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### Assigning Level of Care in Blunt Chest Trauma Patients: Applying Objective Scoring Systems

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## INTRODUCTION

25% of all traumatic deaths are related to blunt chest trauma and another 50% have in hospital morbidity and mortality. Recognizing patients with high risk of mortality is just as important as recognizing the immediate severely injured patients. AtlantiCare Regional Trauma Center developed a scoring system in an attempt to properly assign these patients to an appropriate level of care. The system was developed based on a literature review but has not yet been studied to review its effectiveness in improving outcomes in chest trauma patients. Therefore, the scoring system is used as a guideline and not an official document in the patients' chart. The aim of this study is to examine outcomes in patients suffering blunt chest trauma and to determine if this scoring system has any significant impact.

## METHODS

### Study Samples:

This study is a retrospective analysis at a single, Level II Trauma Center in Atlantic City, NJ. Records were reviewed for all chest trauma patients seen between 2000 and 2015. Patients qualified for the study if they were above 18 years of age, had qualifying chest trauma, and had initial presenting trauma admitted between 07/01/2000 and 07/01/2015. Patients were excluded if they were under 18 years of age, they were pronounced dead in trauma bay prior to admission, and if they presented to trauma bay in cardiac arrest.

### Data Collection:

The Blunt Chest Scoring System was implemented at AtlantiCare Regional Medical Center (ARMC) in 2005. Hospital records were reviewed prior to and post implementation of the scoring system. Designated ICD-10 codes for blunt chest trauma were utilized in the search criteria. Primary end points for each patient included: Age, Length of Stay, Level of Care within the first 24 hours, Morbidity, and/or Mortality.

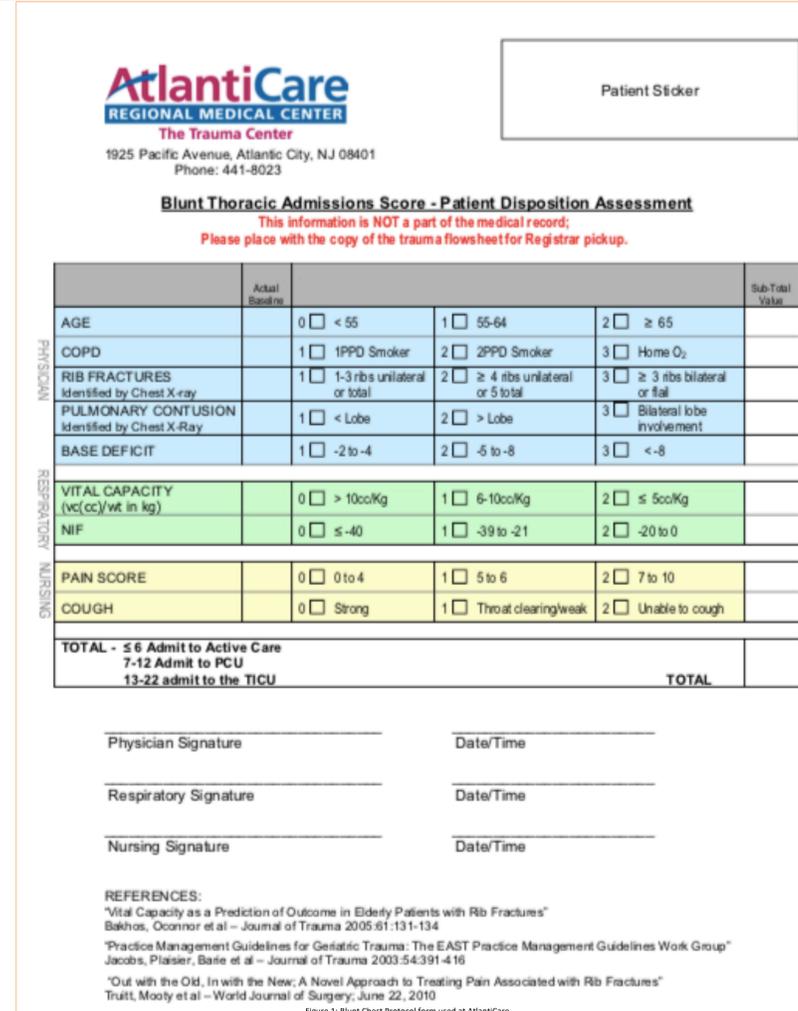
The Blunt Chest Scoring System was developed to assign blunt chest trauma patients to one of three levels of care based on several admission criteria. Patients are assigned points from 0-3 in 9 separate categories. The categories included: age, tobacco use, presence and number of rib fractures, pulmonary contusion, base deficit based on arterial blood gas, vital capacity, negative inspiratory force, pain score, and strength of cough. A score of less than or equal to 6 is admitted to active care, or a typical medical/surgical care floor, designated for trauma patients with 6:1 patient to nurse ratio and nursing assessments conducted every 4 hours. A score of 7-12 assigned a patient to Progressive Care Unit (PCU); level of care includes 4:1 patient to nurse ratio, assessments every 2 hours, and continuous telemetry monitoring. A score greater than 12 is admitted to the Trauma Intensive Care Unit (TICU); ICU level of care with 2:1 patient to nurse ratio with invasive and continuous monitoring.

### Statistical Analyses:

Participants were divided based on floor at time of admission: active care, PCU, and TICU. Age groups were divided as such: 18-29, 30-44, 45-59, 60-74, greater than 75 years of age. The study population was divided into two arms: those admitted pre-implementation of Blunt Chest Score Protocol and those admitted Post-implementation.

Age Group	Pre-Implementation	Post-Implementation	Total Participants
18-29	207	191	398
30-44	151	173	324
45-59	214	297	511
60-74	135	237	372
>75	147	216	363
Total:	854	1114	1968

## IMAGES



**Blunt Thoracic Admissions Score - Patient Disposition Assessment**  
This information is NOT a part of the medical record;  
Please place with the copy of the trauma flowsheet for Registrar pickup.

	Actual Baseline			Sub-Total Value
AGE	0 <input type="checkbox"/> < 55	1 <input type="checkbox"/> 55-64	2 <input type="checkbox"/> ≥ 65	
COPD	1 <input type="checkbox"/> 1PPD Smoker	2 <input type="checkbox"/> 2PPD Smoker	3 <input type="checkbox"/> Home O <sub>2</sub>	
RIB FRACTURES Identified by Chest X-ray	1 <input type="checkbox"/> 1-3 ribs unilateral or total	2 <input type="checkbox"/> ≥ 4 ribs unilateral or 5 total	3 <input type="checkbox"/> ≥ 3 ribs bilateral or flail	
PULMONARY CONTUSION Identified by Chest X-Ray	1 <input type="checkbox"/> < Lobe	2 <input type="checkbox"/> > Lobe	3 <input type="checkbox"/> Bilateral lobe involvement	
BASE DEFICIT	1 <input type="checkbox"/> -2 to -4	2 <input type="checkbox"/> -5 to -8	3 <input type="checkbox"/> < -8	
VITAL CAPACITY (vc(cc)/wt in kg)	0 <input type="checkbox"/> > 10cc/Kg	1 <input type="checkbox"/> 6-10cc/Kg	2 <input type="checkbox"/> ≤ 5cc/Kg	
NIF	0 <input type="checkbox"/> ≤ -40	1 <input type="checkbox"/> -39 to -21	2 <input type="checkbox"/> -20 to 0	
PAIN SCORE	0 <input type="checkbox"/> 0 to 4	1 <input type="checkbox"/> 5 to 6	2 <input type="checkbox"/> 7 to 10	
COUGH	0 <input type="checkbox"/> Strong	1 <input type="checkbox"/> Throat clearing/weak	2 <input type="checkbox"/> Unable to cough	
<b>TOTAL - ≤ 6 Admit to Active Care 7-12 Admit to PCU 13-22 admit to the TICU</b>				<b>TOTAL</b>

Physician Signature \_\_\_\_\_ Date/Time \_\_\_\_\_  
Respiratory Signature \_\_\_\_\_ Date/Time \_\_\_\_\_  
Nursing Signature \_\_\_\_\_ Date/Time \_\_\_\_\_

REFERENCES:  
\*Vital Capacity as a Prediction of Outcome in Elderly Patients with Rib Fractures\*  
Bakhos, O'Connor et al - Journal of Trauma 2005;61:131-134  
\*Practice Management Guidelines for Geriatric Trauma: The EAST Practice Management Guidelines Work Group\*  
Jacobs, Pleiser, Barie et al - Journal of Trauma 2003;54:391-416  
\*Out with the Old, In with the New: A Novel Approach to Treating Pain Associated with Rib Fractures\*  
Truitt, Mooty et al - World Journal of Surgery, June 22, 2010

## RESULTS

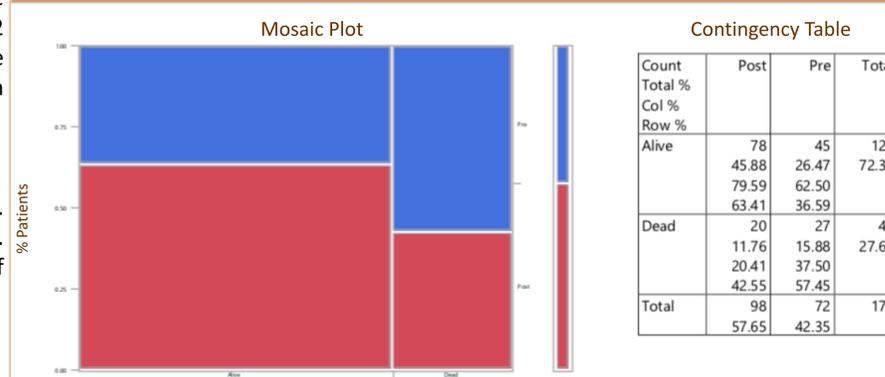


Figure 2: Patients in the >75 year old age group admitted to the TICU post-implementation had a statistically significant lower risk of mortality compared to pre-implementation of the Blunt Chest Score Protocol.

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## DISCUSSION

There are over 100,000 trauma related deaths in the US every year, most occurring in a population between 14-60 years old. 25% of these patients have a thoracic injury. Motor vehicle collision (MVC) is the most common cause of all blunt thoracic injuries (70%); falls are the second most common (8%); assault/homicide is the third (7%). Blunt trauma to the chest has a higher mortality rate when compared to penetrating injuries. Great vessel injury has the lowest incidence.

Disruptions of the chest wall and bony structures have extensive complications that can have greater physiologic disruption than penetrating wounds. Pneumonia and hypoxia are among the most common. They are also at risk of lung injury in the form of contusion or disruption of the pleura resulting in pneumothorax. Spleen, kidney and liver are also at risk from rib fractures. 35% of traumatic chest injury patients have rib fractures and the mortality associated is well documented, especially in the elderly. Patients 65 years or older with three or more fractures have a five times greater rate of mortality and a four times greater risk of pneumonia than those without fracture. These statistics increase by 8-16% with each additional fracture. Overall mortality in patients with rib fractures is 4.7% greater across all populations and flail chest is associated with 11-40% mortality. Patients with rib fractures are at very high risk of other pulmonary complications within the first 48-72 hours after admission and should be watched closely in the inpatient setting.

Isolated chest trauma patients have a 4-6% increased rate of mortality, which then doubles when another organ system is involved. There are major life threatening injuries as a result from chest trauma. This includes but is not limited to airway obstruction, pneumothorax, myocardial contusion, aortic disruption, diaphragmatic rupture, esophageal perforation and tracheobronchial injury.

There is a clear need to delineate how closely patients should be monitored when admitted for blunt chest trauma and polytrauma. Assigning a patient to a less closely monitored unit can result in excessive complications and possible increased length of stay. This predisposes a patient to further complications, such as hospital acquired infections and deconditioning. In contrast, assigning a patient to an ICU when it is not warranted is a substantial waste of resources and a financial loss.

The Blunt Chest Score created and used at AtlantiCare Regional Trauma center was created in attempt to properly assign these patients to an appropriate level of care and our hypothesis is that this has made improvements in care.

Limitations to this study is not including the injury severity score (ISS) to take into account the severity of the patient's status overall for comparison. Of course, not all confounding variables could be taken into account in this analysis either. Further studies can be performed to try to include this information in the methods to see if any change in outcomes.

## CONCLUSION

Implementation of the Blunt Chest Score led to improved patient outcomes in blunt chest trauma patients over the age of 75. The other age group's did not exhibit a statistically significant difference when comparing post-implementation to pre-implementation. However, non-inferiority was noted as there was no worsening in outcomes with the protocol in place. Given the limitations of not injury severity score, the recommendation would be to undergo further analysis factoring in confounding variables. including Upon additional investigation of the Blunt Chest Score, consideration can go into adjusting the protocol based on the results to improve the system in the future.