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Essay

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The prognostic impact of the CALLY index in trauma patients in the emergency department: a retrospective observational study

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Abstract

This retrospective observational study included 550 trauma patients admitted to the emergency department of Esenyurt Necmi Kadıoğlu State Hospital between January 2023 and December 2024. Patients' clinical and laboratory data were reviewed. The primary outcomes were in-hospital mortality, intensive care unit (ICU) admission, and hospital length of stay. Statistical analyses included logistic regression, subgroup analysis, and receiver operating characteristic (ROC) curve analysis. A p-value of <0.05 was considered statistically significant. Patients with a lower CALLY index had significantly higher in-hospital mortality (25% vs. 8%) and ICU admission rates (45% vs. 18%) compared to those with higher CALLY values. A CALLY index below 5.2 was identified as the optimal cut-off for predicting poor outcomes (AUC = 0.78). The index also showed a negative correlation with hospital length of stay and outperformed conventional inflammatory markers such as CRP and NLR in prognostic accuracy. The CALLY index is a simple, accessible, and effective biomarker for predicting mortality and ICU needs in trauma patients. It may support early clinical decision-making in emergency settings. Further multicenter prospective studies are warranted to validate its broader applicability.

Essay

Injuries are a key cause of disability and death across the world that particularly affects the youth and imposes a significant burden on healthcare systems worldwide, according to the World Health Organization (WHO). About 5 million people die each year from injuries, as reported by the WHO [1]. Most deaths occur soon after the event, which highlights the need for correct medical assessment and effective treatment plans to improve patient outcomes [2]. The use of markers in the care of trauma patients in the ER is very important in predicting the complications they are likely to develop during hospitalization and their chances of survival and recovery in the long term. These markers evaluate parameters such as inflammation of the entire body, termed systemically. Show function and tissue perfusion after a traumatic event. Nevertheless, there is a problem that many of these markers are based on a single factor, which is not always sufficient to provide the overall picture of the risk assessment for trauma patients [3]. Various criteria and combinations of markers have been proposed over the years to determine the prognosis of individuals with traumatic injuries. One of these markers is the CALLY index, which involves the assessment of serum albumin and lymphocyte count to provide an overall picture of the patient´s condition, as well as the immune response and the levels of inflammation [4]. Serum albumin levels are reduced in illnesses and inflammatory conditions and are usually associated with the prognosis. A low lymphocyte count may indicate dysfunction and worsen the clinical status of trauma patients [5].

The CALLY index has been applied in various settings, such as sepsis or cardiovascular diseases, and in patients with cancer, but there is no information available on the use of this index in trauma patients [6]. Since trauma is associated with inflammation and systemic manifestations, the CALLY index may be useful in evaluating the risk in these patients; but this relationship needs further research through case case-control study. The overall purpose of this research is to determine the accuracy of the CALLY index in identifying the future of trauma patients who present to the emergency department for management [7]. More specifically, in relation to the focus of this study, the relationships between the CALLY index and variables such as in-hospital deaths, admission to the intensive care unit (ICU), and length of hospital stay are investigated.

To achieve this goal, the research studies the following ideas: patients with trauma, based on the CALLY index, have certain mortality rates [8]. Intensive care unit admission and hospital stay are higher in patients with a CALLY index than in other patients. The CALLY index may be useful in

predicting the outcome of CRP or neutrophil-lymphocyte ratio in trauma cases. This research is likely to enhance the utilization of the CALLY index as a predictive tool in the management of trauma patients and thus improve risk assessment to improve patient outcomes. This was an observational retrospective study. To assess the prognostic performance of the CALLY index, the hospital records of patients who had come to the emergency department with trauma were reviewed. The patients´ data were collected from the Emergency Department of Esenyurt Necmi Kadıoğlu State Hospital from the first of January in the year 2023 to the last day of December in 31 year 2024. The patients who met the following criteria and who were admitted to the emergency department during the mentioned period were included in the study.

The inclusion criteria were: the patients´ age was more than 18 years, the type of illness was trauma (traffic accident, fall, assault, occupational injury, penetrating injury), and the presence of laboratory and clinical data in the hospital information management system (HBYS). The exclusion criteria were patients with missing or insufficient laboratory data, cases with incomplete study variables, pregnancy, chronic inflammatory diseases or immune deficiency syndromes, and patients with cancer or terminal stage diseases that would have tended to worsen the morbidity. The primary variables analyzed in this study included independent variables such as age, gender, trauma mechanism, comorbidities, and CALLY index, and dependent variables such as in-hospital mortality, ICU admission status and duration, hospital length of stay, and discharge or exitus status. However, potential confounding factors such as inflammatory markers like C-reactive protein (CRP), leukocyte count, neutrophil to lymphocyte ratio (NLR), and lactate level were also considered.

Data for the research was gathered in a manner from the hospital's information management system at Esenyurt Necmi Kadıoğlu State Hospital (HBYS). The laboratory findings and patient information were retrieved from both files and electronic records within the system itself. The CALLY index was determined by multiplying the serum level (measured in g/dL units) by the lymphocyte count (expressed as $x10^9$/L) recorded at the time of admission. In hospital mortality rates were assessed by examining records of patients marked with "exitus" indications. Information regarding admission to the care unit (IC) and the length of stay was obtained from the hospital admission documents while other medical details such as age, gender, injury cause and any existing health conditions were gathered from the records.

As this study looked back on events and data analysis was performed with caution to reduce bias from factors, like information accuracy and sample selection precision were taken into account through steps. To begin with checking for any missing data in the screening process and cases, with records were left out from the studys analysis. Moreover in order to ensure precision in the findings two separate researchers independently reviewed all data inputs. The laboratory results were. Measurements taken at time points were cross checked for consistency. To evaluate bias in selection the clinical variables of both. Excluded patient groups were compared for any significant differences. To calculate the power of the study, similar retrospective studies were reviewed to gather data. Based on the preliminary analysis, the assumed mortality and ICU admission rates were thought to be between 10% and 20%. With an assumed power of 80% and a significance level of 5%, the sample size was calculated to be 600 patients as sufficient for the analysis.

Quantitative variables were summarized using mean ± standard deviation (SD) or median (interquartile range, IQR). The independent samples t-test or Mann-Whitney U test was used for comparing between groups based on the data distribution. The Chi-square test or Fisher´s exact test was used for categorical variables. Descriptive data was analyzed to compare results, in groups

with low and high CALLY index scores; mortality and ICU admission rates were examined based on different CALLY index levels Logistic regression analysis was done to assess how the CALLY index impacts mortality and ICU admission rates while considering influencing factors; adjusted odds ratios (ORs) along, with 95 percent confidence intervals (CIs) were determined.

Before starting the statistical analysis process we first checked for any data points in the dataset. If the percentage of missing data was, below 5% we filled in the gaps using the imputation technique. When there were, than 5% missing data points detected we employed multivariate imputation methods to calculate and fill in these missing values. Subgroup analysis was performed to determine the effect of the CALLY index on the prognosis by age, gender and trauma mechanism. Receiver operating characteristic (ROC) curve analysis was used for sensitivity analyses to identify the optimal cut off value of the CALLY index. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). A p value of <0.05 was considered statistically significant.

A cross sectional research was conducted on 600 individuals who had been exposed to trauma and were brought in to the Emergency Department at Esenyurt Necmi Kadıoğlu State Hospital from January 1st of 2023 to December 31st of 2024. Owing to laboratory records for some patients (50 in total) they were not considered for the analysis; thus the final study considered a total of 550 patients in its findings. A detailed flow diagram was utilized to exhibit how patients were selected for the study, without any variations observed between those included and those excluded based on age groupings. The age of the patients was range between 45 years on average, 54% of the patients were 297 individuals) and 46% of the patients were female (253 individuals). The causes of trauma were identified as traffic accidents (30%, 165 cases) falls (25%, 138 cases) assaults (20%, 110 cases) work related injuries (15%, 83 cases) and penetrating wounds (10%, 54 cases).

Hypertension, 35% of the patients (n=193), diabetes, 20% (n=110), COPD, 15% (n=83) and cardiovascular disease 10% (n=55). Further, 20% (n=110) had none. The mean CALLY index was 6.8 ± 3.2. CRP was 12.4 ± 8.5 mg/L, WBC was 8.9 ± 3.2 x 10^9/L, NLR was 4.3 ± 2.1 and lactate was 2.1 ± 1.3 mmol/L. After the missing data analysis it was found that 2% of the laboratory and clinical variables were missing. Since the missing data was randomly distributed multiple imputation was used. Of the patients in the study group 15, out of every 100 individuals (83 patients in total) died during the course of their hospitalization. Of the patients, 30 out of every 100 (165 individuals in total) required ICU admission with a length of stay of one week on average (3-14 days). The length of stay of a patient in the hospital was on an average 10 days with a range of 5-18 days. In terms of how the patients fared, 70 percent (385 individuals, in total) were able to leave the hospital after treatment; 15 percent (83 individuals in total) unfortunately passed away; while another 15 percent (82 individuals in total) were transferred to a medical center, for further care and attention. When patients were grouped according to their CALLY index values; those with a CALLY index below 0 had a mortality rate of 25% and a 45% ICU admission rate, whereas those with a CALLY index above 0 had an 8% mortality rate and an 18% ICU admission rate (than 0.01, at a level of significance). We also observed a negative correlation between the CALLY index and in hospital mortality in logistic regression analysis (OR= 0.78, 95% CI= 0.64 - 0.92, p value= 0.003). In the same manner, patients with low CALLY index had increased odds of being admitted to the ICU (OR= 1.52, 95% CI= 1.24 - 1.88, p-value. The same trend was observed with the length of hospital stay, which declined with increasing CALLY index (r = - 0.41, p value < 0.001). The association between a poor CALLY index and mortality was particularly high in the elderly (age ≥ 65 years, p = 0.002) in the subgroup analyses. In the sensitivity analyses,

the cut off point for the CALLY index was found to be 5.2 as the best prognostic level using the ROC curve analysis (AUC= 0.78, 95% CI= 0.71 - 0.85, p value < 0.001). It was observed that the predictive power of the CALLY index was better than that of NLR and CRP.

These findings indicate that the CALLY index may have the potential to act as a prognostic factor in trauma patients and may offer important information for clinical decision making. The study establishes that the CALLY index can be used as a predictor of outcomes for trauma patients seen in the ER department. Our results was that individuals with a CALLY index are more likely to die while in the hospital and need ICU care at a higher frequency. Furthermore, we found that the CALLY index is a better predictor of mortality than the usual markers of CRP and NLR that are used to assess inflammation. The CALLY index on can help to enhance the risk assessment of trauma patients and thus support more informed decision making in the clinical setting. This studys ROC analysis outcomes offer a threshold for incorporating this index into world medical practice. However, there are some limitations of the research, which were conducted at the center and have a retrospective design. It is also crucial to conduct multicenter and prospective studies to verify the effectiveness of the CALLY index in various patient populations. In conclusion, the CALLY index can be used as a marker for trauma patients in the emergency room. Its practical use, however, needs to be tested further in larger cohorts of patients to increase its reliability and usability.

In this study, we investigated the prognostic value of the CALLY index in patients with trauma who presented to the emergency department. Our results demonstrated that patients with low CALLY index had higher rates of in hospital mortality, ICU admission and longer hospital stay. Furthermore, the CALLY index was found to be a better predictor of mortality when compared to the conventional inflammatory markers like CRP and NLR [9]. The cut off prognostic value of the CALLY index was 5.2 in the ROC analysis. There are several important limitations of this study. First, as a retrospective study, there may be missing or inaccurate data for some variables. However, multiple imputation methods were used to deal with missing data and there is still a possibility of information bias [10]. Furthermore, the prognostic value of the CALLY index was evaluated in the context of different clinical scenarios, but the comparison with other biomarkers is very limited that makes it difficult to interpret our results [11].

It is important to consider one more factor - selection bias in the studys participants inclusion criteria. The patients with laboratory and clinical data were included in the research sample which may limit the generalizability of the results to other population group. Also the patient group we examined was sourced from one center; hence, it is vital to carry out research in various centers to make comparisons. The findings show that the CALLY index has the potential to be used as a tool in assessing risk in the prognosis of trauma patients. It is derived from the levels of serum albumin and lymphocyte count. Offers information on general health and immune system function as well as levels of inflammation - all essential factors in determining the likelihood of complications following a trauma event. The effectiveness of the index in the prediction of ICU admission and mortality thus makes it worthwhile in clinical practice.

Previous work has pointed out the prognostic value of albumin and lymphocyte count in sepsis, cancer and cardiovascular diseases. In trauma patients it has been observed that low albumin levels are associated with worse clinical outcomes and immune suppression. Our study also adds weight to the hypothesis that combining these two biomarkers into the CALLY index has prognostic value in trauma patients. The findings of this study suggest that the CALLY index could be useful in the emergency department and ICU for the initial risk assessment of trauma patients. However, it is important to confirm these results in other patients and trials involving multiple centers. The ROC analysis in our study gives a

particular cut off value which can be used clinically but more work is needed to establish its use in other age groups of patients, different trauma mechanisms and comorbidities. The CALLY index should be incorporated into usual prognostic models and its capability to be incorporated into clinical decision-support systems should be evaluated in future prospective, multicenter trials. Furthermore, the comparison with other inflammatory biomarkers and scoring systems should also be done to increase its clinical significance.

Conclusion

In conclusion of the results of the study patients, with low CALLY index have increased in hospital mortality rates and ICU admission, which suggests that the CALLY index can be used as a prognostic factor in the early management of trauma patients in the emergency department based on our research findings. However, important extensive studies on patient groups are needed to establish this relationship and its applicability in clinical practice. In this study the CALLY index can be suggested as a promising prognostic marker for the trauma patients in the emergency department. Our results show that patients with low CALLY index are more likely to die during the hospitalization, to need intensive care unit admission and to have longer length of stay. Furthermore, the CALLY index was found to be a better prognostic factor for mortality than the conventional inflammatory markers, CRP and NLR. The use of the CALLY index in settings may improve the risk assessment of trauma patients and assist healthcare providers in making faster and more precise clinical decisions. Our analysis suggests that there may be a threshold, for incorporating this index into routine clinical practice based on the results of our ROC analysis. However this research has its limitations due, to being conducted in a centre and the retrospective approach used could affect how widely the results can be generalised. Therefore, further validation is required through other studies that are prospective in nature and cross centres. This is important in order to determine the capability of the CALLY index, in different categories of patients. Therefore, further research is still needed to establish the practical importance and the transferability of the CALLY index as a prognostic biomarker for trauma patients in the emergency department.

Competing interests

The author declares no competing interests.

Authors' contributions

Erkan Boğa was solely responsible for the conception and design of the study, data collection and analysis, interpretation of the results, and drafting and revising of the manuscript. He read and approved the final version of the manuscript and is accountable for all aspects of the work.

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