Koşuyolu Heart Journal

Koşuyolu Heart J 2025;28(3):133–139
DOI: 10.51645/khj.2025.547

Original Article

The Role of the C-Reactive Protein-albumin-lymphocyte Index in Predicting In-hospital Mortality Among Patients Undergoing Pericardiocentesis

Samet Sevinç,[1] Yusuf Demir,[2] Sezgin Atmaca,[1] Erhan Melikoğlu,[1] Selahattin Türen[1]

[1]Department of Cardiology, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training Research Hospital, İstanbul, Türkiye

[2]Department of Cardiology, Bakırçay University Ciğli Training and Research Hospital, İzmir, Türkiye

Abstract

Objectives: Pericardiocentesis is a key treatment for pericardial effusion (PE), with the tamponade technique used to extract fluid from the pericardial space. The CALLY index combines the prognostic nutrition index (PNI) and C-reactive protein (CRP) to assess nutritional, immune, and inflammatory status in cancer patients. This study aims to explore how the CALLY index, assessed at admission, relates to predicting in-hospital mortality in patients with PE undergoing pericardiocentesis.

Methods: This study is a retrospective observational analysis conducted at a single center. Following the application of exclusion criteria, a total of 204 patients were ultimately included in the study. The study sample was split into two groups based on whether in-hospital mortality was present or not.

Results: The primary outcome of the study was that the CALLY index was lower in the in-hospital mortality group than in the survival group. In addition, in the group with in-hospital mortality, the CALLY index of pericardial fluid calculated using pericardial fluid albumin was lower than in the survival group. Univariate logistic regression analysis revealed significant correlations between in-hospital mortality and lactate, the CALLY index, as well as the CALLY index of pericardial fluid. Further analysis of these variables using multivariate logistic regression analysis indicated that lactate, the CALLY index, and the CALLY index of pericardial fluid were independent predictors for the development of in-hospital mortality.

Conclusion: This study shows the prognostic importance of the CALLY index and the CALLY index of pericardial fluid for in-hospital mortality in patients with PE undergoing pericardiocentesis.

Keywords: C-reactive protein-albumin-lymphocyte; mortality; pericardial effusion; pericardiocentesis.

Cite This Article: Sevinç S, Demir Y, Atmaca S, Melikoğlu E, Türen S. The Role of the C-Reactive Protein-albumin-lymphocyte Index in Predicting In-hospital Mortality Among Patients Undergoing Pericardiocentesis. Koşuyolu Heart J 2025;28(3):133–139

Address for Correspondence:
Samet Sevinç

Department of Cardiology, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training Research Hospital, İstanbul, Türkiye

E-mail: sametsevincdr@gmail.com

Submitted: September 15, 2025
Revised: November 16, 2025
Accepted: November 19, 2025
Available Online: December 16, 2025

Perikardiyosentez Uygulanan Hastalarda Hastane İçi Mortaliteyi Tahmin Etmede C-reaktif Protein-albümin-lenfosit İndeksinin Rolü

Özet

Amaç: Perikardiyal efüzyon (PE) için temel bir tedavi yöntemi olan perikardiyosentezde, perikardiyal boşluktan sıvı çekilir. CALLY indeksi, kanser hastalarında beslenme, bağışıklık ve inflamatuar durumu değerlendirmek için prognostik beslenme indeksi (PNI) ve C-reaktif proteini (CRP) birleştirir. Bu çalışma, kabul sırasında değerlendirilen CALLY indeksinin, perikardiyosentez uygulanan PE hastalarında hastane içi mortaliteyi öngörmedeki ilişkisini araştırmayı amaçlamaktadır.

Gereç ve Yöntem: Bu çalışma, tek bir merkezde yürütülen retrospektif bir gözlemsel analizdir. Dışlama kriterlerinin uygulanmasının ardından, toplam 204 hasta çalışmaya dahil edilmiştir. Çalışma örneği, hastane içi mortalitenin mevcut olup olmamasına göre iki gruba ayrılmıştır.

Bulgular: Çalışmanın birincil çıktısı, CALLY indeksinin hastane içi mortalite grubunda, sağkalım grubuna göre daha düşük olmasıdır. Ek olarak, hastane içi mortalite grubunda, perikardiyal sıvı albümini kullanılarak hesaplanan perikardiyal sıvı CALLY indeksi, sağkalım grubuna göre daha düşüktü. Tek değişkenli lojistik regresyon analizi, hastane içi mortalite ile laktat, CALLY indeksi ve perikardiyal sıvı CALLY indeksi arasında anlamlı korelasyonlar olduğunu ortaya koydu. Bu değişkenlerin çok değişkenli lojistik regresyon analizi kullanılarak daha ileri analizi, laktat, CALLY indeksi ve perikardiyal sıvı CALLY indeksinin hastane içi mortalite gelişimi için bağımsız öngörücüler olduğunu gösterdi.

Sonuç: Bu çalışma, perikardiyosentez uygulanan PE hastalarında hastane içi mortalite açısından CALLY indeksi ve perikardiyal sıvı CALLY indeksinin prognostik önemini göstermektedir.

Anahtar sözcükler: C-reaktif protein-albümin-lenfosit; mortalite; perikardiyal efüzyon; perikardiyosentez.

Introduction

Pericardial effusion (PE) refers to the accumulation of fluid within the pericardial cavity and constitutes a notable issue in critical care practice. Excess fluid may restrict cardiac filling and, in severe cases, progress to cardiac tamponade, which requires immediate intervention. PE may originate from various causes, including idiopathic, infectious, inflammatory, neoplastic, or iatrogenic factors, with the predominant etiologies varying across regions and populations.[1]

Pericardiocentesis continues to be the primary therapeutic approach for PE, in which fluid is aspirated from the pericardial sac to relieve tamponade. This procedure offers rapid improvement in hemodynamic status by restoring cardiac output and alleviating symptoms.[2] Beyond symptom relief, pericardiocentesis also serves as an essential diagnostic and therapeutic intervention for individuals with PE of different etiologies.[2] The risk of morbidity is approximately 1–3%, while the procedure-associated death rate is reported to be under 1%.[3]

In oncology, the C-reactive protein–albumin–lymphocyte (CALLY) Index has demonstrated superior prognostic performance in predicting survival results for colorectal and gastric cancer individuals compared with conventional markers.[4,5] Comprehensive evaluation of nutritional, immunological, and inflammatory parameters has been suggested as beneficial in reducing the burden of age-related morbidity and death rate. Lida et al.[6] proposed the CALLY Index, which integrates the prognostic nutrition index (PNI) with C-reactive protein (CRP) to better capture the interplay of nutritional, immune, and inflammatory status in cancer individuals. The CALLY Index has therefore emerged as a valuable biomarker for forecasting cancer prognosis.[4,5] Additionally, previous research has addressed the link between nutritional status assessed by PNI and recurrence of pericarditis,[7] as well as the association of the CRP/albumin ratio (CAR) with in-hospital death rate among PE individuals undergoing pericardiocentesis.[8]

However, to date, no investigation has specifically investigated the association between the CALLY Index and in-hospital death rate in individuals treated with pericardiocentesis for PE. Thus, the present investigation aims to examine whether the CALLY Index, measured at admission, can serve as a predictor of in-hospital death rate in this patient group.

Materials and Methods

This retrospective, single-center observational investigation included 260 adult individuals (≥18 years) who underwent percutaneous pericardiocentesis for pericardial effusion (PE) in the intensive care unit of our tertiary referral hospital between February 2017 and December 2024. Individuals with effusions following cardiac or thoracic surgery, acute aortic syndromes, tuberculosis, or iatrogenic PE related to invasive cardiac procedures were excluded. After applying these exclusion criteria, 204 individuals were eligible for analysis (Fig. 1). Data collected retrospectively from hospital records included demographics, clinical presentation (asymptomatic, tamponade, dyspnea, hemodynamic instability), etiological diagnosis, pericardial fluid characteristics (macroscopic and microscopic), death rate data, and other relevant variables. The primary endpoint was the short-term all-cause in-hospital death rate. The investigation protocol was approved by the Local Ethics Committee (date: 01.09.2025, decision no: 2025.07-73) and all procedures adhered to the Declaration of Helsinki.

Pericardiocentesis

Procedures were performed in the coronary intensive care unit by experienced interventional cardiologists under sterile conditions and local anesthesia. Afterward, individuals were closely monitored in the same unit. Procedural success was defined as complete or near-complete fluid drainage, absence of intraprocedural death rate, and no requirement for surgical intervention.

Definitions

All individuals underwent echocardiography-guided percutaneous pericardiocentesis, followed by drainage with a sheath and pigtail catheter until minimal residual fluid remained. Neoplastic effusion was diagnosed in individuals with atypical cells in pericardial fluid cytology, confirmed malignancy, or imaging observations consistent with pericardial tumor involvement despite negative cytology. PE arising during invasive cardiac procedures (e.g., coronary interventions, pacemaker implantation, percutaneous valvuloplasty) was categorized as iatrogenic. Individuals with autoimmune disease or polyserositis were classified as autoimmune effusion, while those requiring dialysis, with blood urea nitrogen (BUN) levels ≥60 mg/dL and without alternative causes, were considered to have uremic effusion. Congestive heart failure was defined by an ejection fraction <50%. Classification of pericardial fluid as transudate or exudate was based on simultaneous blood sampling and Light's criteria.[9] Hemodynamic instability was defined as cardiac arrest, systolic blood pressure <90 mmHg despite adequate fluid therapy, or vasopressor requirement to maintain systolic pressure ≥90 mmHg, accompanied by evidence of end-organ hypoperfusion (e.g.,

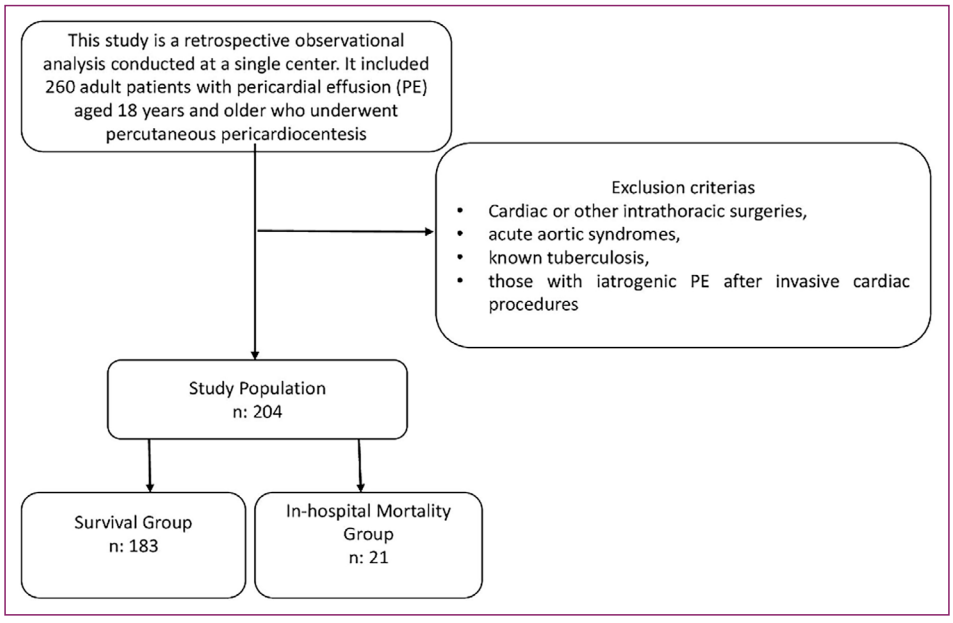

Figure 1. Flowchart.

impaired mental status, oliguria/anuria, elevated lactate).[10] Chronic kidney disease (CKD) was identified when estimated glomerular filtration rate (eGFR) was <60 mL/min/1.73 m², in accordance with KDIGO guidelines.[11]

Follow-up and Outcomes

Echocardiographic assessment was performed after the procedure in all individuals. The main investigation outcome was in-hospital death rate, with follow-up extending from the day of pericardiocentesis until death or discharge.

Laboratory Tests

Blood samples were obtained within 24 hours of hospital admission. Laboratory parameters included serum CRP, albumin, and lymphocyte count. The CALLY Index was calculated using the following formula:

CALLY Index = (albumin×lymphocyte count) / (CRP×10).[6]

Statistical Analysis

Continuous variables were assessed for distribution using the Kolmogorov–Smirnov test in combination with visual inspections, including histograms and probability plots. Data were expressed as mean ± standard deviation for normally distributed variables, or as median with interquartile range (IQR 25–75) for non-normally distributed ones. Depending on distribution, comparisons between groups were performed with either the independent Student's t-test or the Mann–Whitney U test. To evaluate the predictive performance of the CALLY Index for in-hospital death rate among individuals with PE treated with pericardiocentesis, receiver operating characteristic (ROC) curve analysis was applied, and the optimal cutoff value was determined using the Youden index [maximum (sensitivity+specificity – 1)]. Categorical variables were summarized as counts (n) and percentages (%) and compared using Pearson's chi-square test or Fisher's exact test, as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to estimate the effect size of individual risk factors. Both univariate and multivariate logistic regression analyses were conducted to identify independent predictors of in-hospital death rate. Statistical significance was defined as a two-tailed p-value <0.05. The discriminative ability of the model was also assessed using the area under the ROC curve (AUC).

Results

The baseline demographic and clinical features of the 204 individuals who underwent pericardiocentesis for PE are summarized in Table 1. The mean age was 66±16 years, and 108 individuals (52.9%) were male. Individuals were divided into two groups: survivors and those who experienced in-hospital death rate. No notable differences were observed between the two groups regarding sex distribution, prevalence of diabetes mellitus, hypertension, or coronary artery disease. Similarly, there were no group differences in left ventricular ejection fraction, history of tamponade, or duration of hospitalization. Hematological and biochemical variables—including glucose, hemoglobin, platelet count, lymphocytes, lactate dehydrogenase, thyroid-stimulating hormone, and total protein—did not differ significantly between groups. In contrast, the in-hospital death rate group was older and had a higher prevalence of chronic renal failure (CRF) compared with the survivor group. Among laboratory parameters, white blood cell count, CRP, creatinine, and lactate levels were elevated in the death rate group, while serum albumin levels were reduced (Table 1). The biochemical characteristics of pericardial fluid are presented in Table 2. There were no notable differences in fluid protein, albumin, total cholesterol, triglycerides, amylase, lactate dehydrogenase (LDH), or glucose. However, creatinine levels in pericardial fluid were higher, and the CALLY Index calculated from pericardial fluid albumin was

Table 1. Demographic and clinical of the study group

	Survival group n=183		In-hospital mortality group n=21		All patients n=204		p
	n	%	n	%	n	%	
Age (years)	65±16		73±12		66±16		**0.028**
Gender (male)	101	55.2	7	33.3	108	52.9	0.058
Patients with DM	66	36.3	6	28.6	72	35.5	0.486
Patients with HT	110	60.4	13	61.9	123	60.6	0.897
Patients with CAD	72	39.3	11	52.4	83	40.7	0.251
Patients with CKD	48	26.2	12	60	60	29.6	**0.002**
LVEF (%)	56±10		51±18		56±11		0.378
Tamponade	68	45	8	50	76	45.5	0.705
Glucose level (mg/dL)	116 (98–152)		111 (98–186)		116 (98–155)		0.708
Hemoglobin level (g/L)	11.3±2		10.4±2.1		11.2±2		0.129
WBC count (10^3/ml)	8.76 (6.7–11.2)		10.7 (8.2–14.78)		8.96 (6.8–11.5)		**0.005**
Platelet count (10^3/ml)	252 (196–345)		284 (238–362)		259 (197–353)		0.278
CRP (mg/dL)	32.86 (9.11–84)		66 (36–112.4)		36.8 (10.6–86.4)		**0.012**
Albumin (g/L)	36.4±5.7		32.6±7.5		36±6		**0.021**
Lymphocyte count (10^3/ml)	1.24 (0.85–1.83)		1.12 (0.75–1.55)		1.23 (0.84–1.78)		0.356
CALLY index	0.15 (0.05–0.66)		0.06 (0.02–0.18)		0.13 (0.04–0.47)		**0.014**
Creatinine (mg/dL)	0.90 (0.68–1.24)		1.77 (1.03–2.04)		0.93 (0.7–1.33)		**0.001**
LDH (units/L)	212 (156–253)		198 (187–226)		209 (158–249)		0.768
Lactate (mEq/L)	0.8 (0.7–1)		1.6 (0.75–2)		0.8 (0.7–1.04)		**0.002**
TSH (uIU/mL)	1.9 (1.1–3.1)		2.1 (0.9–3.3)		1.9 (1.1–3.2)		0.792
Total Protein (g/dL)	60.3±11.8		57 ±6.8		59.9±11.3		0.184
LoS, (days)	8 (5–13)		7 (4–11)		8 (5–13)		0.538

CALLY: C-reactive protein-albumin-lymphocyte; p: Probability statistic; DM: Diabetes mellitus; HT: Hypertension; CAD: Coronary artery disease; CKD: Chronic kidney disease; WBC: White blood cell; CRP: C-reactive protein; LVEF: Left ventricular ejection fraction; LDH: Lactate dehydrogenase; TSH: Thyroid stimulating hormone; LoS: Length of hospital stay.

Table 2. Characteristics of pericardial fluid

	Survival group n=183	In-hospital mortality group n=21	All patients n=204	p
Protein (g/dL)	50.8±11.3	47.7±15.6	50.5±11.7	0.506
Albumin (g/L)	32.5±5.26	31.1±6.1	32.4±5.3	0.573
Total Cholesterol (mg/dl)	93.8±40.4	100.9±27.2	94.3±39.6	0.445
Triglyceride (mg/dl)	39 (20–59)	59.5 (43–71)	40 (22–62)	0.098
Creatinine (mg/dL)	0.81 (0.61–1.23)	1.33 (0.91–2.05)	0.83 (0.61–1.28)	**0.02**
Amylase (U/L)	27 (15–38)	24 (23–52)	26 (16.42)	0.392
LDH (units/L)	407 (175–1037)	895 (153–3902)	425 (175–1056)	0.469
Glucose (mg/dL)	98 (70–121)	95.5 (52.5–120)	98 (70–121)	0.589
CALLY Index of Fluid	0.13 (0.04–0.48)	0.07 (0.02–0.15)	0.12 (0.04–0.36)	**0.012**

LDH: Lactate dehydrogenase; CALLY: C-reactive protein-albumin-lymphocyte.

lower in individuals who died during hospitalization. The etiologies of PE are detailed in Table 3. Idiopathic effusion was the most common cause, accounting for 93 cases (45.6%).

Outcomes

The primary finding was that the CALLY Index was significantly lower in individuals who experienced in-hospital death rate compared with survivors (0.15 [0.05–0.66] vs. 0.06 [0.02–0.18], p=0.014). Similarly, the pericardial fluid–derived CALLY Index was also lower in the death rate group (0.13 [0.04–0.48] vs. 0.07 [0.02–0.15], p=0.012) (Table 1).

Table 3. Etiology of pericardial effusion

	n	%
Malignancy	59	29
Idiopathic	93	45.6
Infectious	23	11.4
Uremia	7	3.5
Thyroid diseases	4	2
Post-MI conditions	8	4
Connective tissue disease	9	4.5

MI: Myocardial infarction.

Table 4. Results of the univariate and multivariate analyses of the variables regarding their prognostic value in-hospital mortality in patients with pericardial effusion undergoing pericardiocentesis

	Univariate analysis			Multivariate analysis		
	Univariate OR, 95% CI		p	Multivariate OR, 95% CI		p
Age	1.043	(0.963–1.129)	0.303	–	–	–
CRF	1.53	(0.142–16.537)	0.726	–	–	–
Creatinine	1.034	(0.237–4.509)	0.965	–	–	–
Lactate	4.486	(1.134–17.749)	**0.032**	1.105	(1.016–1.202)	**0.02**
Pericadial fluid creatinine	0.217	(0.025–1.887)	0.166	–	–	–
CALLY index (pericardial fluid) ×100	1.009	(1.002–1.926)	**0.048**	1.007	(1.004–1.968)	**0.007**
CALLY index×100	1.838	(1.002–3.374)	**0.049**	1.97	(1.094–4.003)	**0.003**

OR: Odds ratio; CI: Confidence interval; p: Probability statistic; CRF: Chronic renal failure; WBC: White blood cell; CALLY: C-reactive protein-albumin-lymphocyte.

Independent Predictors of In-hospital Mortality

Univariate logistic regression identified lactate, the serum CALLY Index, and the pericardial fluid CALLY Index as notable predictors of in-hospital death rate (Table 4). In multivariate analysis, lactate (OR: 1.105, 95% CI: 1.016–1.202; p=0.02), the serum CALLY Index (OR: 1.97, 95% CI: 1.094–4.003; p=0.003), and the pericardial fluid CALLY Index (OR: 1.007, 95% CI: 1.004–1.968; p=0.07) remained independent predictors.

ROC analysis showed that both the serum CALLY Index and the pericardial fluid CALLY Index were associated with in-hospital death rate (Fig. 2). The serum CALLY Index demonstrated an AUC of 0.678 (95% CI: 0.604–0.745; p=0.045), while the pericardial fluid CALLY Index had an AUC of 0.673 (95% CI: 0.599–0.741; p=0.049).

An optimal cutoff value of ≤0.28 for the serum CALLY Index predicted in-hospital death rate with 98.2% sensitivity and 40% specificity. For the pericardial fluid CALLY Index, a cutoff of ≤0.18 predicted in-hospital death rate with 94.7% sensitivity and 42% specificity (Fig. 2).

Discussion

The present investigation shows that the C-reactive protein–albumin–lymphocyte (CALLY) Index serves as an independent predictor of in-hospital death rate among individuals with pericardial effusion (PE) who undergo pericardiocentesis. To our knowledge, this is the first investigation to evaluate the prognostic role of the CALLY Index for short-term death rate in this clinical setting. Our results highlight its potential as a practical tool for early risk assessment in PE individuals. Because the index is based on widely available laboratory parameters, it can be calculated with ease, facilitating timely identification of high-risk cases and enabling tailored management strategies that may improve results.

Large pericardial effusions frequently require percutaneous drainage to relieve hemodynamic compromise and to determine or exclude the underlying cause. This intervention is relevant for both individuals without an established diagnosis and for those with comorbidities known to predispose to pericardial disease. Recognition of an etiology—particularly malignancy, metastatic disease, or bacterial infection—is critical for guiding therapy and informing prognosis.[12] Advances in fluoroscopy and echocardiography have significantly enhanced the safety and effectiveness of the procedure since its original description.[13] While complication rates have varied from 4% to 10% across studies, large cohorts have reported an overall incidence of approximately 5.9%.[14]

In oncology, the CALLY Index has proven to be a strong prognostic indicator in multiple malignancies, including colorectal and gastric cancers.[4,5] Its predictive capacity has also been explored in ST-elevation myocardial infarction (STEMI) and in elderly populations for both all-cause and cardiovascular death rate.[15,16]

C-reactive protein (CRP), a well-established inflammatory marker, is synthesized in hepatocytes in response to cytokines such as interleukin-1 (IL-1) and interleukin-6 (IL-6).[17] Owing to standardized assays, stability, and strong prognostic significance, CRP has emerged as a key biomarker for cardiovascular results.

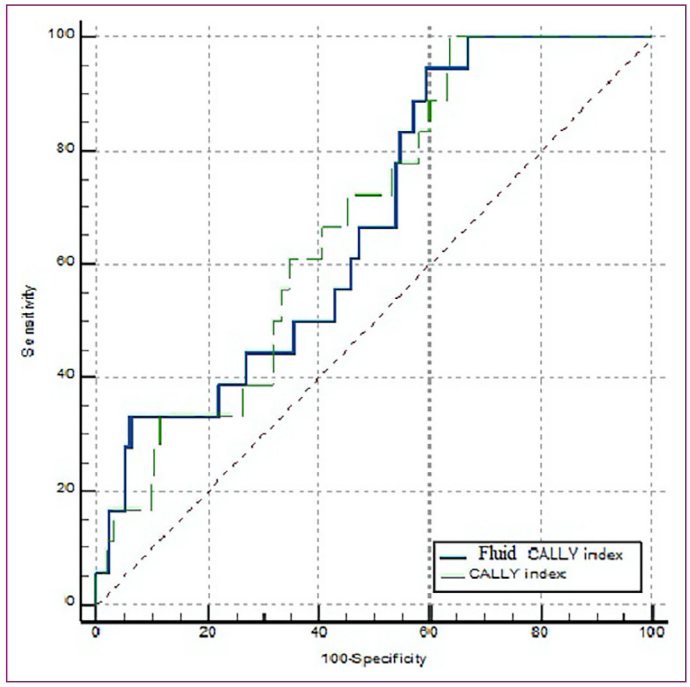

Figure 2. ROC curve analysis of the C-reactive protein-albumin-lymphocyte (CALLY) Index and CALLY index of pericardial fluid in patients with pericardial effusion undergoing pericardiocentesis.

[18] Consistent with prior evidence, our investigation found that elevated CRP levels were associated with higher in-hospital death rate in PE individuals undergoing pericardiocentesis.

Albumin functions as a negative acute-phase reactant, and its serum concentration decreases during systemic inflammation.[19] Beyond its role as an indicator of inflammatory status, albumin possesses antioxidant and antiplatelet effects and is linked to reduced cardiovascular risk.[20] Low lymphocyte counts reflect impaired immune competence associated with malnutrition, further contributing to poor results.[21] In PE, pericardial inflammation can lead to reduced prognostic nutrition index (PNI) scores, which correlate with recurrence. In our cohort, individuals who died during hospitalization had significantly lower albumin levels, in addition to a higher prevalence of malignancy.

Advanced age and comorbidities have consistently been linked to increased death rate in PE individuals.[22] Our results are in line with this evidence, showing that the non-survivor group was older and had more comorbidities such as chronic renal failure (CRF), which itself has been reported as an independent predictor of death rate following pericardiocentesis. Elevated lactate levels, a marker of impaired tissue perfusion, were also identified as an independent risk factor in our investigation, echoing previous reports highlighting lactate as a poor prognostic marker in critically ill individuals.[23,24]

Since complex risk models are not always practical in routine care, simpler and readily available scoring systems are needed. The CALLY Index can be calculated rapidly using standard admission blood tests, with no additional cost, making it feasible for bedside use. Its straightforward nature enhances its utility over more complex systems. Effective risk stratification with this tool may assist clinicians in identifying high-risk individuals, ensuring closer monitoring and more aggressive management. Taken together, our observations support the use of the CALLY Index as a novel prognostic parameter in PE individuals undergoing pericardiocentesis. Nevertheless, larger multicenter studies are warranted to confirm these results.

Limitations

This investigation has some limitations. First, it was conducted retrospectively at a single institution, which may restrict generalizability and introduce selection bias. Second, the sample was limited to one hospital within a defined period, which may reduce the applicability of results to other populations. In addition, subgroup analyses may have been underpowered due to sample size constraints. Finally, incomplete or missing demographic and clinical information could have influenced the ability to comprehensively evaluate all relevant variables.

Conclusion

This investigation highlights the prognostic value of the CALLY Index and CALLY Index of pericardial fluid for in-hospital death rate in individuals with pericardial effusion (PE) undergoing pericardiocentesis.

Disclosures

Ethics Committee Approval: The study was approved by the İstanbul University of Health Sciences Mehmet Akif Ersoy Hospital Ethics Committee (no: 2025.07-73, date: 01/09/2025).

Informed Consent: Informed consent was obtained from all participants.

Conflict of Interest Statement: All authors declared no conflict of interest.

Funding: The authors declared that this study received no financial support.

Use of AI for Writing Assistance: No AI technologies utilized.

Author Contributions: Concept – S.S., Y.D., S.T.; Design – S.S., Y.D., S.T.; Supervision – S.S., S.T.; Resource – S.A., S.S., E.M.; Materials – S.A., E.M., S.T.; Data collection and/or processing – Y.D., S.T., S.A.; Data analysis and/or interpretation – S.S., Y.D., S.T.; Literature search – E.M., S.A., S.S.; Writing – S.S., Y.D.; Critical review – S.T., S.S.

Peer-review: Externally peer-reviewed.

References

1. Levy PY, Corey R, Berger P, Habib G, Bonnet JL, Levy S, et al. Etiologic diagnosis of 204 pericardial effusions. Medicine (Baltimore) 2003;82:385–91.
2. Sagristà-Sauleda J, Mercé AS, Soler-Soler J. Diagnosis and management of pericardial effusion. World J Cardiol 2011;3:135–43.
3. Inglis R, King AJ, Gleave M, Bradlow W, Adlam D. Pericardiocentesis in contemporary practice. J Invasive Cardiol 2011;23:234–9.
4. Yang M, Lin SQ, Liu XY, Tang M, Hu CL, Wang ZW, et al. Association between C-reactive protein–albumin–lymphocyte (CALLY) index and overall survival in patients with colorectal cancer. Front Immunol 2023;14:1131496.
5. Zhang H, Shi J, Xie H, Liu X, Ruan G, Lin S, et al. Superiority of CRP–albumin–lymphocyte index as a prognostic biomarker for patients with gastric cancer. Nutrition 2023;116:112191.
6. Lida H, Tani M, Komeda K, Nomi T, Matsushima H, Tanaka S, et al. Superiority of CRP–albumin–lymphocyte index as a non-invasive prognostic biomarker after hepatectomy for hepatocellular carcinoma. HPB (Oxford) 2022;24:101–15.
7. Başkurt AA, Demir Y, Şenöz O. Prognostic nutritional index as a predictor of recurrence in patients undergoing pericardiocentesis: a retrospective analysis. Cardiol Res Pract 2025;2025:5598299.
8. Küçük U, Gazi E, Kırılmaz B. Roles of the ratio of C-reactive protein to serum and pericardial fluid albumin levels in predicting in-hospital mortality in patients undergoing pericardiocentesis. Arch Curr Med Res 2021;3:146–52.
9. Light RW, Macgregor MI, Luchsinger PC, Ball WC. Pleural effusions: the diagnostic separation of transudates and exudates. Ann Intern Med 1972;77:507–13.
10. Konstantinides SV, Meyer G. The 2019 ESC guidelines on the diagnosis and management of acute pulmonary embolism. Eur Heart J 2019;40:3453–5.
11. Stevens PE, Levin A, Members KDIGO CKD GDWG. Evaluation and management of chronic kidney disease: synopsis of the KDIGO 2012 clinical practice guideline. Ann Intern Med 2013;158:825–30.
12. Bogaert J, Cruz I, Voigt JU, Sinnaeve P, Imazio M. Value of pericardial effusion as imaging biomarker in acute pericarditis. Int J Cardiol 2015;191:284–5.
13. Krikorian JG, Hancock EW. Pericardiocentesis. Am J Med 1978;65:808–14.
14. Strobbe A, Adriaenssens T, Bennett J, Dubois C, Desmet W, McCutcheon K, et al. Etiology and long-term outcome of patients undergoing pericardiocentesis. J Am Heart Assoc 2017;6:e007598.
15. Ji H, Luo Z, Ye L, He Y, Hao M, Yang Y, et al. Prognostic significance of C-reactive protein–albumin–lymphocyte (CALLY) index after primary percutaneous coronary intervention in patients with STEMI. Int Immunopharmacol 2024;141:112860.

16. Luo L, Li M, Xi Y, Hu J, Hu W. C-reactive protein–albumin–lymphocyte index as a feasible nutrition–immunity–inflammation marker of all-cause and cardiovascular mortality in elderly. Clin Nutr ESPEN 2024;63:346–53.
17. Black S, Kushner I, Samols D. C-reactive protein. J Biol Chem 2004;279:48487–90.
18. Yousuf O, Mohanty BD, Martin SS, Joshi PH, Blaha MJ, Nasir K, et al. High-sensitivity C-reactive protein and cardiovascular disease: a resolute belief or an elusive link? J Am Coll Cardiol 2013;62:397–408.
19. Eckart A, Struja T, Kutz A, Baumgartner A, Baumgartner T, Zurfluh S, et al. Relationship of nutritional status, inflammation, and serum albumin levels during acute illness: a prospective study. Am J Med 2020;133:713–22.e7.
20. Arques S. Human serum albumin in cardiovascular diseases. Eur J Intern Med 2018;52:8–12.
21. Fock RA, Blatt SL, Beutler B, Pereira J, Tsujita M, de Barros FE, et al. Study of lymphocyte subpopulations in bone marrow in a model of protein-energy malnutrition. Nutrition 2010;26:1021–8.
22. Pennacchioni A, Nanni G, Sgura FA, Imberti JF, Monopoli DE, Rossi R, et al. Percutaneous pericardiocentesis for pericardial effusion: predictors of mortality and outcomes. Intern Emerg Med 2021;16:1771–7.
23. Vincent JL, Quintairos E Silva A, Couto L Jr, Taccone FS. The value of blood lactate kinetics in critically ill patients: a systematic review. Crit Care 2016;20:257.
24. Bakker J, Nijsten MW, Jansen TC. Clinical use of lactate monitoring in critically ill patients. Ann Intensive Care 2013;3:12.