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RESEARCH ARTICLE

Prognostic Value of the Lactate-to-albumin Ratio for Predicting Mortality in Patients with Gastrointestinal Bleeding

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ABSTRACT

Objective: Among the critical health emergencies stands upper gastrointestinal bleeding. In this study, we aimed to assess the factors that may influence mortality due to upper gastrointestinal bleeding. We also investigated the prognostic significance of the lactate/albumin ratio.

Materials and Methods: Retrospectively included in the study were patients admitted to the internal medicine clinic due to upper gastrointestinal bleeding. Into two groups, the patients were classified based on treatment outcomes: those who recovered and those who died. Demographic data, comorbidities, causes of bleeding, AIMS65, Rockall, and Glasgow-Blatchford scores, as well as lactate/albumin ratios, were compared. Additionally, factors affecting mortality were assessed using univariate and multivariate analyses.

Results: Of the 300 patients included retrospectively, 31 were in the mortality group, while 269 were in the recovery group. In the mortality group, liver cirrhosis was detected in 7 patients (22.6%), whereas in the recovery group, 20 patients (7.4%) exhibited the condition, indicating a higher prevalence among those who did not survive. In the mortality group, malignancy-associated bleeding appeared in 6 patients (19.4%), whereas in the recovery group, it was present in only 9 patients (3.3%), highlighting its stronger association with poor outcomes. Identified as independent risk factors for mortality due to gastrointestinal bleeding were a high lactate/albumin ratio and the existence of malignancy, according to univariate and multivariate analyses.

Conclusion: An elevated lactate/albumin ratio in serum stands out as an independent prognostic factor for mortality among patients suffering from upper gastrointestinal bleeding.

Keywords: Albumin, gastrointestinal hemorrhage, lactate, mortality

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INTRODUCTION

Among the most urgent medical emergencies ranks acute gastrointestinal bleeding due to its potentially fatal outcomes.[1] Hemorrhage occurring above the ligament of Treitz is classified as upper gastrointestinal bleeding and constitutes roughly 85% of all gastrointestinal bleeding incidents.[2] Approximately 100 per 100,000 people is the annual incidence of upper gastrointestinal bleeding.[3,4] Mortality is reduced through endoscopic interventions and pharmacological treatments such as proton pump inhibitors. Despite these treatments, mortality rates can still reach up to 10%.[5] Considering these factors, predicting patient prognosis through risk stratification and identifying biomarkers that can predict mortality are extremely important.

Among the scoring systems frequently employed today to forecast gastrointestinal bleeding outcomes are the Glasgow-Blatchford, Rockall, and AIMS65 scores.[6–8] These scoring systems are often complex and time-consuming. Additionally, it can be challenging to remember all the required parameters. On the other hand, in patients with acute upper gastrointestinal bleeding, it is often difficult to obtain the medical history required for existing nomograms due to the severity of symptoms.

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Lactate is an important biomarker in acute clinical conditions and is used for both diagnosis and prognosis in many critical illnesses such as hypoperfusion, shock, massive hemorrhage, and sepsis. Albumin is a plasma protein with many important functions in the body. As a negative acute-phase reactant, albumin provides valuable information for both diagnosis and prognosis in acute conditions. Rising in importance as a prognostic marker for mortality in some critical diseases is the lactate/albumin ratio.

In septic shock, organ failure, and lung diseases, the lactate/albumin ratio has demonstrated its ability to predict mortality.[9–11] In addition, previous studies have shown that an elevated lactate/albumin ratio is associated with adverse outcomes in a variety of clinical conditions, including liver disease, sepsis-induced acute kidney injury, type 2 diabetes mellitus, and heart failure. These associations support the use of LAR as a prognostic marker in different critical illness settings.[12–14] Although the prognostic value of the lactate/albumin ratio has been examined in several clinical contexts, studies focusing specifically on its role in patients with gastrointestinal bleeding remain scarce.

To investigate the predictive ability of the lactate/albumin ratio for mortality in patients with upper gastrointestinal bleeding was the aim of this study.

MATERIALS and METHODS

A retrospective evaluation was conducted on patients who applied in the Internal Medicine Department with upper gastrointestinal bleeding between April 2021 and April 2025. According to treatment outcomes, patients were categorized into two distinct groups. One group consisted of those who died despite treatment, while the other group included those who were discharged after clinically recovering. All patients received pantoprazole as an 80 mg intravenous bolus. In patients with ulcers, the infusion was continued at a rate of 8 mg/hour. Blood transfusion was administered when hemoglobin was <7 g/dL in patients without cardiac disease, and when hemoglobin was <8 g/dL in those with a history of heart disease. Therapeutic endoscopic procedures such as band ligation, adrenaline injection, and sclerotherapy were performed. The study was conducted in accordance with the Declaration of Helsinki and was approved by the Basaksehir Cam and Sakura Hospital Ethics Committee (Approval no: KAEK/08.01.2025.10).

Among the documented parameters were demographic details, haemoglobin levels, hospitalisation duration, and the existence of chronic conditions including renal disease, liver cirrhosis, malignancy, coronary artery pathology, and heart failure. To assess patient prognosis, scoring systems including Rockall, AIMS65, and Glasgow-Blatchford, commonly applied to predict outcomes in gastrointestinal bleeding, were calculated. Additionally, lactate/albumin ratios were recorded. Laboratory parameters such as hemoglobin, lactate, and albumin were measured at the time of admission.

Statistical Analysis

Statistical analysis were performed using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation (SD). The distributional normality of the data was evaluated using the Shapiro–Wilk test. To compare groups, the chi-squared test was applied for categorical variables, while the Mann–Whitney U test was used for non-normally distributed continuous data. To examine variables associated with mortality, univariate and multivariate logistic regression analyses were conducted. To assess their ability to predict mortality, Receiver Operating Characteristic (ROC) curve analysis was conducted for the lactate/albumin ratio alongside the Glasgow-Blatchford, Rockall, and AIMS65 scores. Calculated for each parameter was the area under the curve (AUC) to evaluate diagnostic accuracy. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Included in the study were 300 patients in total. Of these, 31 individuals (10.3%) comprised the mortality group, whereas 269 (89.7%) were classified under the recovery group.

Table 1 displays the demographic details and patient features. The average age recorded was 64.9±13.6 for the mortality group, compared to 58.5±19.2 in the recovery group (p=0.138). A ratio of 17 males to 14 females was observed in the mortality group, while the recovery group exhibited a ratio of 186 to 83 (p=0.154). In the mortality group, the length of hospital stay was 14.2±12 days, whereas it was 8.4±6.2 days in the recovery group (p=0.04). Liver cirrhosis was observed in 7 individuals (22.6%) within the mortality group compared to 20 patients (7.4%) in the recovery group (p<0.013). The number of malignancy-related bleeding cases was 6 (19.4%) in the mortality group and 9 (3.3%) in the recovery group (p=0.002). Malignancy was present in 14 individuals (45.2%) within the mortality group compared to 27 patients (10.0%) in the recovery group (p<0.001). Hemoglobin measurements showed means of 7.7±1.6 g/dL in patients who died and 8.8±2.7 g/dL in those who recovered (p=0.03).

Table 1. General characteristics of patients

	Mortality group n=31	Recovery group n=269	p
Age	64.9±13.6	58.5±19.2	0.138
Gender			0.154
Male	17	186	
Female	14	83	
Presenting symptom			0.587
Melena	0	2	
Haematochezia	1	5	
Syncope	30	262	
CKD			0.117
Yes	8	39	
No	23	230	
Liver cirrhosis			**0.013**
Yes	7	20	
No	24	249	
Malignancy			**<0.001**
Yes	14	27	
No	17	242	
Coronary disease			0.231
Yes	13	74	
No	18	195	
Heart failure			0.08
Yes	9	43	
No	22	226	
Endoscopic diagnosis			**0.002**
Variceal bleeding	6	25	
Hemorrhagic gastritis	12	93	
Ulcer bleeding	7	136	
Malignancy-related bleeding	6	9	
Mallory-Weiss tear	0	3	
Dieulafoy lesion	0	3	
Hospitalization (day)	14.2±12	8.4±6.2	**0.04**
Hemoglobin levels (g/dl)	7.7±1.6	8.8±2.7	**0.03**
Lactate albumin ratio	0.14±0.13	0.06±0.05	**<0.001**
AIMS65 score	1.58±0.9	0.9±0.8	**<0.001**
Rockall score	5.74±1.9	4.07±2	**<0.001**
Glasgow-blatchford score	12.6±2.9	9.7±3.4	**<0.001**

CKD: Chronic kidney disease

The Glasgow-Blatchford score, Rockall score, and AIMS65 score were all significantly higher in the mortality group compared to the recovery group (p<0.001). The lactate/albumin ratio was 0.14±0.13 in the mortality group and 0.06±0.05 in the recovery group (p<0.001).

According to univariate and multivariate analyses, a high lactate/albumin ratio and the presence of malignancy were observed as independent risk factors for mortality due to gastrointestinal bleeding (Table 2). Shown in Figure 1 are ROC analyses evaluating the predictive power of the Glasgow-Blatchford, Rockall, AIMS65 scores, and lactate/albumin ratio for mortality. As follows were the area under the curve (AUC) values in the ROC analysis predicting mortality: lactate/albumin ratio 0.800; AIMS65 score 0.688; Rockall score 0.723; and Glasgow-Blatchford score 0.747. The AUC and cut-off value of the lactate/albumin ratio are presented in Table 3. Lactate/albumin ratio values above 0.8 were found to be more strongly associated with mortality. This cut-off value was determined through ROC analysis.

DISCUSSION

The study demonstrated that an elevated serum lactate/albumin ratio serves as an independent predictor of mortality in cases of upper gastrointestinal bleeding. Additionally, it showed that it was superior to other scoring systems used after gastrointestinal bleeding.

To assess the capability of the lactate/albumin ratio in predicting mortality-related outcomes, we compared it with the AIMS65, Rockall, and Glasgow-Blatchford scores. To the best of our knowledge, few studies have evaluated the relationship between the lactate/albumin ratio and mortality in upper gastrointestinal bleeding. Thus, it is believed that the present study will add valuable insights to the literature.

Currently used scores such as AIMS65, Rockall, and Glasgow-Blatchford are calculated based on combinations of information and physical examinations that may be difficult to obtain in emergency department settings.[15,16] The Glasgow-Blatchford score is complex and challenging to use due to its inclusion of multiple parameters. Similarly, the Rockall score is also difficult to calculate because it re-

Table 2. Univariate and multivariate regression models to predict mortality

	Univarite model 95% CI			Multivarite model 95% CI		
	OR	Lower–upper	p	OR	Lower–upper	p
Age	0.98	0.960–1.002	0.075			
Gender	1.84	0.869–3.919	0.111			
Presenting symptom	0.57	0.065–5.065	0.587			
CKD	2.05	0.857–4.912	0.107			
Liver cirrhosis	3.63	1.394–9.458	**0.008**	2.190	0.707–6.778	0.174
Malignancy	7.38	3.279–16.617	**<0.001**	5.875	2.489–13.871	**<0.001**
Coronary disease	1.903	0.888–4.077	0.098			
Heart failure	0.465	0.201–1.079	0.075			
Haemoglobin levels	1.194	1.022–1.396	**0.026**	1.111	0.924–1.336	0.261
Lactate albumin ratio	0.112	0.001–0.018	**<0.001**	0.006	0.001–0.281	**0.009**

CI: Confidence interval; OR: Odds ratio; CKD: Chronic kidney disease

Table 3. The AUC and cut-off value of the lactate-to-albumin ratio

	AUC (%95 CI)	Cut off value	p	Sensitivity (%)	Specificity (%)
Lactate/albumin	0.800 (0.728–0.873)	0.8	<0.001	98.9	91.3

AUC: Area under the curve; CI: Confidence interval

quires similar variables and endoscopic findings. The more recently developed AIMS65 score is relatively easier to apply compared to the other two scoring systems; however, it still consists of four parameters: albumin level, systolic blood pressure, age, and altered mental status.[8] A potential issue with this score is the subjective nature of assessing altered mental status by physicians.

In emergency settings, distinguishing between upper and lower gastrointestinal bleeding can sometimes be challenging. Although the main focus of our study was on upper gastrointestinal bleeding outcomes, biomarkers that concurrently indicate tissue hypoperfusion (lactate) and chronic patient condition (albumin), independent of bleeding origin, hold greater significance. A recent study showed that mortality prediction due to upper gastrointestinal bleeding is more accurate with the AIMS65 score compared to the Glasgow-Blatchford and Rockall scores.[17] With a larger cohort and evaluation of the lactate/albumin ratio, our study demonstrated that this ratio serves as the most precise predictor of mortality.

A recent study, resembling ours, identified malignancy and liver disease as factors associated with mortality in gastrointestinal bleeding patients.[18] In agreement with prior

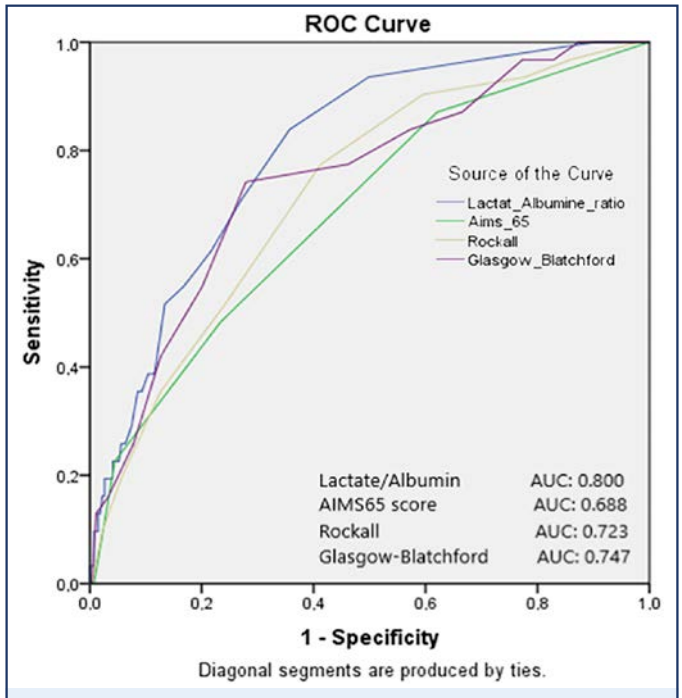

Figure 1. ROC curve analyses of the Glasgow-Blatchford score, Rockall score, AIMS65 score, and Lactate Albumin ratio

ROC: Receiver operating characteristic; AUC: Area under the curve

research, our study found that mortality in upper gastrointestinal bleeding patients is associated with liver cirrhosis and malignancy. Among patients thought to have gastrointestinal bleeding, a randomized study found that upper gastrointestinal bleeding was the source in 15% of cases.[19] From this perspective, it is unlikely that the lactate/albumin ratio's contribution to predicting mortality in gastrointestinal bleeding is solely due to bleeding originating from the lower gastrointestinal tract.

In the study by Sung et al.,[18] cases related to variceal bleeding were found to have higher intensive care unit requirements and mortality rates. In our study, however, cancer-related bleeding was more common in the mortality group, while ulcer-related bleeding was found to be less associated with mortality. Unlike our study, Sung et al.[18] evaluated all gastrointestinal bleeding cases, and the lack of a separate classification for patients requiring intensive care in our study may have contributed to the observed variations.

Our study has some limitations. The relatively small sample size may be the first limitation. Secondly, the study is potentially subject to bias due to its retrospective nature. We did not perform Kaplan–Meier analysis because the number of deaths within the first 24–48 hours was low. Additionally, the absence of a separate assessment for patients requiring intensive care unit care in our study can be considered a limitation compared to similar studies.

CONCLUSION

The serum lactate/albumin ratio serves as an independent predictor of mortality in patients with upper gastrointestinal bleeding. Its predictive accuracy surpasses that of existing nomograms, which often rely on more complex and subjective assessments. In conclusion, the lactate/albumin ratio may be a valuable prognostic marker for identifying patients at high risk of mortality, thereby facilitating risk stratification and guiding clinical decision-making.

Disclosures

Ethics Committee Approval: The study was approved by the Basaksehir Cam and Sakura Hospital Ethics Committee (No: KAEK/08.01.2025.10, Date: 20/01/2025).

Informed Consent: Informed consent was obtained from all patients or their relatives.

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