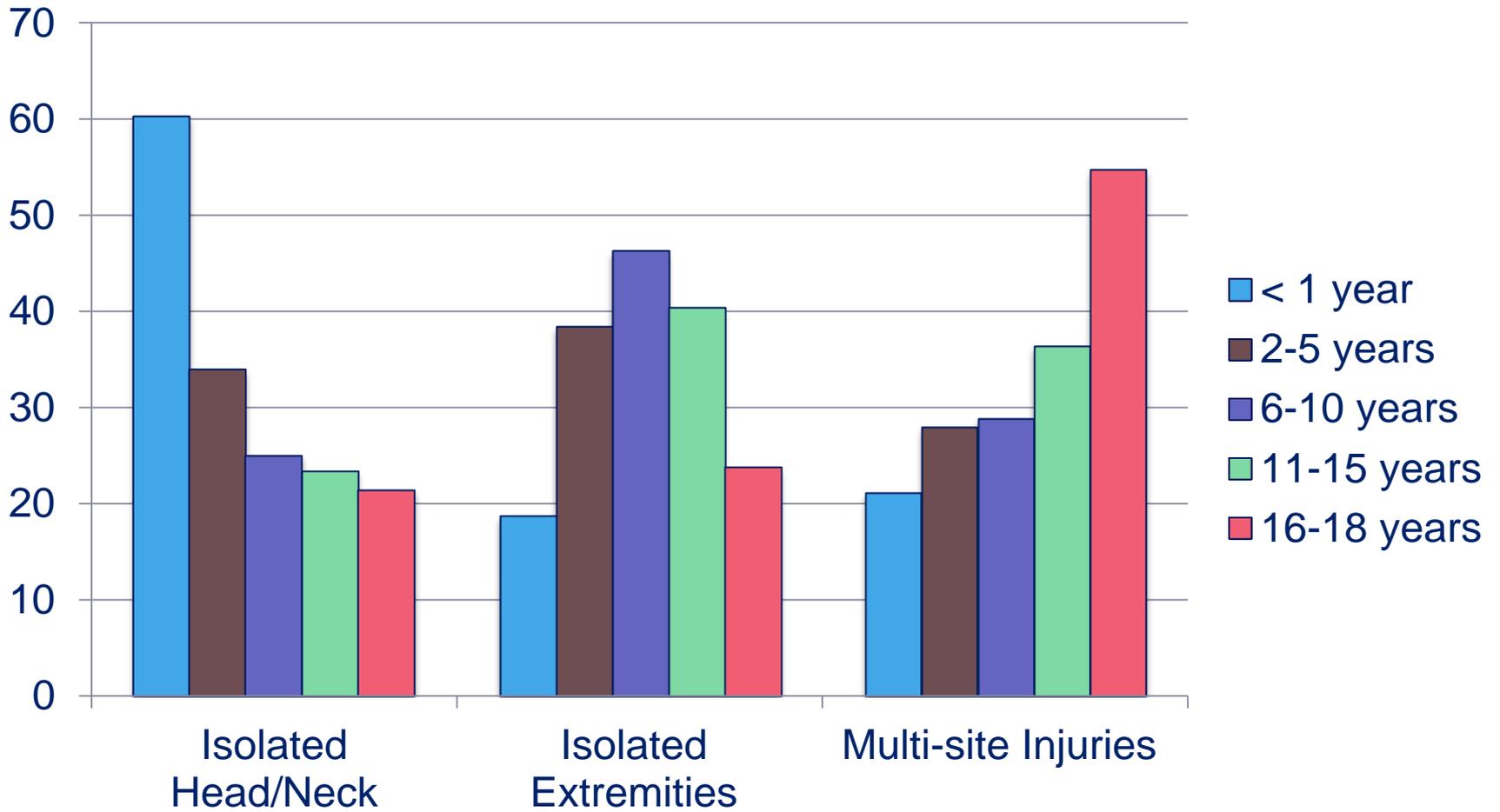
- Found a significant relationship between injury pattern and risk of developing HAP in pediatric trauma patients
 - *Risk higher in patients with multi-site or isolated head and neck injuries compared to isolated extremity injuries*
- Identified heterogeneity in stratum-specific odds ratios
 - *Age 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



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

		Odds Ratio (95% Confidence Interval)	p-value
< 1 year	Isolated head and neck	Reference	-
	Isolated extremities	0.48 (0.05-4.36)	0.52
	Multiple regions	1.50 (0.64-3.50)	0.35
2-5 years	Isolated head and neck	Reference	-
	Isolated extremities	0.43 (0.20-0.93)	0.03
	Multiple regions	1.37 (0.93-2.02)	0.11
6-10 years	Isolated head and neck	Reference	-
	Isolated extremities	0.46 (0.17-1.27)	0.13
	Multiple regions	1.30 (0.79-2.16)	0.30
11-15 years	Isolated head and neck	Reference	-
	Isolated extremities	0.66 (0.29-1.52)	0.33
	Multiple regions	1.65 (1.16-2.34)	0.006
16-18 years	Isolated head and neck	Reference	-
	Isolated extremities	0.51 (0.29-0.91)	0.02
	Multiple regions	1.33 (1.07-1.66)	0.01

Odds Ratio of Developing HAP by Injury Region and Age Group

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