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Evaluating the Efficacy of PIC Scoring in Chest Trauma: A Prospective Study on Morbidity and Mortality Outcomes

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Abstract

Introduction*: Chest trauma is a critical concern in trauma care, contributing significantly to global morbidity and mortality rates. Given the unique respiratory challenges associated with thoracic injuries, there is a need for a dedicated assessment tool to guide patient management. This study evaluates the efficacy of the PIC (Pain, Inspiratory capacity, Cough) scoring system as a standardized protocol for managing chest trauma, focusing on reducing respiratory complications, ICU admissions, and hospital stay.*

Materials and Methods*: An observational, prospective study was conducted involving 119 chest trauma patients admitted to a tertiary care hospital from March 2022 to September 2024. Patients were divided into two groups: Group A, managed using the PIC scoring system, and Group B, without it. Demographic data, respiratory complications, ICU admission rates, hospital stay, and discharge outcomes were collected. Statistical analysis, including chi-square tests and linear regression, was performed to assess associations between PIC scores and clinical outcomes, with a significance threshold of $p < 0.05$.*

Results*: Group A exhibited significantly lower respiratory complications (14.55% vs. 29.68%) and ICU admissions (36.36% vs. 54.69%) compared to Group B. Additionally, the average hospital stay was shorter in Group A (2.735 days) than in Group B (3.761 days). Discharge outcomes were similar across both groups, indicating that the PIC score effectively reduces complications and resource use without compromising discharge success rates.*

Discussion*: The findings support the PIC scoring system as an effective tool for managing chest trauma, providing a streamlined approach that enhances respiratory outcomes and reduces ICU dependency. Compared to general trauma scoring systems, PIC's focused assessment of pain, inspiratory capacity, and cough strength offers a targeted protocol that can optimize resource allocation and improve patient care in emergency settings.*

Conclusion*: This study highlights the potential of the PIC scoring system to serve as a standard protocol in chest trauma management, enabling timely and effective interventions. Further research is recommended to validate these findings in larger, multicenter settings.*

Keywords: *chest trauma, PIC scoring, respiratory complications, ICU admissions, hospital stay, trauma management, morbidity and mortality, pain assessment, inspiratory capacity, cough strength*

I. Introduction

Trauma, broadly defined as injury resulting from the transfer of energy from an external source, is a significant cause of morbidity and mortality worldwide. Trauma-related injuries affect various parts of the body and may arise from diverse mechanisms, including mechanical forces, chemical agents, thermal factors, and ionizing radiation. The outcomes of traumatic events are often severe and can result in long-term physical, emotional, and economic impacts. Notably, trauma is the third leading cause of death across all age groups globally and is particularly common among younger populations, contributing significantly to premature death and disability [1]. Within the spectrum of trauma, chest trauma is particularly noteworthy due to its high prevalence and potential for critical complications, making up approximately 60% of polytrauma cases and exhibiting a mortality rate between 20% and 25%.

Chest trauma encompasses a range of injuries, including damage to the ribs, lungs, heart, and major blood vessels within the thoracic cavity. These injuries may be classified as blunt or penetrating, with blunt trauma accounting for nearly 70% of chest injuries. Motor vehicle accidents, falls, and violent incidents are leading causes of chest trauma, with high-speed collisions posing a particular risk. Blunt trauma from these incidents can lead to significant conditions such as pneumothorax, hemothorax, flail chest, and pulmonary contusion, each of which can severely impair respiratory function and increase the risk of mortality [2]. Chest trauma often requires specialized care and may necessitate surgical interventions, such as thoracotomy, or intensive respiratory management. This need for specialized interventions underscores the importance of timely and effective assessment tools that can guide decision-making in the management of chest trauma patients.

The rising incidence of traumatic chest injuries highlights the need for improved clinical protocols to assess injury severity and optimize resource allocation in healthcare facilities. In India, where trauma accounts for 5.8 million deaths annually, chest injuries represent a considerable portion of the healthcare burden. Currently, chest trauma-related fatalities occur approximately every 1.9 minutes, with around 20 million individuals hospitalized each year due to traumatic injuries [3]. The increasing number of cases not only strains healthcare resources but also emphasizes the need for standardized assessment tools that can quickly and accurately determine the severity of chest injuries and assist in triage and treatment decisions.

While scoring systems like the Injury Severity Score (ISS) and Trauma and Injury Severity Score (TRISS) have become established tools in the assessment of polytrauma, no universal scoring system currently exists for isolated chest trauma. This gap has implications for the treatment and management of thoracic injuries, as healthcare providers lack a reliable and standardized method for assessing the severity of chest trauma. To address this, the PIC (Pain, Inspiratory capacity, Cough) scoring system was developed by Wellspan York Hospital as a targeted assessment tool for chest trauma [4]. The PIC score is specifically designed for patients with blunt chest trauma and assesses three critical parameters—pain level, inspiratory capacity, and cough strength—each of which contributes to

respiratory function and the patient's overall condition. By focusing on these aspects, the PIC score provides an integrated view of the patient's respiratory capacity and pain, which are vital indicators of trauma severity and recovery prospects.

The PIC scoring system is grounded in the need for simplicity, efficiency, and clinical relevance in trauma settings. Pain level, for instance, is evaluated using the Wong-Baker Visual Analog Scale, a well-established measure that provides an objective view of the patient's discomfort, which can impact breathing efforts and recovery. Inspiratory capacity is assessed using incentive spirometry, which reflects the patient's willingness and ability to expand their lungs—a critical factor in preventing complications like atelectasis or pneumonia [5]. Cough strength is also measured, as effective coughing is essential for clearing secretions and maintaining airway patency. Together, these parameters form a score that clinicians can use to stratify patients into different risk categories and decide on appropriate interventions, including ICU admission, enhanced monitoring, or specific respiratory therapies.

The PIC score is intended as an accessible, cost-effective tool for improving the management of chest trauma patients. By providing daily evaluations of key respiratory and pain-related factors, the PIC scoring system allows for continuous monitoring and timely interventions, thus reducing the risk of complications. Studies have demonstrated that patients with higher PIC scores tend to experience better outcomes, including reduced respiratory complications, shorter ICU stays, and lower overall hospitalization time [6]. The scoring system serves as a valuable addition to the clinical toolkit for managing chest trauma, particularly in resource-limited settings where quick assessments and streamlined decision-making processes are essential for delivering effective care.

This study aims to establish the PIC scoring system as a standardized protocol in hospitals managing chest trauma patients, with the goal of reducing morbidity and mortality associated with chest injuries. By implementing PIC scoring as a mandatory protocol, healthcare providers can ensure that patients with chest trauma receive systematic assessments that inform treatment decisions and improve patient outcomes. The study will focus on assessing the correlation between PIC scores and critical outcomes, including respiratory complications, ICU admissions, and hospital length of stay. Specifically, it will analyze the differences in outcomes between patients managed with the PIC scoring system and those treated without it, with the expectation that PIC scoring will demonstrate significant benefits in reducing the burden on critical care resources and improving recovery rates.

In summary, chest trauma represents a major clinical challenge due to its high incidence and potential for severe complications. The PIC scoring system offers a promising approach to addressing this challenge by providing a standardized method for assessing trauma severity and guiding treatment decisions. This study seeks to validate the efficacy of the PIC score in improving clinical outcomes for chest trauma patients, with the ultimate goal of establishing it as a compulsory protocol in hospitals. Such a protocol would not only enhance patient care but also optimize healthcare resources, particularly in settings where trauma-related injuries are a significant healthcare burden.

II. Background

Chest trauma is one of the most critical forms of injury encountered in emergency and trauma care, with both high incidence rates and significant morbidity and mortality. Chest trauma, or thoracic injury, refers to physical harm sustained by structures within the thoracic cavity, including the chest wall, lungs, heart, blood vessels, and other vital organs. These injuries are commonly categorized as either blunt or penetrating, with blunt trauma being the more prevalent type [7]. In cases of blunt trauma, injuries typically result from high-impact incidents such as motor vehicle accidents, falls, and industrial accidents, which can lead to severe complications like pneumothorax (air in the pleural cavity), hemothorax (blood in the pleural cavity), flail chest (a segment of the rib cage breaking off), and pulmonary contusion (bruising of lung tissue).

Globally, trauma is one of the leading causes of death and is particularly significant in young adults, contributing to premature mortality and long-term disability. Chest trauma, specifically, accounts for 60% of polytrauma cases and has a high mortality rate, ranging from 20% to 25%. In India, trauma-related injuries result in approximately 5.8 million deaths each year, with nearly one trauma-related death occurring every 1.9 minutes. The burden of trauma is not limited to fatalities; millions more experience severe injuries, requiring prolonged hospitalization and extensive rehabilitation [8]. Chest injuries, due to their impact on critical respiratory functions, are associated with higher rates of complications and often require specialized interventions to prevent life-threatening outcomes.

High-speed vehicular accidents are a primary cause of chest trauma, which has seen an increase with the rise in road traffic incidents globally. This type of trauma often results in complications like tension pneumothorax (when air trapped in the pleural space builds up pressure, compressing the lung and other structures), massive hemothorax (excessive blood in the pleural cavity), and damage to major thoracic blood vessels [9]. These conditions can rapidly compromise a patient's respiratory function and hemodynamic stability, underscoring the need for immediate and effective clinical assessment. In the face of such complex injuries, accurate assessment protocols are essential to guide treatment, prioritize resource allocation, and reduce morbidity and mortality.

Despite the high incidence and risk associated with chest trauma, there remains a lack of standardized scoring systems specifically tailored to isolated thoracic injuries. While general trauma scoring systems, such as the Injury Severity Score (ISS) and the Trauma and Injury Severity Score (TRISS), are useful for polytrauma, they do not adequately address the unique challenges presented by chest trauma alone [10]. Given the critical impact of respiratory complications in chest trauma patients, a specific assessment system is needed to monitor respiratory function, pain levels, and the risk of complications in these cases. The absence of such a standardized protocol can lead to inconsistencies in care, unnecessary ICU admissions, extended hospital stays, and a higher incidence of respiratory complications.

The PIC Scoring System

In response to the need for a focused, accessible scoring method for chest trauma, the PIC (Pain, Inspiratory capacity, Cough) scoring system was developed by Wellspan York Hospital. The PIC score

was designed to provide an efficient, clinically relevant, and cost-effective assessment tool specifically for patients with blunt chest trauma. This scoring system evaluates three core parameters: pain level, inspiratory capacity, and cough strength, which together provide a comprehensive view of the patient's respiratory status and pain management. Each parameter is assessed individually, yielding a score that reflects the severity of the injury and helps guide clinical decisions.

1. Pain: Pain intensity is a key component in chest trauma because it directly influences respiratory effort. The PIC score uses the Wong-Baker Visual Analog Scale, a standardized tool, to assess pain levels, offering an objective means of gauging the patient's discomfort. Effective pain management is crucial, as severe pain can hinder breathing efforts, lead to shallow breathing, and increase the risk of complications such as atelectasis (collapsed lung) and pneumonia.
2. Inspiratory Capacity: Inspiratory capacity is measured using incentive spirometry, which helps indicate the patient's willingness and ability to take deep breaths and expand their lungs. Poor inspiratory capacity can suggest higher pain levels or lung compromise, signaling the need for interventions to prevent complications.
3. Cough Strength: Coughing is a vital reflex that aids in clearing secretions from the lungs, reducing the risk of respiratory infections. A strong, effective cough reflects adequate respiratory strength and capacity, whereas a weak or absent cough may indicate compromised respiratory function and higher risk of complications.

By combining these factors, the PIC scoring system provides a straightforward yet informative assessment of chest trauma severity, allowing clinicians to categorize patients into different risk levels and determine necessary interventions. Patients with higher PIC scores generally show fewer respiratory complications, reduced ICU admissions, and shorter hospital stays, which demonstrates the scoring system's potential effectiveness in improving patient outcomes and optimizing healthcare resources.

This study aims to validate the PIC scoring system as a standard protocol for managing chest trauma patients, focusing on its effectiveness in reducing morbidity and mortality. The goal is to implement the PIC score as a compulsory protocol in healthcare settings to ensure that all patients with chest trauma are systematically evaluated and managed according to a standardized assessment. The study will investigate the association between PIC scores and key outcomes, such as respiratory complications, ICU admissions, and length of hospital stay, with the expectation that the PIC scoring protocol will lead to improved clinical outcomes and more efficient use of hospital resources.

III. Materials and Methods

This study was conducted as an observational, prospective study aimed at evaluating the efficacy of the PIC scoring system in managing chest trauma patients. The primary objective was to assess whether the PIC score, which evaluates pain, inspiratory capacity, and cough strength, can serve as an effective tool in reducing morbidity and mortality associated with chest trauma. The study was conducted in a tertiary care setting, where the PIC scoring system was applied to patients with chest trauma to guide clinical decision-making, including ICU admissions, respiratory management, and hospital discharge

planning. Below is an overview of the study design, population characteristics, data collection procedures, and statistical analyses employed in the study.

A. Study Design: Observational, Prospective Study

An observational, prospective design was chosen to observe outcomes in real-time as patients were assessed and treated according to the PIC scoring protocol. This design allowed for the systematic collection of data across the study period, as well as the ability to monitor changes in patient outcomes that could be directly correlated with their PIC scores. By using a prospective approach, the study aimed to avoid potential biases associated with retrospective data collection and ensure that results reflected the most current clinical practices and patient responses. The study spanned from March 2022 to September 2024, during which 119 cases of chest trauma were analyzed from the time of hospital admission until discharge or death.

B. Population: Inclusion and Exclusion Criteria

The study population consisted of patients admitted to the hospital with chest trauma who met specific inclusion and exclusion criteria. The following parameters guided patient selection:

a. Inclusion Criteria

1. Age Range: Patients between 14 and 65 years old were included in the study. This age range was chosen as it encompasses both young adults, who are commonly involved in high-impact injuries like motor vehicle accidents, and older adults, who may suffer chest trauma due to falls.
2. Isolated Chest Trauma: Only patients with isolated chest trauma were included, as this study aimed to evaluate the PIC scoring system specifically in the context of thoracic injuries. The inclusion criteria ensured that no other major injuries that could impact the scoring were present.
3. Polytrauma with Major Chest Injury: Patients with polytrauma, in which chest trauma was the major injury among other minor injuries, were included. This allowed the study to evaluate the efficacy of the PIC score in cases where the primary concern was the thoracic injury, even if minor injuries were present elsewhere.
4. Ability to Provide Informed Consent: All patients or their legal representatives were required to provide informed consent for participation in the study. This included consent for assessment, scoring, and data collection.

b. Exclusion Criteria

1. Patients Below 14 Years: Pediatric patients were excluded as the physiological responses and recovery patterns for chest trauma may differ significantly from those of adults, potentially affecting the validity of the PIC score in this population.

2. Patients Above 65 Years: Patients over the age of 65 were excluded to minimize confounding factors related to age-associated comorbidities and frailty, which may influence outcomes in chest trauma cases.
3. Severe Polytrauma Cases: Patients with severe polytrauma where the chest injury was not the predominant trauma were excluded. These cases could potentially skew the outcomes, as other life-threatening injuries may complicate the assessment and management based on the PIC score.
4. Altered Mental Status or Traumatic Brain Injury: Patients with altered mental status or traumatic brain injury were excluded to ensure accurate and reliable self-reported pain assessments, which are a critical component of the PIC score.

C. Data Collection: Scoring and Assessment Protocol

Data collection began upon patient admission and continued throughout their hospital stay. Each patient underwent an initial clinical assessment, during which baseline PIC scores were recorded. Follow-up scores were taken at regular intervals, based on the initial PIC score, to monitor changes in patient status and adjust treatment protocols as necessary. Data collected included demographic information, clinical history, PIC score components, ICU admission status, respiratory complications, and length of hospital stay.

D. PIC Scoring Components

The PIC scoring system evaluates three core parameters: pain level, inspiratory capacity, and cough strength. Each parameter was scored separately to provide a composite PIC score, which was used to guide clinical decision-making.

1. Pain Level: Pain was assessed using the Wong-Baker Visual Analog Scale, a widely accepted tool for measuring subjective pain. Scores ranged from "Controlled" (3 points) to "Severe" (1 point). Patients with controlled pain were scored the highest, as this indicated better respiratory effort and likely improved outcomes.
2. Inspiratory Capacity: Inspiratory capacity was measured using incentive spirometry. Patients were asked to breathe into an incentive spirometer, and their scores were categorized as "Greater than goal" (4 points), "Goal to alert" (3 points), "Less than alert" (2 points), or "Unable to do" (1 point). A higher score represented better respiratory effort and lower risk of complications.
3. Cough Strength: Cough strength was evaluated based on the ability to produce a strong cough, which is critical for clearing airway secretions. Cough scores ranged from "Strong" (3 points), "Weak" (2 points), to "Absent" (1 point).

Assessment Protocol and Frequency of Scoring

The frequency of PIC score assessments was determined by the initial score:

- Score > 7: Patients were admitted to the general ward and reassessed every 8 hours.

- Score 5-7: Patients were admitted to the ICU and reassessed every 4 hours.
- Score < 5: Patients were admitted to the ICU with a reassessment frequency of every 2 hours.

Each assessment included a review of the three PIC components, which allowed for continuous monitoring and timely interventions to address any deterioration in the patient's respiratory function or pain management needs.

E. Statistical Analysis: Methods and Significance Threshold

The collected data were organized and analyzed to establish correlations between PIC scores and patient outcomes. Statistical analysis was performed using SPSS software (version 23), with p-values less than 0.05 considered statistically significant. The following statistical methods were employed:

1. Descriptive Statistics: Mean, standard deviation, and frequency distribution were used to summarize demographic and clinical data, such as age, gender, respiratory complications, ICU admissions, and length of hospital stay.
2. Chi-Square and Fisher's Exact Tests: These tests were used to assess associations between categorical variables, such as the relationship between PIC scores and the presence of respiratory complications or ICU admissions. For instance, the incidence of respiratory complications was compared between patients with high and low PIC scores to determine if a higher PIC score correlated with fewer complications.
3. Linear Regression Analysis: Linear regression was employed to explore the relationship between PIC scores and continuous outcomes, such as the length of ICU stay and hospital stay. This analysis helped determine the extent to which the PIC score predicted hospital stay duration, with a focus on reducing the burden on ICU resources and minimizing patient hospitalization.
4. Survival Analysis: To assess the effect of the PIC scoring system on mortality, Kaplan-Meier survival curves were generated for patients with different PIC scores. This analysis provided insights into whether the PIC score could serve as a predictor of mortality, with a particular emphasis on identifying patients at higher risk of adverse outcomes.
5. Multivariate Analysis: To control for potential confounding factors, multivariate analysis was conducted. This allowed for the assessment of the independent effect of the PIC score on key outcomes, adjusting for variables such as age, gender, and the presence of comorbidities.

F. Ethical Considerations

The study received approval from the Institutional Ethics Committee, and informed consent was obtained from all participants or their legal representatives. Patient confidentiality was strictly maintained, and all data were anonymized to protect patient identity. The study followed the guidelines of the Declaration of Helsinki, ensuring that patient rights and well-being were prioritized throughout the research process.

IV. Results

a. Demographics

A total of 119 patients were included in this study, all of whom were admitted with chest trauma. The demographic distribution of these patients was recorded to identify trends and patterns in age and gender, which are summarized below.

Age Distribution

The age of patients ranged from 16 to 65 years, with an average age of 38.46 years (SD = 12.90). Age groups were categorized as follows:

Age Group (Years)	Number of Patients	Percentage (%)
14-25	24	20.1%
26-35	27	22.6%
36-45	31	26.0%
46-55	24	20.1%
56-65	13	10.9%

Table 1. Age distribution among patients with chest trauma.

Explanation: The highest proportion of patients was in the 36-45 age group, likely reflecting the increased risk of motor vehicle accidents among younger to middle-aged adults. Falls and slower reaction times were common causes in the older groups.

b. Gender Distribution

Gender differences were also observed, with a higher proportion of male patients, as shown in Table 2.

Gender	Number of Patients	Percentage (%)
Male	94	79%
Female	25	21%

Table 2. Gender distribution of patients with chest trauma.

Explanation: Males constituted the majority of patients (79%), which may be attributed to a higher likelihood of engaging in high-risk behaviors such as driving and involvement in physical labor.

Respiratory Complications and ICU Admissions

An important aspect of this study was assessing respiratory complications and ICU admission rates, particularly in relation to the PIC scoring system. Patients were divided into two groups: those managed with PIC scoring (Group A) and those without PIC scoring (Group B).

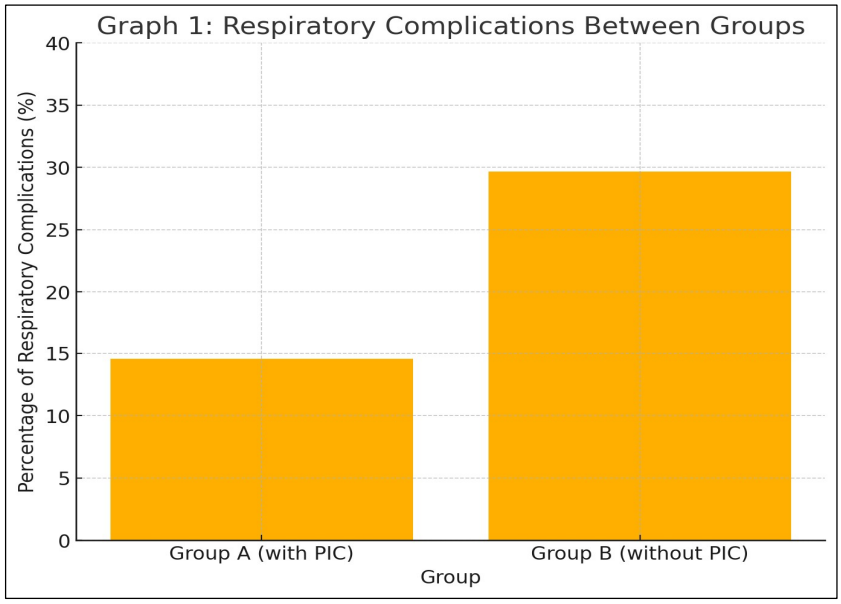
c. Respiratory Complications

The incidence of respiratory complications in both groups is summarized in Table 3.

Group	Respiratory Complications Present	Respiratory Complications Absent	Percentage of Complications (%)
Group A (with PIC)	8	47	14.55%
Group B (without PIC)	19	45	29.68%

Table 3. Comparison of respiratory complications between groups.

Explanation: Group A, which was managed using the PIC scoring system, showed a significantly lower incidence of respiratory complications (14.55%) compared to Group B (29.68%). This indicates that the PIC scoring system may have contributed to better respiratory outcomes by enabling timely interventions.



Graph 1: Respiratory Complications Between Groups

Interpretation: The graph visually represents the reduced rate of respiratory complications in Group A. This data suggests a positive association between the PIC scoring protocol and decreased respiratory issues, which aligns with the hypothesis that systematic scoring can aid in preventing respiratory complications.

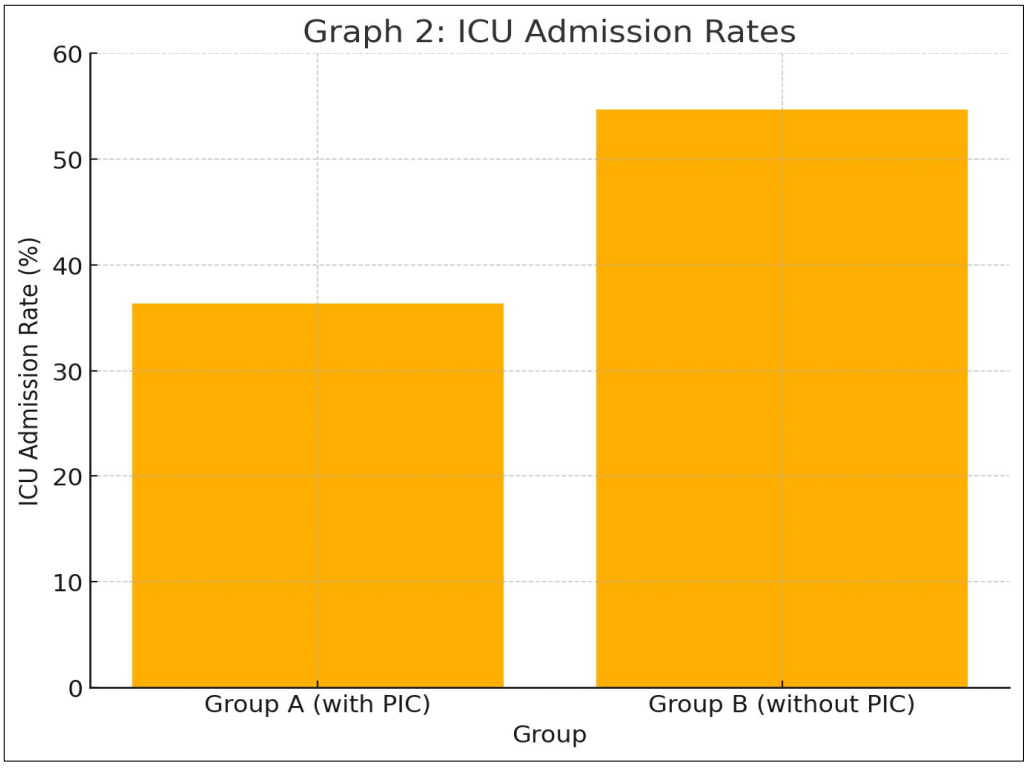
d. ICU Admissions

ICU admission rates were compared across both groups, as shown in Table 4.

Group	ICU Admissions (Present)	ICU Admissions (Absent)	Percentage (%)
Group A (with PIC)	20	35	36.36%
Group B (without PIC)	35	29	54.69%

Table 4. ICU admissions in patients with and without PIC scoring.

Explanation: ICU admissions were significantly lower in Group A, with only 36.36% requiring ICU care compared to 54.69% in Group B. This finding suggests that the PIC scoring system effectively identified patients at higher risk and provided a basis for early interventions that potentially reduced the need for critical care.



Graph 2: ICU Admission Rates

Interpretation: The reduction in ICU admissions in Group A underscores the PIC score's potential role in preventing severe outcomes by aiding in early and appropriate care planning.

e. Length of Hospital Stay and Discharge Outcomes

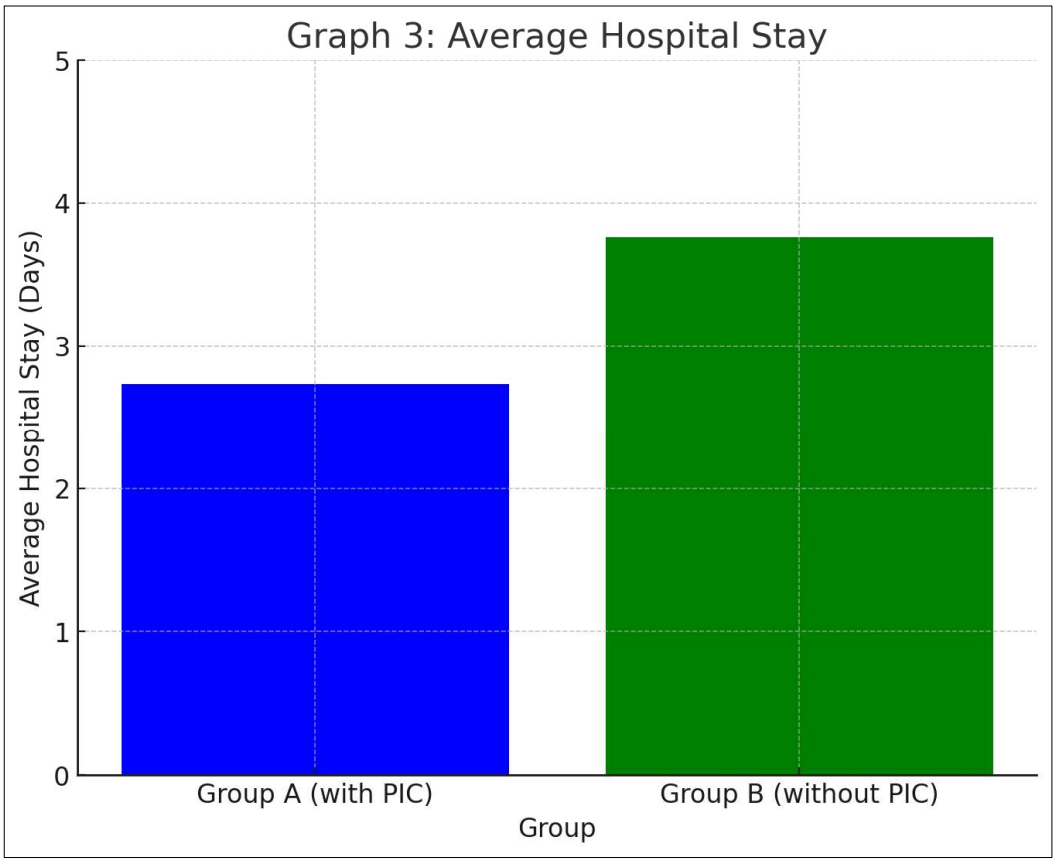
The length of hospital stay is a critical metric, reflecting the overall efficiency and effectiveness of patient management. The study compared the average hospital stay between the two groups.

Hospital Stay

Group	Average Hospital Stay (Days)	Standard Deviation (Days)
Group A (with PIC)	2.735	1.497
Group B (without PIC)	3.761	1.846

Table 5. Average hospital stay for patients with and without PIC scoring.

Explanation: Patients in Group A had a shorter average hospital stay (2.735 days) compared to those in Group B (3.761 days). This result was statistically significant, suggesting that the PIC scoring system may help in reducing hospital stay by enabling efficient triaging and management.



Graph 3: Average Hospital Stay

Interpretation: The shorter hospital stay observed in Group A indicates that the PIC scoring system may contribute to quicker recovery or discharge readiness, thereby reducing the hospital resource burden and improving patient throughput.

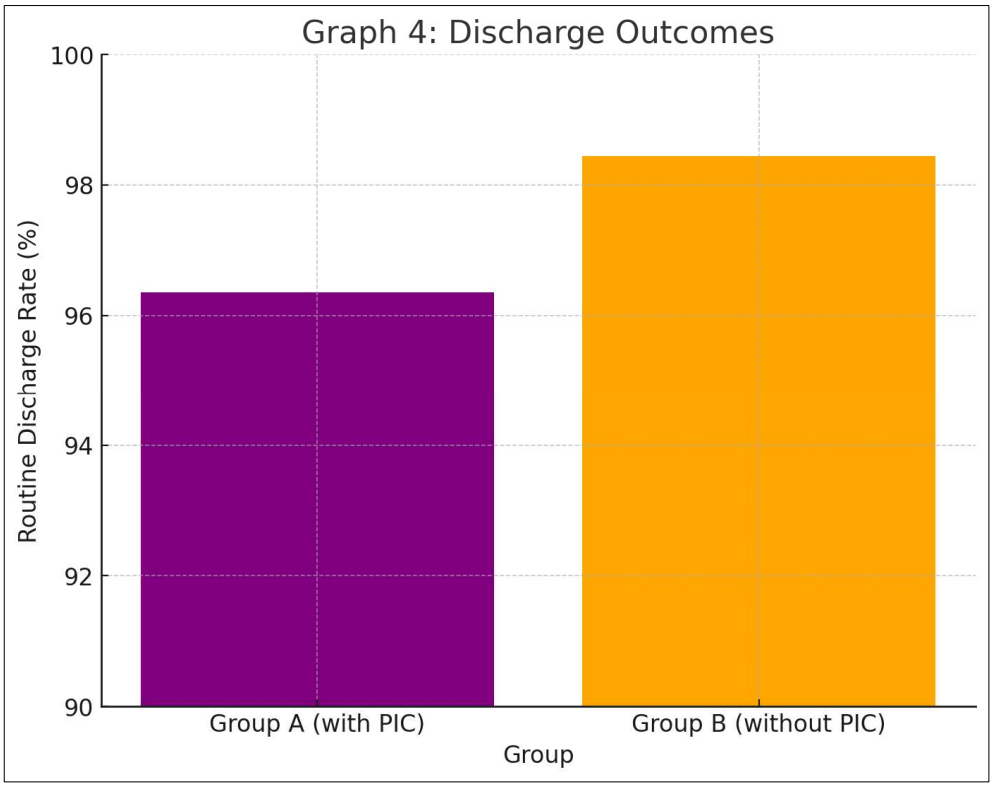
f. Discharge Outcomes

Discharge outcomes were analyzed to understand if there were significant differences in discharge status between the two groups. Table 6 shows the proportion of patients discharged routinely versus those who died.

Group	Routine Discharge	Deaths	Percentage of Routine Discharge (%)
Group A (with PIC)	53	2	96.36%
Group B (without PIC)	63	1	98.44%

Table 6. Discharge outcomes for patients with and without PIC scoring.

Explanation: Both groups had similar discharge outcomes, with most patients being discharged routinely. Group A showed a slightly higher percentage of deaths; however, this difference was not statistically significant. This suggests that while the PIC scoring system was effective in reducing complications and ICU admissions, it did not adversely impact the likelihood of successful discharge.



Graph 4: Discharge Outcomes

Interpretation: The similarity in discharge outcomes between the two groups indicates that implementing the PIC scoring system does not compromise patient discharge status, and its use in triaging and patient care is consistent with high-quality outcomes.

V. Discussion

The findings of this study indicate that the PIC scoring system is a valuable tool in managing patients with chest trauma, providing clinicians with a simple, effective protocol to assess injury severity and guide patient care. The study highlights that the PIC scoring system may reduce respiratory complications, ICU admissions, and overall hospital stay, which contributes to both patient well-being and healthcare resource optimization. Below is a discussion of the primary results and their implications, followed by a comparison to existing literature and potential limitations of the study.

1. Demographics and Trends

The demographic analysis showed that most chest trauma patients were male (79%), with the highest age concentration in the 36–45 age group. These findings are consistent with patterns seen globally, where males and younger to middle-aged adults face higher risks of traumatic injuries due to factors like vehicular accidents, occupational hazards, and risk-taking behavior. This demographic insight emphasizes the need for targeted trauma prevention and management strategies for high-risk groups, especially in areas with high vehicular traffic and industrial activity.

2. Respiratory Complications

One of the most significant findings of this study is the lower rate of respiratory complications among patients in Group A, who were managed using the PIC scoring system. Respiratory complications in chest trauma patients, such as pneumothorax, hemothorax, and pulmonary infections, can severely impact recovery and increase mortality risks. The PIC score's focus on assessing inspiratory capacity, pain, and cough strength enables early identification of patients at higher risk for these complications. By identifying such patients, clinicians can implement respiratory therapies and monitoring sooner, reducing the likelihood of complications.

The reduction in respiratory complications from 29.68% in Group B to 14.55% in Group A suggests that the PIC scoring system is effective in reducing adverse respiratory outcomes. This is a promising result, especially given that respiratory issues are a leading cause of morbidity in chest trauma patients.

3. ICU Admissions

ICU admissions were markedly lower in Group A compared to Group B, with rates of 36.36% and 54.69%, respectively. This difference highlights the PIC score's potential in optimizing ICU resource allocation by identifying patients who truly need intensive care versus those who can be managed in general wards. Early PIC scoring allows for better triage and resource distribution, which is critical in emergency settings, where ICU resources are often limited.

Reducing ICU admissions not only lowers the direct costs associated with intensive care but also decreases the burden on critical care staff and facilities. For hospitals operating in resource-constrained environments, adopting the PIC scoring system could enable more efficient and cost-effective trauma care, improving patient throughput and overall outcomes.

4. Length of Hospital Stay

The analysis showed that patients in Group A, managed using the PIC score, had a significantly shorter hospital stay (2.735 days) compared to those in Group B (3.761 days). This reduction in hospital stay has multiple implications: it suggests that patients who are closely monitored and managed using PIC scoring may experience faster recovery, enabling earlier discharge. Reducing the length of hospital stay can alleviate the strain on healthcare facilities, minimize hospital-related complications, and enhance patient satisfaction by shortening recovery time.

This shorter hospital stay may be attributed to the PIC score's ability to facilitate timely interventions, such as pain management, respiratory therapies, and ICU admissions. Since each component of the PIC score directly impacts respiratory health, a systematic approach to addressing these factors early in the hospitalization process can improve recovery rates and reduce overall hospital days.

5. Discharge Outcomes

The study found that discharge outcomes between the two groups were comparable, with routine discharge rates of 96.36% in Group A and 98.44% in Group B. This finding suggests that the PIC scoring system did not adversely impact discharge success rates and, by extension, the quality of patient care. Importantly, the similar discharge rates between groups confirm that the shorter hospital stays and reduced ICU admissions in Group A did not come at the cost of patient safety or recovery.

The fact that the PIC scoring system did not negatively impact discharge outcomes supports its efficacy as a decision-making tool. Rather than simply minimizing hospital stay and ICU admissions, it provides a balanced approach that maintains high standards of patient care.

The PIC scoring system fills a critical gap in the assessment of isolated chest trauma, a field where scoring systems like ISS and TRISS have traditionally been less effective. While ISS and TRISS are well-established in polytrauma evaluation, they lack specific assessments of respiratory capacity and pain, which are essential in managing chest trauma. The findings of this study align with those of previous research on targeted scoring systems, which suggest that focused protocols can lead to better outcomes in specific trauma types.

Previous studies on scoring systems like the Rib Fracture Score (RFS) have highlighted the value of evaluating pain and respiratory effort in chest trauma management. The PIC score builds on these principles but simplifies the process, making it more accessible and practical for routine clinical use.

Study Limitations

While the study results are promising, several limitations should be considered:

1. **Single-Center Study**: The study was conducted at a single hospital, which may limit the generalizability of the results. Multicenter studies could provide a more comprehensive understanding of the PIC scoring system's efficacy across diverse patient populations and healthcare settings.
2. **Sample Size**: With 119 patients, the sample size is relatively modest. A larger sample size would increase the statistical power of the study and allow for more detailed subgroup analyses, such as evaluating outcomes based on specific types of respiratory complications.
3. **Lack of Long-Term Follow-Up**: This study focused on outcomes up to the point of discharge, without long-term follow-up data. Tracking patients after discharge would provide insights into the PIC score's effectiveness in preventing readmissions and post-discharge complications, which are critical metrics in trauma management.

4. **Potential Confounding Variables**: Although the study controlled for age and gender, other confounding factors such as pre-existing respiratory conditions or comorbidities could have influenced the outcomes. Future studies with more rigorous control of these variables would enhance the validity of the findings.

Clinical Implications

The findings of this study support the adoption of the PIC scoring system as a standard protocol in the assessment and management of chest trauma patients. By enabling early identification of high-risk patients, the PIC score can guide decisions on ICU admissions, respiratory therapy, and discharge planning. This structured approach can improve patient outcomes, reduce healthcare costs, and optimize the use of hospital resources, making it particularly beneficial in settings with limited ICU availability.

VI. Conclusion

The PIC scoring system demonstrates significant potential as an effective and practical tool for managing chest trauma patients, with promising results in reducing respiratory complications, ICU admissions, and overall hospital stay. This study's findings suggest that the structured assessment of pain, inspiratory capacity, and cough strength can provide valuable insights into patient risk levels, enabling timely interventions that optimize patient care and resource allocation. By implementing the PIC scoring system as a standard protocol in trauma care, healthcare facilities can improve patient outcomes while reducing the burden on critical care resources. The PIC scoring system's simplicity and cost-effectiveness make it an accessible tool, particularly for hospitals operating in resource-limited settings. Although further research with larger sample sizes and multicenter studies is needed to validate these findings, the evidence presented here strongly supports the adoption of the PIC scoring protocol for enhancing the quality of chest trauma management. In conclusion, the PIC score offers a practical, efficient approach to managing chest trauma, aligning with the goals of improving patient safety, reducing morbidity, and supporting effective healthcare delivery.

References

1. Bailey & Love. *Short Practice of Surgery.* 28th Edition. Hodder Arnold Ltd, London. Chapter 26, p. 342.
2. Ekpe, E.E., & Eyo, C. (2014). Determinants of mortality in chest trauma patients. *Nigerian Journal of Surgery*, 20(1), 30-34.
3. O'Connor, J.V., & Adamski, J. (2010). The diagnosis and treatment of non-cardiac thoracic trauma. *BMJ Military Health*, 156(1), 5-14. doi:10.1136/jramc-156-01-02.
4. Sakran, J.V., Greer, S.E., Werlin, E., & McCunn, M. (2012). Care of the injured worldwide: Trauma still the neglected disease of modern society. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 20, 1-6.
5. Kant, K.C., Kant, K.S., & Noman, M. (2021). A study to evaluate the clinico-etiologic profile and management of patients with trauma to the chest in a tertiary care hospital. *European Journal of Molecular and Clinical Medicine*. doi:10.1155/2021/8052586.

6. Dogrul, B.N., Kiliccalan, I., Asci, E.S., & Peker, S.C. (2020). Blunt trauma-related chest wall and pulmonary injuries: An overview. *Chinese Journal of Traumatology*, 23(1), 1-7. doi:10.1016/j.cjtee.2020.04.003.
7. de Moya, M., & Mayberry, J. (2018). History of rib fracture management in rib fracture management. In *Rib Fracture Management*. SpringerLink.
8. Inaba, K., Lustenberger, T., & Nagata, I. (2012). Does size matter? A prospective analysis of 28-32 vs. 36-40 French chest tube size in trauma. *The Journal of Trauma and Acute Care Surgery*, 72(1), 1-8. doi:10.1097/TA.0b013e3182452444.
9. Terry, S.M., Shoff, K.A., & Sharrah, M.L. (2021). Improving blunt chest wall injury outcomes: Introducing the PIC score. *Journal of Trauma Nursing*, 28(1), 1-6. doi:10.1097/JTN.0000000000000618.
10. Zarogoulidis, P., Kioumis, I., & Pitsiou, G. (2014). Pneumothorax: From definition to diagnosis and treatment. *Journal of Thoracic Disease*, 6(1), 1-9. doi:10.3978/j.issn.2072-1439.2014.09.24.