Predictors of adverse outcomes in patients suffering multiple rib fractures from blunt chest trauma: a single-center retrospective analysis

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Introduction

- Blunt chest trauma and rib fractures result in a large number of emergency department visits and hospital admissions each year.
- Rib fractures are associated with high morbidity and mortality rates, but factors contributing to these poor outcomes remain unclear.
- Proper triage of patients presenting with moderate trauma is difficult as life-threatening complications may arise up to a week after injury or hospital admission.
- Recent literature seeks to combine predictors of adverse outcomes to develop a severity scoring system to allow for ease of triage and management of rib fracture patients.

Objectives

- Primary Objective: Identify patient characteristics and injury patterns leading to adverse outcomes.
  - Adverse Outcomes: Defined as 30-day mortality, unplanned intubation, and unplanned ICU admission.
- Secondary Objective: Propose a scoring system to identify patients with increased risk for complications.

Methods

- Study Design: Single-center retrospective cohort
- Data Collection: Data was collected from 305 patient charts via Our Lady of the Lake (OLOL) trauma registry.
- Inclusion Criteria: Admission to OLOL with > 2 rib fractures following blunt chest trauma.
- Exclusion Criteria: Patients presenting with penetrating injuries. Patients under the age of 18, pregnant, or incarcerated.

Predictors of Morbidity and Mortality

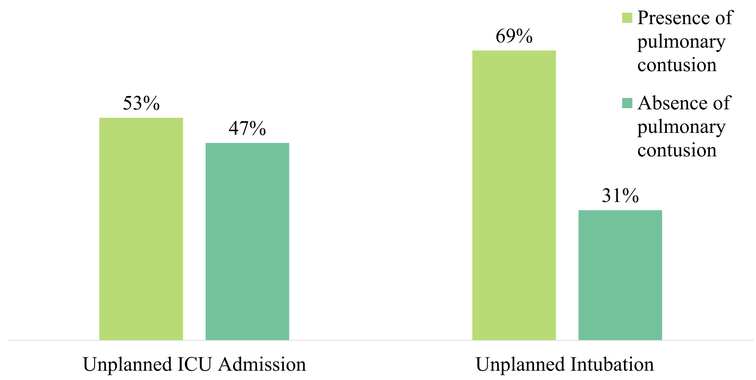

Figure 1. Presence versus absence of pulmonary contusion in unplanned ICU admissions and unplanned intubations.

Unplanned ICU admission	**N = 17 (5.6%)**
pulmonary contusion	9 (53%)
Unplanned Intubation	**N = 16 (5.2%)**
avg. # rib fractures	5.0 (4.5, 9.0)
pulmonary contusion	11 (69%)

Table 1. Predictors of unplanned ICU admission and intubation include pulmonary contusion and number of rib fractures (overall N=305).

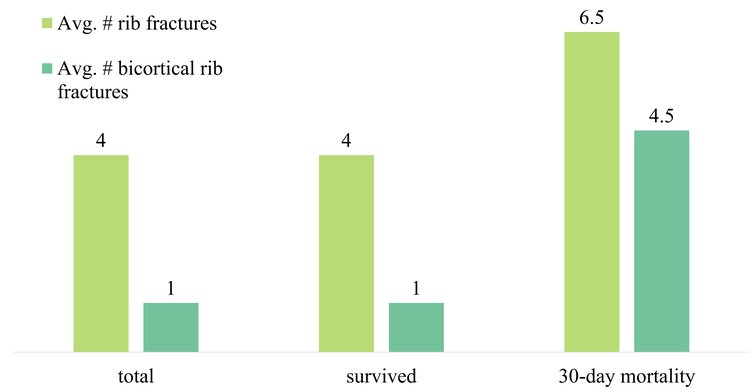

Figure 2. Average number of rib fractures and average number of bicortical rib fractures in total, survived, and 30-day mortality groups.

Predictors of 30-day Mortality	**N = 16 (5.2%)**
traumatic brain injury	7 (44%)
spinal injury	9 (56%)
# extremities injured	
0	10 (63%)
1	1 (6.3%)
2	1 (6.3%)
3	2 (13%)
4	2 (13%)
avg. # rib fractures	6.5 (5.0, 9.0)
# displaced rib fractures	
0	3 (19%)
1	3 (19%)
2	2 (13%)
3	5 (31%)
4	1 (6.3%)
5	1 (6.3%)
6	1 (6.3%)
8	0 (0%)
# bicortical rib fractures	4.5 (2.0, 5.5)

Table 2. Predictors of 30-day mortality include presence of traumatic brain injury, spinal injury, number of extremities injured, total number of rib fractures, number of displaced rib fractures, and number of bicortical rib fractures (overall N = 305).

Results

- **Predictors of Morbidity**
  - Univariate Analysis
    - Unplanned ICU Admission: Statistically significant predictors included pulmonary contusion.
    - Unplanned Intubation: Statistically significant predictors included number of rib fractures and presence of pulmonary contusion.
  - Multivariate Logistic Regression
    - Pulmonary contusion was found to be independently associated with increased odds of unplanned ICU admission (OR 4.23; 95% CI:1.42-12.97) and unplanned intubation (OR 5.75; 95% CI: 1.99-19.00).
    - Rib fracture number was found to be independently associated with increased odds of unplanned intubation (OR 1.24; 95% CI: 1.05, 1.48).
- **Predictors of 30-day Mortality**
  - Univariate Analysis
    - 30-day Mortality: Statistically significant predictors included presence of traumatic brain injury, spinal injury, number of extremities injured, number of rib fractures, number of displaced rib fractures, and number of bicortical rib fractures.

Conclusion

- Determining predictors of poor outcomes in patients presenting with rib fractures due to blunt chest trauma remains a crucial task in order to develop proper triage and management protocols.
- Based on the findings presented in the study we propose that a scoring system based on rib fracture number and pattern, presence of associated injuries, and presence of pulmonary contusion may be worthy of further investigation.
- Future Research: We plan to finalize a hypothesized scoring system based on the results of this study and proceed with a prospective study design to determine the scoring system's ability to properly predict poor outcomes in blunt chest trauma patients.