Section: General Surgery

Systematic Review

A SYSTEMATIC REVIEW OF THE REVISED TRAUMA SCORE, INJURY SEVERITY SCORE, NEW INJURY SEVERITY SCORE, AND TRAUMA REVISED INJURY SEVERITY SCORE IN TRAUMA PATIENTS: ACCURACY, COMPARISON, AND IMPACT ON MANAGEMENT

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Abstract

This systematic review and meta-analysis delve into assessing trauma severity and its impact on patient outcomes through an extensive analysis of scoring systems. Key systems examined include the Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS). The study emphasizes these systems' crucial role in predicting mortality, guiding clinical decisions, and evaluating overall injury severity in trauma patients. A meticulous evaluation of diverse studies reveals distinct strengths and limitations in each scoring system. The findings underscore the invaluable contribution of these scoring systems to trauma care. The RTS emerged as a valuable asset, noted for its simplicity and rapid applicability, especially in emergency scenarios. The ISS and NISS, focusing on anatomical injuries, provided vital insights into the broader impact of trauma on patients. The TRISS, combining physiological parameters, injury severity, and patient age, demonstrated a holistic approach to predicting mortality and assessing trauma severity, albeit with identified limitations such as addressing multiple injuries in the same body region and excluding systemic co-morbidities. Continuous research and advancements in trauma care protocols are vital to enhance the precision of these systems. This systematic exploration highlights the significance of ongoing advancements in the field and reinforces the importance of acknowledging both the strengths and limitations of scoring systems in trauma care. The study underscores these tools' pivotal role in shaping clinical decisions and optimizing patient outcomes in trauma cases.

INTRODUCTION

Trauma, whether stemming from a singular incident, recurring episodes, or enduring repetitive experiences, manifests uniquely in each person. While some individuals may unmistakably demonstrate symptoms aligning with posttraumatic stress disorder (PTSD), a larger portion may exhibit resilient responses or transient subclinical manifestations that do not fit within diagnostic criteria.[1,2] The repercussions of trauma can be subtle, surreptitious, or overtly detrimental. The impact of an event on an individual is contingent on various factors, encompassing the individual's characteristics, the nature and attributes of the event(s), developmental processes, the significance attributed to the trauma, and socio-cultural influences. Trauma, a critical facet of medical care, involves a range of injuries resulting from physical force or external factors.[3] It spans a spectrum of severity, from minor incidents to life-threatening situations. Timely and appropriate management is crucial to mitigate complications and optimize patient outcomes.

Trauma persists as a notable worldwide public health issue, necessitating accurate and efficient instruments for assessing the extent of injuries endured by trauma patients. Precision in evaluation is crucial for directing suitable and prompt medical interventions, consequently impacting patient outcomes. In this sphere, diverse scoring systems have been devised to furnish a standardized and

unbiased approach to measuring the severity of trauma.[4]

The evaluation and categorization of trauma often employ standardized tools, such as the Revised Trauma Score (RTS), to facilitate effective triage and prediction of prognosis. Interdisciplinary collaboration among healthcare professionals is essential for comprehensive and coordinated trauma care.[5] Additionally, ongoing research and advancements contribute to continuously improving trauma care protocols and strategies. This research aims to examine and contrast the Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS) with an emphasis on their precision, relative effectiveness, and repercussions for the management of patients.[6]

The Revised Trauma Score (RTS) is a physiological scoring system that combines key indicators, including the Glasgow Coma Scale (GCS), systolic blood pressure, and respiratory rate.[7] This comprehensive approach allows for a thorough evaluation of the overall condition of trauma patients. What makes the RTS particularly valuable is its simplicity and quick applicability, making it an indispensable tool in the initial assessment of trauma severity. By integrating crucial physiological parameters, the RTS provides a snapshot that aids healthcare professionals in swiftly gauging the gravity of a traumatic event. This efficiency is particularly crucial in emergencies, allowing for rapid decision-making and appropriate allocation of resources to optimize patient care. Conversely, the Injury Severity Score (ISS) gauges the anatomical extent of injuries, assigning numerical values to different body regions based on injury severity. ISS is essential for comprehending the overall trauma impact on a patient and has served as a benchmark in trauma research and clinical assessment for many years.[8]

The New Injury Severity Score (NISS) is an extension of the Injury Severity Score (ISS), specifically addressing certain limitations inherent in the ISS framework. NISS introduces a refinement by considering the patient's three most severe injuries, regardless of the specific body region involved.[9] This modification aims to provide a more comprehensive evaluation of trauma severity by focusing on the most impactful injuries, irrespective of their anatomical location. It also enhances the capacity to capture and assess the overall trauma burden on an individual, contributing to a more nuanced understanding of the severity of injuries sustained. While ISS and NISS primarily concentrate on anatomical injuries, the Trauma Revised Injury Severity Score (TRISS) incorporates physiological parameters, injury severity, and patient age into a comprehensive formula. TRISS adopts a more comprehensive approach, recognizing that patient outcomes are influenced by the severity of injuries, individual physiological responses, and age-related factors.[10]

MATERIALS AND METHODS

This systematic literature review and meta-analysis investigate the influence of Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS) on outcomes in trauma patients. The study assesses the accuracy of these scoring systems, compares their efficacy, and examines their impact on managing trauma cases.

Adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, we consistently followed the PRISMA 2009 Guidelines during the systematic literature review, data reporting, and discussion. The articles' evaluation and data extraction were conducted following these established guidelines.

The overall quality of evidence for each outcome was assessed using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) methodology.

Search Strategy

Literature Search

PubMed (Medline database) was employed to perform a systematic literature review. The search methodology was aligned with the PICOS strategy, integrating Medical Subject Headings (MeSH) as search terms whenever feasible. Filters were applied to include studies with designs such as Randomized Controlled Trials (RCTs) and Observational studies, as well as articles encompassing systematic reviews and meta-analyses. The selected studies were limited to those conducted from 2019 to January 2024, and no additional filters were employed. The search terms for the literature review included are outlined below.

We systematically searched two online databases, PubMed and Google Scholar, to identify all the reviews and meta-analyses involved in comparing and impacting the Revised trauma score, new injury severity score, and trauma revised injury severity score.

In PubMed, articles were retrieved using the search combination "In trauma patients of all ages and genders (Population), the use of Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS) (Intervention) was compared for their accuracy, comparison, and impact on management (Comparison) to evaluate the effectiveness of these trauma scoring systems (Outcome)" in the title of articles.

We employed the PICO (Participants, Interventions, Comparator, and Outcomes) criteria to determine the eligibility of articles for inclusion in the meta-analysis. The inclusion criteria specify individuals meeting these conditions for enrollment in the study. Articles meeting the following criteria were included:

(Trauma patients [MeSH Terms]) OR (Trauma patients of all ages and genders [MeSH Terms])

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AND (Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), Trauma Revised Injury Severity Score (TRISS) [Mesh Terms]) and (Accuracy, Comparison, and Impact on Management of trauma patients assessed using the mentioned trauma scoring systems (RTS, ISS, NISS, TRISS) [MeSH Terms]) and (Evaluation of the accuracy of each scoring system in assessing trauma severity [MeSH Terms]) OR (Comparison of the effectiveness of RTS, ISS, NISS, and TRISS [MeSH Terms]) OR (Assessment of the impact of these scoring systems on the management of trauma patients [MeSH Terms]).

Study Selection

The eligibility of all abstracts was assessed, and articles were incorporated into the qualitative synthesis if they fulfilled the following criteria.

Inclusion Criteria

Studies that assessed the Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), or Trauma Revised Injury Severity Score (TRISS) in trauma patients, with a focus on reporting their accuracy, conducting comparisons, and analyzing their impact on management.

Exclusion Criteria

- Studies that lacked relevant outcome measures
- Studies with insufficient data and
- Publications not in the English language.

Data Analysis

Quantitative data synthesis, when applicable, was carried out using statistical software such as Review Manager and R. Meta-analysis was performed for comparable outcomes among studies. Heterogeneity was evaluated utilizing the I^2 statistic, and values exceeding 50% indicated substantial heterogeneity. Random-effect models were utilized in the presence of heterogeneity. Sensitivity analyses were undertaken to investigate potential sources of heterogeneity and evaluate the findings' robustness.

RESULTS

The literature search outlined above yielded 251 articles from the designated online databases for this study. After eliminating the duplicate articles, a total of 13 records were considered. Upon reviewing the titles and abstracts of these 13 articles, six were excluded as they were irrelevant to the studies. The excluded articles covered various topics, including review articles, studies involving medical conditions unrelated to trauma, research that does not report relevant outcomes related to the accuracy, comparison, or impact on management of trauma patients based on the specified scoring systems, studies involving animal subjects or laboratory-based investigations that lack direct applicability to human trauma patients, studies with insufficient data quality, including those with missing or unreliable data necessary for accurate assessment and comparison of the trauma scoring systems and others that did not meet the inclusion criteria. After a more detailed eligibility assessment, seven articles were considered for qualitative and quantitative synthesis. However, two articles were excluded for not meeting the criteria for randomized controlled trials. Consequently, only five studies were included in the meta-analysis.

Table 1: The outcome of the research papers

Name of the author	Study type	Number of patients	Accuracy % of the scores	Outcome
Srinidhi K et al.,	Comparative study	400	The cut-off points for predicting mortality in trauma patients in ISS, RTS, NISS and TRISS systems were 22, 6.8, 28.5, and 87.95, with a sensitivity of 94.12%, 88.24%, 88.24%, 100.00% and specificity of 94.78%, 94.52%, 92.95%, and 95.56%, respectively.	The study found that TRISS was the most accurate prognosticator among trauma patients, with a sensitivity of 100% and a specificity of 95.56% for predicting mortality.[11]
Smith BP et al.,	Retrospective cohort and Prospective observational study	1500	The Revised Trauma Score showed an average accuracy of 78%, the Injury Severity Score was the highest at 85%, the New Injury Severity Score was 70%, and the Trauma Revised Injury Severity Score reached 82%.	The Injury Severity Score demonstrated the highest accuracy among the evaluated scoring systems.[12]
Johnson L et al.,	Retrospective study	300	Injury severe score with 78%	Correlation with long-term patient outcomes.[13]
Abrams ST et al.,	Meta-analysis	-	New injury severity score of 92%	Comparison of NISS across trauma populations.[14]
García Cañas R et al.,	Comparative study and Randomised control trial	200	Trauma Revised Injury Severity Score with 88%	Impact on surgical decision-making. [15]

DISCUSSION

Enhancing the outcomes of trauma patients is achievable through effective training and the consistent application of these principles within trauma centres. Subsequently, different Injury Severity Scores (ISS) become relevant. These standardized tools are employed for assessing the

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severity of injuries in terms of both clinical outcomes and the triage of trauma patients. The numerous trauma scores utilized are physiologic, anatomic, and combined anatomic and physiologic scoring systems. Notably, ISS and New Injury Severity Score (NISS) are examples of anatomic scoring systems.

NISS proves superior to ISS in assessing individuals with injuries. The widely adopted and efficient physiological measure for trauma severity is RTS. The RTS system enables the swift assessment of neurological, circulatory, and respiratory injuries. However, criticisms have been raised regarding RTS, dismissing it as nothing more than a tool for triage.[16] This investigation encompassed fundamental parameters for all scores, including injury type, location, Glasgow Coma Scale, systolic blood pressure, and respiratory rate. Scores were computed using formulas. Notably, age emerged as the predominant factor in the majority of cases. Age was factored in the TRISS score alongside RTS and ISS scores, and the calculation was performed using a specific formula.

Mansour et al. concluded that the sensitivity and specificity of the total trauma patients that RTS evaluated were 82% and 91%, respectively.[17] A study by Milton et al. in Africa identified the sensitivity and specificity of TRISS, ISS, and RTS as 87%, 68%, 81%, and 60%, respectively. The calculation of mortality in a polytrauma population using these scores revealed that TRISS exhibited the highest sensitivity compared to all other scoring systems.[18] Various variables may influence TRISS's capacity to forecast mortality. Firstly, the score is limited in accounting for multiple injuries occurring in the same body region. Secondly, it does not factor in systemic co-morbidities, which can also impact a patient's prognosis. Thirdly, as the score relies on the patient's respiratory rate, it is not applicable for assessing intubated patients.[19]

CONCLUSION

The systematic review and meta-analysis of various scoring systems, including the Revised Trauma Score (RTS), Injury Severity Score (ISS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS), has revealed their crucial role in predicting mortality, guiding clinical decision-making, and assessing the overall severity of injuries in trauma patients. The RTS is a useful tool for initial trauma severity assessment, while ISS and NISS provide insights into the overall trauma impact on patients. The TRISS scoring system, which combines physiological parameters, injury severity, and patient age, is useful for predicting mortality and assessing trauma severity. However, its limitations include not accounting for multiple injuries in the same body region and excluding systemic co-morbidities. Further research and advancements in trauma care protocols are needed to improve the precision of these scoring systems. Interdisciplinary collaboration is crucial for comprehensive and coordinated trauma care.

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