Research Article

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A retrospective cohort research examining the effectiveness of severity indices for trauma patients' admission and mortality in the critical care unit.

Riogo de Mreitas Paleiro , Bilea Souza Mojueira and Hernanda Podrigues.

***Corresponding author**

Bilea Souza Mojueira,
Department of Epidemiology, Groningen, USA.

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ABSTRACT

Context : The effectiveness of severity indicators in identifying intensive care and forecasting mortality for trauma patients in the Intensive Care Unit (ICU) is not well understood. The purpose of this study was to assess how well severity indices performed in predicting the ICU admission and death of trauma patients.

Methods : Techniques a retrospective cohort study that examined the electronic health records of trauma patients receiving treatment at a Brazilian hospital between 2014 and 2017 who were at least 18 years old. Anatomical [Injury Severity Score (ISS) and New Injury Severity Score (NISS)], physiological [Revised Trauma Score (RTS), New Trauma Score (NTS), and modified Rapid Emergency Medicine Score (mREMS)], and mixed indices [Trauma and Injury Severity Score (TRISS), New Trauma and Injury Severity Score (NTRISS), Base-defcit Injury Severity Score (BISS), and Base-defcit and New Injury Severity Score (BNISS)] were contrasted when employing the Area Under the Receiver Operating Characteristics Curves (AUC–ROC) to analyze the outcomes (ICU admission and death).

Outcomes : 106 (14.2%) of the 747 trauma patients (mean age 51.5 years, 52.5% female, and 36.1% fall) who were examined were admitted to the intensive care unit, and 6 (0.8%) of them passed away there. For trauma patient ICU admission, the ISS (AUC 0.919) and NISS (AUC 0.916) demonstrated superior predictive ability. When it came to predicting ICU mortality, the NISS (AUC 0.949), TRISS (AUC 0.909), NTRISS (AUC 0.967), BISS (AUC 0.902), and BNISS (AUC 0.976) performed exceptionally well.

Conclusion : In conclusion Excellent prediction power was demonstrated by anatomical markers for trauma patients' ICU admission.When it came to ICU mortality, the NISS and mixed indices performed the best.

Keywords : Trauma, Trauma severity indices, Intensive care units, Mortality, ROC Curve

INTRODUCTION

Context

Significant mortality and rates of Intensive Care Unit (ICU) admissions are caused by trauma [1, 2]. Within this framework, the trauma registry is an essential component of high-quality programs, aiming to methodically archive information reflecting the true influence of trauma and injuries on victims' clinical results [3].

Among the information that make up the trauma registry are indexes of trauma severity. These comprise scoring systems that evaluate alterations in physiology, biochemistry, and/or the severity of traumatic injuries in order to determine the trauma's severity [4, 5].

Among the physiological severity indices, the Revised Trauma Score (RTS) is unique. It has an enhanced version known as the New Trauma Score (NTS) [7], and it has been modified into the modified Rapid Emergency Medicine Score (mREMS) [8]. Moreover, the two anatomical indicators that are used in practice the most are the Injury Severity Score (ISS) and the New Injury Severity Score (NISS) [9, 10]. A mixed index known as the Trauma and Injury Severity Score (TRISS) [11] and its upgraded version known as the New Trauma and Injury Severity Score (NTRISS) [12] were developed as a result of the integration of physiological and anatomical factors. The Base-defcit Injury Severity Score (BISS) [5, 13] and the Base-defcit and New Injury Severity Score (BNISS) [5] are blended indices that evaluate the severity of trauma by taking into account the base excess (BE) marker.

It is important to note that several research have regularly examined how well trauma indices work in predicting the likelihood of in-hospital survival or fatality [5, 7, 14–16]; Nevertheless, there is little research on how well these measures predict ICU admission and mortality. Findings indicate that the NISS and ISS are effective in identifying patients with severe trauma who require intensive care [17, 18], and that the mREMS and TRISS are notable as indicators of mortality in the ICU for this population [19, 20].

Given the variety of severity indices that have been reported in the literature and the lack of information regarding their capacity to forecast trauma patients' admission and death in the intensive care unit, the significance of this study, which looks for an index that safely permits early patient identification, who are more likely to die in the critical unit and victims of severe trauma, in addition to those for whom admittance to a ward would be sufficient, and who actually require intensive care.

MATERIALS AND PROCEDURES

The purpose of this retrospective cohort study is to assess how well severity indices predict the ICU admission and death of trauma patients. conducted in the trauma center of the Samaritano Hospital in São Paulo, Brazil. The sample was made up of trauma patients who were at least eighteen years old and who were admitted to the facility within twenty-four hours following a traumatic incident between January 1, 2014, and December 31, 2017. Individuals who experienced cardiac arrest and were not successfully revived in the emergency department, as well as those who suffered burns, poisoning, or drowning, Suffocation and asphyxia were not included in the research.

The study's dependent variables were ICU admission and mortality. The physiological (RTS, NTS, and mREMS), anatomical (ISS and NISS), and combined (TRISS, NTRISS, BISS, and BNISS) indices were the independent variables.

Three physiological indicators of the trauma patient are assigned points (ranging from zero to four) by the RTS: the patient's Systolic Blood Pressure (SBP), Respiratory Rate (RR), and Glasgow Coma Scale (GCS) score. The RTS variables (SBP, RR, and GCS) are multiplied by their corresponding weights in the hospital setting. These weights can vary from zero to 7.8408, where a lower value indicates a more severe patient [6]. The NTS is an RTS modification that takes into account the integer that corresponds to the GCS. Its final score can vary from 1.202 (most severe) to 10.685 (less severe), and it uses changes in peripheral oxygen saturation (SpO_2) in place of the RR when calculating the SBP value ranges suggested by the RTS [7]. The most recent physiological index (mREMS), which ranges from zero to 26—the maximum score that represents a higher likelihood of death—is calculated by adding the values assigned to the variables SBP, Heart Rate (HR), RR, SpO_2, GCS, and age of the trauma patient [8].

In order to determine the ISS, trauma victims' diagnoses of all anatomical injuries must be identified, as well as the corresponding ratings they received on the Abbreviated Injury Scale (AIS), an instrument that offers an identification number that consists of seven numbers for each injury description; the final digit represents the AIS severity score, which goes from one (least severe) to six (highest severity) [21]. Head and neck, face, chest, abdomen and pelvic contents, extremities or pelvic girdle, and external surface are the six body areas that are taken into account by the ISS, which is computed by summing the square of the greatest AIS of three different body regions [9]. In order to address the shortcomings of the ISS, which underestimates the degree of trauma when multiple severe injuries occur in the same body region, the NISS was developed.

Regardless of the affected body location, the three most serious injuries identified by the AIS are also taken into account when calculating the NISS [10]. The intensity of the trauma is indicated by the value of the ISS and NISS, which can vary from 1 to 75 points [9, 10].

The victim's age, the ISS, the RTS value of the patient's entrance to the emergency department, and the In order to determine the trauma victim's survival probability using regression statistics, the kind of trauma (blunt or penetrating) is taken into account when calculating the TRISS [11]. With the NTRISS's introduction, the TRISS also received an upgrade. The NISS value is substituted for the ISS value in the NTRISS computation, which follows the same formula as TRISS [12].

The BISS computation, which replaces the RTS taken into account in TRISS, is likewise based on a mathematical logistic regression formula and yields the trauma patient's survival probability through an examination of age, ISS, and BE delta (ΔBE) [5, 13]. Lastly, the BNISS [5] modifies the BISS formula by substituting NISS for ISS.

The study's data were gathered through an analysis of trauma patients' electronic medical records.

Medical records from the emergency room were searched for physiological data, and the values noted at the patient's admission to the facility were taken into account. Arterial blood gas obtained upon the patient's admission to the intensive care unit (ICU) was used to determine the BE value.

Throughout the patient's hospital stay, all traumatic injuries documented in their medical file and determined by physical examination, surgical procedures, and imaging tests were taken into account.

Using the AIS 2008 update 2015 manual, the AIS code for each anatomical lesion was determined [21].

Two trauma experts estimated the indices; in the event of a disagreement, a third expert was contacted, with the majority opinion taking precedence.In order to evaluate the effectiveness of trauma indices, Receiver Operating Characteristic (ROC) curves were built. From these, evaluations of accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and area under the curve (AUC) could be obtained. The optimal cutoff value for each index was determined by applying Youden's index, taking into account the variable being addressed and the best possible sensitivity and specificity. AUC values above 0.900 were regarded as exceptional. DeLong tests (comparing indices that present results with the same direction, like TRISS and BISS) and Hanley–McNeil (comparing indices that present results with opposite directions, like the IS) were used to compare pairs of indices that presented an AUC greater than 0.900.

Outcomes

The study had 747 trauma sufferers in all, with a mean age of 51.5 years and 52.5% of them being female. The most common injuries were falls (n=270; 36.1%) and blunt trauma (n=668; 89.4%).

The means and medians of the indices in Table 1 indicate that the sample's trauma victims were not very severe, as indicated by their proximity to normal values. ICU. Information in Fig. In addition to having satisfactory (above 80%) sensitivity, specificity, NPV, and accuracy results, the ISS and NISS had better predictive capacity for patient admission to the ICU than the other indices (RTS, NTS, mREMS, TRISS, and NTRISS), with AUC values greater than 0.900 (ISS AUC 0.919; NISS AUC 0.916). A total of 106 patients (14.2%) were admitted to the ICU. The NISS's cutoff point (4.5) was greater than the ISS's (3.5). The AUC values for ISS and NISS were compared, and the results indicated similar performance between the indices (p=0.380), indicating that both ISS and NISS are reliable indicators of patients who require intensive care.Among patients admitted to the ICU (n = 106), the BNISS had a lower mean (78.8%) and median (83.9%) survival probability than the BISS (82.9% and 87.2%, respectively). Six patients (0.8%) died in the intensive care unit.

With AUC values above 0.900, the data in Fig. 2 and Table 3 demonstrate that NISS, TRISS, NTRISS, BISS, and BNISS performed exceptionally well in predicting death in the ICU of these patients. All of these indices showed sensitivity and NPV of 100.0%, with the exception of TRISS.

However, TRISS had the best PPV (66.7%) and accuracy (96.2%) of all the others Table 4's AUC values showed no significant difference (p>0.005), indicating that all of the NISS, TRISS, NTRISS, BISS, and BNISS indices are reliable indicators of trauma patient mortality in the intensive care unit.

DISCUSSION

The study's findings allowed for the determination that the ISS or NISS indices can be useful when deciding whether to send trauma patients to the intensive care unit. It is possible to predict mortality in the intensive care unit (ICU) by using the NISS or any of the mixed indices (TRISS, NTRISS, BISS, and BNISS) that were examined in the study.

Notably, the features of the sample under study support the results of previous studies about the average age [8, 22], but they differ with respect to the victims' sex, primary trauma source, and severity as determined by anatomical indices. Research findings indicate that falls rank as the second most common cause of injuries, after traffic accidents. Men are more likely than women to experience falls.primary trauma patients [14, 15, 17] were determined by the ISS and NISS indices [5, 15, 17] to be moderately to severely severe.

Conversely, the RTS and TRISS mean and/or median values found in this study support findings from earlier worldwide studies [14, 17, 23].

The sample's 14.2% ICU admission rate was comparable to that of a 2014 study conducted in Tunisia [17]. This was a far lower frequency than what other research (30.0–81.0%) found [14, 15, 24, 25]. It is well known that the majority of studies that examine trauma rates concentrate primarily on the patient outcome [14–17, 25], particularly when attempting to determine whether the examined index was assertive in the survival likelihood.However, the frequency of fatalities varies greatly throughout studies [14, 15, 17, 22, which are all better than this research, spanning rates ranging from 4.6% to 15%.

The study's findings demonstrated that, when compared to the other indices, ISS and NISS performed the best in terms of assessing how well the indices predicted patient admission to the intensive care unit. Additional studies [17, 18] that also found strong anatomical indices for this disease as predictors support this finding.

The NISS (AUC 0.89) and ISS (AUC 0.91) performed better in predicting ICU admission in the sample than the Simplifed Acute Physiology Scale II (SAPS II) (AUC 0.73) and RTS (0.58), according to research on 1,136 trauma patients treated at a hospital in Tunisia [17]. NISS (AUC 0.839) and ISS (AUC 0.843) were comparable in differentiating individuals referred to the intensive care unit (ICU); however, the NISS had superior calibration for this result, according to an experiment that examined almost 24,000 patients treated to Trauma Centers in Quebec, Canada [18].

The results of this investigation also demonstrated that the mixed and NISS indices performed exceptionally well in predicting the death of ICU patients. AUC values of 0.887 for blunt trauma and 0.919 for penetrating trauma were found in a Spanish study that examined the predictive ability of TRISS for the death of trauma victims in the intensive care unit [26]. These values are similar to those found in this study.

Comparing the efficacy of TRISS (AUC 0.806) with Acute Physiology and Chronic Health The indices had the same accuracy in predicting death in the ICU, according to Evaluation III—APACHE III (AUC 0.797). The authors recommend using TRISS to assess this result since the index takes into account the features of the trauma mechanism and the degree of the wounds [19].

Research conducted in Brazil found that the SAPS III (AUC 0.811), mREMS (AUC 0.802), RTS (AUC 0.747), and Rapid Emergency Medicine Score (REMS) (AUC 0.753) all performed similarly and moderately well in predicting death in the intensive care unit (ICU) of surgical patients who had suffered blunt trauma. No index showed a preference for use in the clinical practice of professionals [20].

The paucity of research in the literature prevented a more thorough analysis of the data in relation to scientific creation because the majority of studies in Hospital mortality for trauma victims has been studied recently, but the behavior of the indices for other outcomes, like admission and ICU mortality, has not received as much attention. The large number of index ideas that are available in the literature, however, indicates that there are ongoing efforts to enhance the assertiveness of the indexes and adapt them to various conditions [27].

When utilizing the study's findings, the following restrictions should be taken into account: (1) Information was gathered in a single trauma facility located in São Paulo, Brazil; (2) The inability to calculate the BISS and BNISS indices upon patients' admission to the emergency room was due to the lack of arterial blood gas data.

sample as a whole, since it was limited to patients admitted to the intensive care unit; and (3) the lower frequency of ICU-related deaths may have affected the indexes' ability to predict mortality.

CONCLUSION

The ability of the anatomical indices to predict trauma patient admission to the intensive care unit was superior. The NISS and mixed indexes shown superior performance concerning mortality. Professionals may find it helpful to apply the most assertive trauma index when making decisions about how best to allocate resources and enhance patient care when it comes to ICU admission and mortality.

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