ORIGINAL ARTICLE

C-reactive protein-albumin-lymphocyte (CALLY) index as a predictor of early mortality in elderly patients with hip fractures

Humam Baki,[1] Ömerul Faruk Aydin[2]

[1]Department of Orthopedics and Traumatology, Private Gaziosmanpaşa Hospital, Istanbul Yeni Yüzyıl University, Istanbul-*Türkiye*
[2]Department of Emergency Medicine, Faculty of Medicine, Istanbul Yeni Yüzyıl University, Istanbul-*Türkiye*

ABSTRACT

BACKGROUND: This study aimed to evaluate the prognostic value of the C-reactive protein -albumin-lymphocyte (CALLY) index, an inflammation-based score derived from C-reactive protein (CRP), albumin, and lymphocyte count, in predicting 30-day mortality in elderly patients with hip fractures.

METHODS: A retrospective analysis was conducted on patients aged 65 years and older who were hospitalized with hip fractures between January 2022 and January 2025. Clinical and laboratory data were extracted from electronic medical records. The CALLY index was calculated using the formula: Albumin × Lymphocyte / CRP. The primary outcome was all-cause mortality within 30 days of admission. Receiver operating characteristic (ROC) analysis was used to assess the discriminative ability of the index, and multivariable logistic regression was performed to identify independent predictors of mortality.

RESULTS: A total of 410 patients aged 65 years and older with surgically treated hip fractures were included. The 30-day mortality rate was 14.6% (n=60). The CALLY index was significantly lower in non-survivors than in survivors (median: 5.6 vs. 9.4, p<0.001). Receiver operating characteristic (ROC) analysis showed that the CALLY index had moderate predictive ability for 30-day mortality, with an area under the curve (AUC) of 0.788. At the optimal cutoff value of 7.5, sensitivity was 75% and specificity was 67%. In the multivariable logistic regression model, inclusion of the CALLY index improved overall discrimination, yielding an AUC of 0.962. Kaplan-Meier survival analysis also demonstrated significantly lower survival probability in patients with low CALLY scores (p<0.001).

CONCLUSION: The CALLY index is a simple, accessible score that was independently associated with early mortality in elderly patients with hip fractures. It may help clinicians identify high-risk patients during the initial phase of hospitalization and inform perioperative management decisions.

Keywords: Elderly; hip fracture; immune; inflammation; mortality.

INTRODUCTION

Hip fractures are a major public health concern among the elderly, frequently resulting in functional decline, loss of independence, and increased mortality. With a rapidly aging global population, the incidence of hip fractures continues to rise, especially among individuals over 65 years of age.[1-3] Despite advances in surgical techniques and perioperative care, short-term mortality after hip fracture remains high, with estimates ranging between 1.4% and 10% in the first 30 days after injury.[4-5] Identifying high-risk patients early in their hospital course is essential for optimizing care and resource allocation.

New research emphasizes how crucial inflammation-related indicators are for predicting the prognosis of elderly patients

Cite this article as: Baki H, Aydin MF. C-reactive protein-albumin-lymphocyte (CALLY) index as a predictor of early mortality in elderly patients with hip fractures. Ulus Travma Acil Cerrahi Derg 2025;31:1011-1017.

Address for correspondence: Humam Baki
Department of Orthopedics and Traumatology, Private Gaziosmanpaşa Hospital, Istanbul Yeni Yüzyıl University, Istanbul, Türkiye
E-mail: humambakimd@gmail.com

Ulus Travma Acil Cerrahi Derg 2025;31(10):1011-1017 DOI: 10.14744/tjtes.2025.78553
Submitted: 22.05.2025 Revised: 07.09.2025 Accepted: 10.09.2025 Published: 07.10.2025

after hip fracture surgery.[6,7] Among these, C-reactive protein (CRP), serum albumin, and lymphocyte count have emerged as accessible and clinically relevant indicators of the patient's overall inflammatory burden and nutritional status.[8-10] Several composite indices—such as the CRP-to-albumin ratio and neutrophil-to-lymphocyte ratio—have been investigated for their utility in predicting complications and mortality.[11-12] The C-reactive protein-albumin-lymphocyte (CALLY) index, derived by combining CRP, albumin, and lymphocyte parameters into a unified calculation, has been proposed as a practical tool for predicting short-term mortality; however, its applicability in geriatric hip fracture populations remains insufficiently explored.

The purpose of this study is to assess the predictive utility of the CALLY index in estimating 30-day mortality among older patients admitted to the hospital with hip fractures.

MATERIALS AND METHODS

This retrospective study was conducted in the emergency department of a high-volume academic hospital. The study population included patients aged 65 years and older who were admitted with a diagnosis of hip fracture between January 1, 2022 and January 1, 2025. Ethics approval was obtained from the Ethics Committee of Yeni Yüzyıl University (Approval No: 2025/05-1548, Date: 07.05.2025), and the principles of the Declaration of Helsinki were followed in conducting the study. Patients with radiologically confirmed fractures of the proximal femur, including femoral neck, intertrochanteric, and subtrochanteric regions, who were admitted for surgical treatment were considered eligible. Patients with polytrauma, pathological fractures, open wounds, hematologic malignancies, or missing CRP, albumin, lymphocyte count, or 30-day survival status data were excluded.

Patient charts were reviewed retrospectively to compile clinical findings and laboratory results. The following variables were recorded: age, sex, comorbidities, initial vital signs, fracture type, time to surgery, length of hospital stay, in-hospital complications, and 30-day mortality. Laboratory parameters included CRP, serum albumin, and absolute lymphocyte count, all obtained on the day of admission prior to surgery.

The CALLY index was derived according to the following equation[13]

CALLY Index=Albumin (g/dL)×Lymphocyte (10^9/L)/(CRP (mg/L)×10).

All values were measured in standard units (CRP in mg/L, albumin in g/dL, lymphocytes in 10^9/L). Thirty-day all-cause mortality after admission was designated as the primary outcome.

Statistical Analysis

Statistical computations were performed using R software (version 4.4.2; R Foundation for Statistical Computing, Vienna, Austria). Numeric variables were assessed for normality by visual inspection of histograms and reported as median [interquartile range (IQR)] due to non-normal data distribution. Categorical data were expressed as frequencies and proportions. For numeric data, the Mann-Whitney U (MWU) test was used to compare groups, and depending on appropriateness, the Chi-squared or Fisher's exact test was used to assess categorical variables. To identify independent predictors of 30-day mortality, variables with a p-value below 0.20 in univariable analysis were incorporated into a multivariable logistic regression model. Variance inflation factors (VIF) were computed to evaluate multicollinearity, with variables exceeding a VIF of 5 flagged for potential removal. Results were presented as adjusted odds ratios with 95% confidence interval (CI). Brier score, Nagelkerke R2, and the area under the receiver operating characteristic curve (AUROC) with 95% CI were used to assess the final model's performance. The Hosmer-Lemeshow goodness-of-fit test was applied to evaluate model calibration. Internal validation was performed through 5-fold cross-validation, with AUROC, sensitivity, and specificity reported as mean ± standard deviation across folds. The discriminatory ability of the CALLY index for predicting 30-day mortality was assessed using ROC curve analysis. The AUROC 95% CI was derived using bootstrap resampling with 1,000 iterations. The ROC curve and its 95% CI were visualized using "ggplot2," with the confidence interval displayed as a shaded area for clarity.

RESULTS

A total of 410 elderly patients with hip fractures were included in the study. The observed 30-day all-cause mortality rate was 10.5% (n=43). The baseline demographic and clinical characteristics of the cohort, stratified by 30-day mortality status, are presented in Table 1. The deceased patients were significantly younger than survivors, with a median age of 81 years [interquartile range (IQR): 72.5-84.5] compared to 84 years [IQR: 78-91] (p=0.005). Female sex was similarly prevalent in both groups (79.1% vs. 71.7%; p=0.369). The deceased group exhibited a higher prevalence of dementia (51.2% vs. 33.5%; p=0.028), whereas Charlson Comorbidity Index scores were paradoxically lower [3 (IQR, 1-7) vs. 5 (IQR, 3-7); p=0.026]. Rates of malignancy and American Society of Anesthesiologists Physical Status scores (ASA) did not differ significantly between groups.

Regarding inflammatory and nutritional markers, deceased patients demonstrated significantly higher CRP levels [78 mg/L (IQR: 53-102.75) vs. 58.9 mg/L (IQR: 29.1-97.9); p=0.010], along with lower serum albumin [2.7 g/dL (IQR: 2.4-2.9) vs. 3.2 g/dL (IQR: 2.8-3.6); p<0.001] and lymphocyte counts [0.7×10^9/L (IQR: 0.35-1.15) vs. 1.2×10^9/L (IQR: 0.85-1.7); p<0.001]. The neutrophil-to-lymphocyte ratio was also

Table 1. Comparison of survivor and deceased groups among patients with hip fractures

Variable	Survivor (n=367)	Deceased (n=43)	p
Age (years)	84 [78-91]	81 [72.5-84.5]	0.005
Sex (female)	263 (71.7%)	34 (79.1%)	0.369
Dementia	123 (33.5%)	22 (51.2%)	0.028
Malignancy	79 (21.5%)	9 (20.9%)	1.000
CCI	5 [3-7]	3 [1-7]	0.026
ASA score	2 [1-3]	2 [1-3]	0.282
CRP (mg/L)	58.9 [29.1-97.9]	78 [53-102.75]	0.010
Albumin (g/dL)	3.2 [2.8-3.6]	2.7 [2.4-2.9]	<0.001
Lymphocyte (×10⁹/L)	1.2 [0.85-1.7]	0.7 [0.35-1.15]	<0.001
NLR	5.9 [3.3-8.5]	8 [4.7-9.9]	0.009
Platelet Count (×10⁹/L)	223 [188-267.5]	204 [170.5-244.5]	0.065
Hemoglobin (g/dL)	11.3 [10.7-11.7]	10.3 [9.9-11]	<0.001
Sodium (mmol/L)	137 [135-138]	133 [131-134]	<0.001
Creatinine (mg/dL)	0.98 [0.79-1.12]	1.47 [1.31-1.67]	<0.001
CALLY Index	0.66 [0.36-1.5]	0.24 [0.09-0.40]	<0.001
Time to Surgery (hours)	39 [28-51]	38 [25-48]	0.465
Fracture Type			0.019
Femoral Neck	113 (30.8%)	17 (39.5%)	
Intertrochanteric	209 (56.9%)	26 (60.5%)	
Subtrochanteric	45 (12.3%)	0 (0%)	
Surgery Type			0.391
Arthroplasty	120 (32.7%)	11 (25.6%)	
IM Nail	247 (67.3%)	32 (74.4%)	
Postoperative Pneumonia	34 (9.3%)	11 (25.6%)	<0.001
Postoperative Delirium	74 (20.2%)	10 (23.3%)	0.690
Length of Stay (days)	19 [14-24]	18 [13.5-26]	0.759

CRP: C-reactive protein; ASA: American Society of Anesthesiologists Physical Status Score; NLR: Neutrophil-to-Lymphocyte Ratio; CCI: Charlson Comorbidity Index; CALLY: CRP-Albumin-Lymphocyte Index; IM: Intramedullary.

higher in deceased patients [8 (IQR: 4.7-9.9) vs. 5.9 (IQR: 3.3-8.5); p=0.009]. Additionally, hemoglobin and platelet counts were significantly lower in the deceased group [10.3 g/dL (IQR: 9.9-11) vs. 11.3 g/dL (IQR: 10.7-11.7); p<0.001, and 204×10⁹/L (IQR: 170.5-244.5) vs. 223×10⁹/L (IQR: 188-267.5); p=0.065, respectively]. Serum sodium was markedly lower in deceased patients [133 mmol/L (IQR: 131-134) vs. 137 mmol/L (IQR: 135-138); p<0.001]. Creatinine levels were significantly higher in the deceased group [1.47 mg/dL (IQR: 1.31-1.67) vs. 0.98 mg/dL (IQR: 0.79-1.12); p<0.001]. The CALLY index was markedly reduced among deceased patients [0.24 (IQR: 0.09-0.40) vs. 0.66 (IQR: 0.36-1.5); p<0.001]. Postoperative pneumonia occurred significantly more frequently among deceased patients (25.6% vs. 9.3%; p<0.001), while postoperative delirium and length of hospital stay did not differ significantly.

In the multivariable logistic regression model (Table 2), the CALLY index, sodium, hemoglobin, platelet count, and fracture type emerged as independent predictors of 30-day mortality. Specifically, the CALLY index showed an adjusted odds ratio (aOR) of 0.90 (95% CI: 0.81-0.97; p<0.001), and sodium had the strongest association with mortality (aOR: 0.11; 95% CI: 0.05-0.21; p<0.001). The model demonstrated excellent discrimination with an AUROC of 0.962 (95% CI: 0.936-0.988) and good calibration (Hosmer-Lemeshow p=0.978). The Brier score was 0.037 (95% CI: 0.025-0.050), indicating accurate risk prediction. Nagelkerke's R^2 was 0.816, suggesting substantial explained variance. Internal validation with 5-fold cross-validation yielded a mean AUROC of 0.941±0.056, mean sensitivity of 97.6%±1.8%, and mean specificity of 62.8%±20.2%.

Table 2. Multivariable logistic regression analysis for 30-day mortality

Variable	aOR (95% CI)	p
Age	0.62 (0.38-0.96)	0.032
Dementia	1.69 (0.64-4.58)	0.290
CCI	0.80 (0.50-1.25)	0.331
CALLY Index	0.90 (0.81-0.97)	<0.001
NLR	1.09 (0.68-1.76)	0.711
Platelet Count	0.52 (0.28-0.91)	0.021
Hemoglobin	0.53 (0.31-0.86)	0.010
Sodium	0.11 (0.05-0.21)	<0.001
Fracture Type		
Intertrochanteric	1.15 (0.42-3.23)	0.792
Subtrochanteric	0.038 (0.0002-0.53)	0.012
Postoperative Pneumonia	2.08 (0.60-7.02)	0.241

aOR: Adjusted Odds Ratio; CCI: Charlson Comorbidity Index; CI: Confidence Interval; NLR: Neutrophil-to-Lymphocyte Ratio; CALLY: C-Reactive Protein-Albumin-Lymphocyte Index.

Table 3. Diagnostic performance of the C-reactive protein-albumin-lymphocyte (CALLY) index for 30-day mortality prediction

Metric	Value (95% CI)
AUROC	0.788 (0.711-0.865)
Youden Index	0.477
Criterion	≤0.25
Sensitivity	0.744 (0.702-0.786)
Specificity	0.733 (0.690-0.776)
Positive Likelihood Ratio	2.787 (2.629-2.945)
Negative Likelihood Ratio	0.349 (0.330-0.371)

AUROC: Area Under the Receiver Operating Characteristic Curve; CI: Confidence Interval; CALLY: C-Reactive Protein-Albumin-Lymphocyte Index.

The diagnostic performance of the CALLY index in predicting 30-day mortality is detailed in Table 3 and visualized in Figure 1. The AUROC was 0.788 (95% CI: 0.711-0.865). The optimal threshold, determined by Youden's index, was ≤0.25, providing a sensitivity of 74.4% (95% CI: 70.2-78.6%) and specificity of 73.3% (95% CI: 69.0-77.6%). The corresponding positive likelihood ratio was 2.79 (95% CI: 2.63-2.95), and the negative likelihood ratio was 0.35 (95% CI: 0.33-0.37).

DISCUSSION

This study demonstrates that the CALLY index is significantly associated with 30-day mortality in elderly patients hospitalized with hip fractures. Lower CALLY values were observed in non-survivors, and the index showed moderate discriminative ability in univariable analysis. When integrated into a multivariable logistic regression model, its inclusion contributed to excellent overall predictive performance. These findings highlight the potential utility of the CALLY index as part of a broader risk assessment strategy in geriatric trauma care.

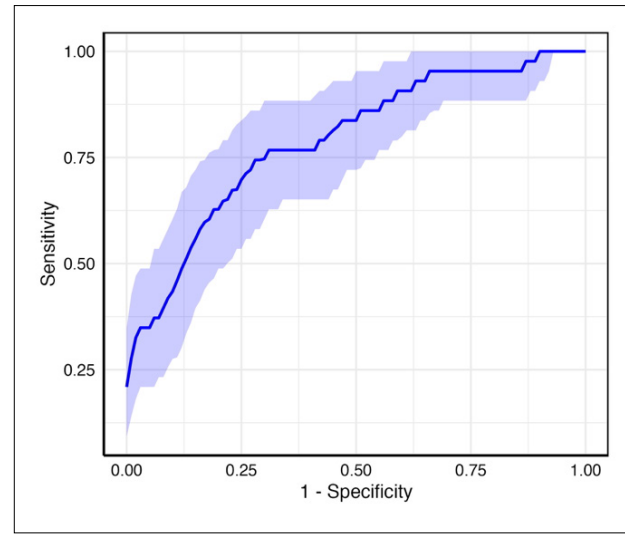

Figure 1. Receiver operating characteristic curve for the C-reactive protein-albumin-lymphocyte (CALLY) index in predicting 30-day mortality.

Hip fractures in the elderly represent a major clinical challenge, often leading to significant morbidity, prolonged hospitalization, functional decline, and increased short-term and long-term mortality. These patients are typically frail, have multiple comorbidities, and reduced physiological reserves, all of which contribute to poorer outcomes after trauma and surgery.[14] Mortality rates within 30 days can exceed 10%, and even among survivors, recovery of pre-injury function is often incomplete.[12] Therefore, early identification of patients at risk of adverse outcomes is essential to optimize perioperative care and resource allocation.[15]

The CALLY index integrates three routinely measured biomarkers—CRP, albumin, and lymphocyte count—each of which has independently demonstrated prognostic value in elderly patients with hip fractures. Their combined use may enhance predictive performance by capturing the inflammatory, nutritional, and immunologic status of the patient.

C-reactive protein is a widely studied marker of systemic inflammation and has been repeatedly linked to poor outcomes following hip fracture surgery in elderly patients. Elevated CRP levels reflect both the acute stress response and the extent of tissue injury, and are often correlated with higher rates of postoperative complications, delirium, and mortality. In a recent retrospective cohort study, Long et al.[12] reported

that elevated CRP at admission was independently associated with increased long-term mortality in geriatric patients undergoing hip fracture surgery, even after adjusting for age and comorbidities. Similarly, a prospective study by Lozano-Vicario et al.[16] found that higher CRP levels were predictive of postoperative delirium, which itself is a known risk factor for early mortality.

Serum albumin is a well-established marker of both nutritional and inflammatory status, and its prognostic value in elderly patients with hip fractures has been consistently demonstrated. Hypoalbuminemia is associated with impaired immune response, delayed wound healing, and increased vulnerability to complications such as infection and prolonged immobilization. Recent studies have confirmed its predictive role in postoperative outcomes. A retrospective cohort by Vural et al.[17] found that albumin was one of the strongest independent predictors of both early and late mortality in elderly patients with proximal femur fractures. Similarly, a study by Li et al.[18] showed that preoperative hypoalbuminemia was significantly associated with the development of postoperative pneumonia, which itself contributed to increased short-term mortality following hip fracture surgery.

Lymphocyte count serves as a surrogate marker of immune competence and physiologic reserve in older adults. Decreased lymphocyte levels, commonly observed in frail and inflamed patients, reflect both immune suppression and nutritional compromise.[19] Several studies have shown that lymphopenia at admission is significantly associated with higher postoperative mortality and complications following hip fracture surgery. For instance, Zhu et al.[20] demonstrated that a low lymphocyte-to-CRP ratio was independently predictive of one-year mortality in elderly patients undergoing hemiarthroplasty for displaced femoral neck fractures. Another cohort study by Lu et al.[21] found that lower absolute lymphocyte counts were associated with increased long-term mortality, regardless of other inflammatory parameters.

To the best of our knowledge, this is the first study to evaluate the prognostic value of the CALLY index specifically in elderly patients with hip fractures. Our findings revealed that lower CALLY scores were independently associated with increased 30-day mortality. Importantly, each component of the CALLY index—CRP, albumin, and lymphocyte count—also showed significant differences between survivors and non-survivors in univariate analysis, supporting the biological rationale of the index. These results suggest that the CALLY index not only reflects systemic inflammation and nutritional status but also captures broader immune vulnerability in this high-risk population.

From a practical standpoint, the CALLY index may serve as a simple bedside tool for early risk stratification in elderly patients admitted with hip fractures. In our study, a cut-off value of ≤0.25 was associated with a substantially increased risk of 30-day mortality. Patients below this threshold may warrant closer hemodynamic and metabolic monitoring, optimization of nutritional status, and more intensive perioperative surveillance. This information could help clinicians identify frail patients at an early stage and allocate resources, such as early geriatric consultation, multidisciplinary management, or admission to higher-level care units.

An unexpected finding of our study was that patients in the deceased group had a lower median age and lower Charlson Comorbidity Index (CCI) score compared to survivors. Several factors may account for this paradoxical observation. First, acute clinical conditions such as perioperative pneumonia, electrolyte disturbances, or renal dysfunction may have contributed more strongly to early mortality than baseline comorbidity burden. Second, fracture type and surgical complexity may have influenced outcomes independently of age and CCI. Third, variations in the timing of surgery and perioperative management could also have affected short-term survival. These observations highlight that short-term mortality after hip fracture is not solely dependent on age or comorbidity indices but is also influenced by acute physiological stressors and perioperative complications.

This study has certain limitations that should be acknowledged. Being conducted at a single center may limit the external validity of the findings. The retrospective nature of the design relies on the accuracy of recorded clinical and laboratory data, which may be subject to documentation bias. Since only patients with complete data and surgical management were included, the study population may not fully represent all elderly patients with hip fractures. In addition, the analysis was restricted to short-term outcomes, and no information was available on long-term survival, functional recovery, or readmission rates. Another limitation of our study is that we did not directly compare the prognostic performance of the CALLY index with other well-established prognostic tools, such as the American Society of Anesthesiologists score, the CCI, or the neutrophil-to-lymphocyte ratio (NLR). Although each of these markers has demonstrated prognostic value in geriatric hip fracture populations, our study focused specifically on the CALLY index. Future prospective studies should perform head-to-head comparisons of these indices to clarify their relative utility and potential complementary roles in clinical practice.

CONCLUSION

The CALLY index is an accessible, inflammation-based score that was independently associated with 30-day mortality in elderly patients with hip fractures. It combines three routinely available laboratory values and may help clinicians identify high-risk patients during early hospitalization. Although its discriminative ability was moderate, the index may serve as a useful adjunct in risk stratification and perioperative decision-making. Future prospective studies are needed to confirm its predictive value across different clinical settings and longer

follow-up periods.

Ethics Committee Approval: This study was approved by the Yeni Yüzyıl Universtiy Ethics Committee (Date: 07.05.2025, Decision No: 2025/05-1548).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: H.B.; Design: H.B.; Supervision: H.B.; Resource: H.B.; Materials: H.B.; Data collection and/or processing: H.B.; Analysis and/or interpretation: H.B., Ö.F.A.; Literature review: H.B., Ö.F.A.; Writing: H.B., Ö.F.A.; Critical review: H.B.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

1. Che YJ, Qian Z, Chen Q, Chang R, Xie X, Hao YF. Effects of rehabilitation therapy based on exercise prescription on motor function and complications after hip fracture surgery in elderly patients. BMC Musculoskelet Disord 2023;24:817. [CrossRef]
2. Pech-Ciau BA, Lima-Martínez EA, Espinosa-Cruz GA, Pacho-Aguilar CR, Huchim-Lara O, Alejos-Gómez RA. Hip fracture in the elderly: Epidemiology and costs of care. Acta Ortop Mex 2021;35:341-7. [Article in Spanish] [CrossRef]
3. Bhandari M, Swiontkowski M. Management of acute hip fracture. N Engl J Med 2017;377:2053-62. [CrossRef]
4. Alpar S, Yılmaz S. Association between C-reactive protein to albumin ratio and mortality in geriatric hip fracture patients. Anatol J Gen Med Res 2025;35:185–91. [CrossRef]
5. Giannoulis D, Calori GM, Giannoudis PV. Thirty-day mortality after hip fractures: Has anything changed? Eur J Orthop Surg Traumatol 2016;26:365-70. [CrossRef]
6. Kolhe SN, Holleyman R, Chaplin A, Langford S, Reed MR, Witham MD, et al. Association between markers of inflammation and outcomes after hip fracture surgery: Analysis of routinely collected electronic healthcare data. BMC Geriatr 2025;25:274. [CrossRef]
7. Belangero W, Barla JD, Rienzi Bergalli DH, Olarte Salazar CM, Fernandez DS, Mite Vivar MA, et al. Nutrition and inflammation influence 1-year mortality of surgically treated elderly intertrochanteric fractures: A prospective international multicenter case series. Geriatr Orthop Surg Rehabil 2019;10:2151459318816982. [CrossRef]
8. Bingol O, Ozdemir G, Kulakoglu B, Keskin OH, Korkmaz I, Kilic E. Admission neutrophil-to-lymphocyte ratio and monocyte-to-lymphocyte ratio to predict 30-day and 1-year mortality in geriatric hip fractures. Injury 2020;51:2663-7. [CrossRef]
9. Sedlář M, Kvasnička J, Krška Z, Tománková T, Linhart A. Early and subacute inflammatory response and long-term survival after hip trauma and surgery. Arch Gerontol Geriatr 2015;60:431-6. [CrossRef]
10. Thomas BK, Bajada S, Williams RL. Albumin is an independent predictor of up to 9-year mortality for intracapsular femoral neck fractures aiding in decision-making for total hip arthroplasty or hemiarthroplasty. J Arthroplasty 2023;38:135-40. [CrossRef]
11. Li S, Zhang J, Zheng H, Wang X, Liu Z, Sun T. Prognostic role of serum albumin, total lymphocyte count, and mini nutritional assessment on outcomes after geriatric hip fracture surgery: A meta-analysis and systematic review. J Arthroplasty 2019;34:1287-96. [CrossRef]
12. Long A, Yang D, Jin L, Zhao F, Wang X, Zhang Y, et al. Admission inflammation markers influence long-term mortality in elderly patients undergoing hip fracture surgery: A retrospective cohort study. Orthop Surg 2024;16:38-46. [CrossRef]
13. Geng M, Zhang K. CRP-Albumin-Lymphocyte index (CALLYI) as a risk-predicting biomarker in association with osteoarthritis. Arthritis Res Ther 2025;27:57. [CrossRef]
14. Yan B, Sun W, Wang W, Wu J, Wang G, Dou Q. Prognostic significance of frailty in older patients with hip fracture: A systematic review and meta-analysis. Int Orthop 2022;46:2939-52. [CrossRef]
15. Boukebous B, Biau D, Gao F. AtoG: A simple score to predict complications and death after hip fractures, in line with the comprehensive geriatric assessment. Orthop Traumatol Surg Res 2024;110:103827. [CrossRef]
16. Lozano-Vicario L, Muñoz-Vázquez ÁJ, Cedeno-Veloz BA, Romero-Ortuno R, Galbete A, Fernández-Irigoyen J, et al. The role of C-reactive protein as a risk marker of postoperative delirium in older hip fracture patients: A prospective cohort study. Eur Geriatr Med 2024;15:1929-35. [CrossRef]
17. Vural A, Dolanbay T, Yagar H. Hemoglobin, albumin, lymphocyte and platelet (HALP) score for predicting early and late mortality in elderly patients with proximal femur fractures. PLoS One 2025;20:e0313842. [CrossRef]
18. Li Y, Li S, Zhu J, Wang Z, Zhang X. Establishment and validation of clinical prediction model and prognosis of perioperative pneumonia in elderly patients with hip fracture complicated with preoperative acute heart failure. BMC Surg. 2024;24:369. [CrossRef]
19. Kılıç M, Ak R, Alışkan H. The utility of hemoglobin, albumin, lymphocyte and platelet (HALP) score in predicting mortality among COVID-19 patients: A preliminary study. Signa Vitae 2023;19:143–7.
20. Zhu J, Cheng X, Li Y, Bai L, Su Z. Low lymphocyte-to-C-reactive protein ratio relates to high 1-year mortality in elderly patients undergoing hemiarthroplasty for displaced femoral neck facture. J Orthop Surg Res 2022;17:512. [CrossRef]
21. Lu Y, Huang Q, Xu Y, Ren C, Sun L, Dong W, et al. Predictors of long-term mortality after intertrochanteric fractures surgery: A 3-year retrospective study. BMC Musculoskelet Disord 2022;23:472. [CrossRef]

ORİJİNAL ÇALIŞMA - *ÖZ*

C-reaktif protein–albümin–lenfosit (CALLY) indeksinin yaşlı kalça kırığı hastalarında erken mortaliteyi öngörmedeki rolü

AMAÇ: Bu çalışmanın amacı, C-reaktif protein (CRP), albümin ve lenfosit sayısından türetilmiş, inflamasyon temelli bir skorlama sistemi olan C-reactive protein-albumin-lymphocyte (CALLY) indeksinin, yaşlı kalça kırığı hastalarında 30 günlük mortaliteyi öngörmedeki prognostik değerini değerlendirmektir.

GEREÇ VE YÖNTEM: Ocak 2022 ile Ocak 2025 tarihleri arasında kalça kırığı nedeniyle hastaneye yatırılan, 65 yaş ve üzeri hastalar retrospektif olarak analiz edildi. Klinik ve laboratuvar verileri elektronik sağlık kayıtlarından elde edildi. CALLY indeksi şu formülle hesaplandı: Albümin x Lenfosit / CRP. Birincil sonuç, hastaneye yatıştan sonraki 30 gün içinde meydana gelen tüm nedenlere bağlı mortaliteydi. CALLY indeksinin ayırt edici gücü, ROC analizi ile değerlendirildi ve mortaliteyi öngören bağımsız değişkenleri belirlemek için çok değişkenli lojistik regresyon kullanıldı.

BULGULAR: Cerrahi olarak tedavi edilen kalça kırığına sahip toplam 410 hasta çalışmaya dahil edildi. Otuz günlük mortalite oranı %14.6 (n=60) idi. CALLY indeksi, hayatta kalanlara kıyasla yaşamını yitiren hastalarda anlamlı düzeyde daha düşüktü (medyan: 5.6 vs. 9.4; p<0.001). ROC analizi, CALLY indeksinin 30 günlük mortaliteyi öngörmede orta düzeyde prediktif güce sahip olduğunu gösterdi (AUC: 0.788). En uygun eşik değeri olan 7,5'te duyarlılık %75, özgüllük ise %67 idi. Çok değişkenli lojistik regresyon modeline CALLY indeksinin dahil edilmesi, genel ayırt edici gücü artırarak AUC'yi 0.962'ye yükseltti. Kaplan-Meier sağkalım analizi, düşük CALLY skoruna sahip hastalarda anlamlı şekilde daha düşük sağkalım olasılığı gösterdi (p<0.001).

SONUÇ: CALLY indeksi, yaşlı kalça kırığı hastalarında erken mortalite ile bağımsız olarak ilişkili bulunan, basit ve kolay erişilebilir bir skorlama sistemidir. Bu indeks, hastaneye yatışın erken evresinde yüksek riskli hastaların belirlenmesine yardımcı olabilir ve perioperatif yönetim kararlarını destekleyebilir.

Anahtar sözcükler: Bağışıklık, inflamasyon, kalça kırığı, mortalite, yaşlı.

Ulus Travma Acil Cerrahi Derg 2025;31(10):1011-1017 DOI: 10.14744/tjtes.2025.78553