



# Prognostic Value of BUN/Albumin Ratio in Acute Upper Gastrointestinal Tract Haemorrhage

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## ABSTRACT

### Original Article

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**Objectives:** Acute upper gastrointestinal (GI) haemorrhage is a life-threatening condition with significant morbidity and mortality. Although risk stratification tools such as AIMS65 and Glasgow-Blatchford Score (GBS) are widely used, there is growing interest in biochemical markers that are easy to calculate and may aid clinical decision-making. This study aimed to investigate the prognostic value of the blood urea nitrogen (BUN)/albumin ratio (BAR) in predicting mortality in patients presenting with acute upper GI haemorrhage and to compare its performance with the AIMS65 and GBS scores.

**Methods:** This retrospective observational study included 356 adult patients admitted to a tertiary emergency department with a diagnosis of acute upper GI haemorrhage between January 2020 and October 2023. Patients with malignancy, liver or renal failure, sepsis, or incomplete records were excluded. Demographic, clinical, and laboratory data were collected. BAR and AIMS65 scores were calculated from initial laboratory results. The primary outcome was in-hospital mortality. Receiver operating characteristic (ROC) analyses were performed to compare the predictive abilities of BAR, AIMS65, and GBS. **Results:** The mean age of the study population was  $67.25 \pm 16.78$  years, and 40.7% were female. The overall in-hospital mortality rate was 18.7%. The mean BAR was  $1.45 \pm 1.15$ . ROC analysis demonstrated that the AIMS65 score had a significantly better predictive ability for mortality than BAR (AUC difference  $p = 0.002$ ). Similarly, GBS outperformed BAR in predicting discharge status (AUC difference  $p < 0.001$ ). While BAR showed some correlation with mortality, it did not exhibit sufficient predictive power to replace established scoring systems.

**Conclusion:** Although the BUN/albumin ratio is an accessible and easily calculable biomarker with theoretical relevance in acute upper GI haemorrhage, this study found that its prognostic utility is inferior to AIMS65 and GBS. BAR alone should not be used in place of established clinical risk scores. However, given its simplicity and cost-effectiveness, further multicentre prospective studies are warranted to explore its role as a supportive prognostic tool in specific patient subgroups.

**Keywords:** Upper gastrointestinal bleeding, BUN/albumin ratio, AIMS65, Prognostic biomarkers, Emergency medicine.



#### How to cite this article

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## INTRODUCTION

Acute upper gastrointestinal tract (GI) haemorrhage represents a serious clinical picture that constitutes a significant proportion of hospital admissions and requires urgent intervention. This condition is associated with high morbidity and mortality rates and is a life-threatening problem, especially in older age groups [1]. Upper GI haemorrhage is defined as haemorrhage originating from the gastrointestinal segments between the oesophagus and the ligament of Treitz and most commonly develops due to pathologies including peptic ulcer, oesophageal varices, and Mallory-Weiss tears [2]. Although a significant decrease has been achieved in the mortality rates related to these haemorrhages in recent years, thanks to the widespread use of proton pump inhibitors (PPIs) and advanced endoscopic treatment methods, mortality rates are still around 5-10% [3]. This situation highlights the severity of acute upper GI hemorrhage and the challenges in managing these patients.

Current clinical guidelines recommend the use of various risk assessment scores to ensure rapid and effective decision-making in the management of acute upper GI bleeding. These scores have been developed to predict clinical outcomes, including rebleeding risk, mortality, need for transfusion, and intensive care unit requirement [4]. In this context, risk scores such as the Glasgow-Blatchford Score (GBS) and AIMS65 both support physicians' decision-making processes and contribute to the adoption of a standardized approach in patient care [5-7]. These scores help to discharge low-risk patients safely and to refer high-risk patients to units requiring advanced treatment, such as the intensive care unit, in the early period.

However, biochemical parameters that evaluate renal function and reflect nutritional status are also considered important prognostic indicators in acute upper GI haemorrhage. Among these parameters, blood urea nitrogen (BUN) and albumin levels are prominent. Decreased renal perfusion due to blood loss and metabolism of digested blood to BUN in the gastrointestinal system led to increased BUN levels in patients with acute upper GI bleeding [8]. On the other hand, albumin is a basic plasma protein that plays a crucial role in the body's inflammatory response and nutritional status [9]. Low albumin levels have a negative effect on the clinical course of patients and are associated with an increased risk of mortality. Indeed, low albumin levels have been associated with increased mortality in pneumonia [10], acute coronary

syndrome [11], pancreatitis, and geriatric patient groups [12].

In the current literature, studies have investigated whether scoring systems and shock index can be used to predict mortality and prognosis in patients presenting to the emergency department with upper gastrointestinal bleeding [13]. In addition, although it has been reported that elevated BUN and low albumin levels may be effective in predicting mortality in various disease groups, there are insufficient studies on the use of the BUN/Albumin ratio as a prognostic indicator in acute upper GI bleeding. In this study, we aim to investigate the potential value of the BUN/Albumin ratio in predicting mortality in acute upper GI haemorrhage and to introduce this ratio into clinical practice.

## METHODS

### *Study design:*

This study was designed as a retrospective observational study. The study included patients admitted to the emergency department between January 1, 2020, and October 1, 2023. Local ethics committee approval was obtained prior to commencing the study.

### *Study population:*

Our study included patients aged 18 years and older who presented to the emergency department and were diagnosed with upper gastrointestinal bleeding. Among these patients, we excluded pregnant and lactating women, patients with missing data, patients with a history of malignancy, patients with sepsis, patients with acute renal failure, patients with hepatic failure, and patients with a history of anti-inflammatory or immunosuppressive drug use. Patients who were referred to an external centre and for whom no outcome information was available were also excluded.

### *Data collection:*

Patient records were accessed on the hospital information management system to determine the patients to be included in the study. A total of 411 patients admitted to the emergency department within the specified date range were identified. Of these patients, 29 were excluded because of a history of malignancy, 21 because of missing data, 14 because of liver failure, 3 because of a history of haematological

disease, 2 because of pregnancy, and 1 because of receiving immunosuppressive treatment. The remaining 356 patients were included in the study. Age, gender, laboratory data, imaging data, duration of hospitalization, mortality, and comorbidities of all patients were recorded in the data recording form for use in statistical analysis. AIMS65 scores and BAR (BUN/Albumin Ratio) values were calculated on the data obtained from the patients. The calculated values were compared with each other in terms of predicting the emergency department outcome and patient mortality.

**Outcomes:**

The primary objective of this study was to investigate the utility of the BAR value as a predictor of mortality in patients with upper gastrointestinal bleeding presenting to the emergency department. The secondary outcome was to investigate whether the BAR value is superior to the AIMS65 score.

Data calculation: In the study, BAR and AIMS65 scores

were calculated using hemogram and biochemistry results obtained for each case.

BAR: BUN/Albumin

AIMS65: This score gives 1 point for each of the following five parameters:

- Albumin: Serum albumin level  $\leq 3.0$  g/dL
- INR (International Normalized Ratio): INR  $> 1.5$
- Mental Status: Altered mental status (e.g., loss of consciousness, confusion)
- Systolic Blood Pressure: Systolic blood pressure  $\leq 90$  mmHg
- Age: Age  $\geq 65$

1 point is given for each criterion, and the total score ranges from 0 to 5. Higher scores indicate a worse prognosis and mortality risk.

- 0 points: Low risk
- 1-2 points: Medium risk
- 3-5 points: High risk

**Statistical analysis:**

After the data collection process, the data were

**Table 1:** Descriptive Characteristics

Variables	$\bar{x} \pm ss$	M (min-max)
Age	67,25±16,78	70 (18-95)
Gender, n (%)		
Female	146 (40,7)	
Male	213 (59,3)	
Hematemesis, n (%)	72 (20,1)	
Haematochezia, n (%)	72 (20,1)	
Melena, n (%)	188 (52,4)	
Other, n (%)	28 (7,8)	
Systolic blood pressure	117,83±24,20	115 (50-200)
Diastolic blood pressure	65,01±14,21	65 (22-110)
Pulse	92,27±18,33	90 (48-163)
Creatinine	3,71±19,97	1,03 (0,34-221)
BUN	40,01±27,09	32 (5-162)
Albumin	30,25±6,59	31 (12-48)
INR	7,91±73,32	1,16 (0-946)
Haemoglobin	9,66±8,92	8,6 (3,4-95)
Haematocrit	31,43±36,18	26,6 (11,1-367)
Platelets	246,24±120,21	226 (9-848)
Mental deterioration, n (%)	66 (18,4)	
Near syncope, n (%)	19 (5,3)	
History of liver disease, n (%)	22 (6,1)	
Heart failure, n (%)	5 (1,4)	
BAR	1,45±1,15	1,14 (0,15-6,57)
GBS	7,92±4,14	8 (0-18)
AIMS 65	1,57±1,14	1 (0-5)
Discharged from the ER, n (%)	37 (10,3)	
Hospitalization, n (%)		
Outpatient	37 (10,3)	
Ward	145 (40,4)	
Intensive care	177 (49,3)	
Outcome, n (%)		
Exitus	292 (81,3)	
Discharged	67 (18,7)	

$\bar{x}$ : Mean, ss: Standard deviation, M: Median

**Table 2:** Comparison of BAR and AIMS 65 Variables by ROC Analysis According to Outcome

	Test Value		Area Differences Under the Curve	Standard Error (Difference)	Area under the Curve (AUC) 95% Confidence Limits	
	z	p			Lower limit	Upper limit
<b>BAR – AIMS 65</b>	3,025	<b>0,002</b>	-0,105	0,257	-0,173	-0,037
<b>BAR - GBS</b>	4,542	<b>&lt;0,001</b>	-0,181	0,288	-0,259	-0,103

digitized and statistically analyzed. SPSS software (IBM Corporation, Armonk, NY) was used for all analyses. P values less than 0.05 were considered significant, and all statistics were performed at a 95% confidence interval. Descriptive statistics were presented as frequency, percentage, mean, standard deviation, median, minimum, and maximum values. Normality assumptions were tested using the Shapiro-Wilk test, as well as skewness and kurtosis values, and Q-Q plots. The data of the participants were compared using the Independent Samples t-test when the data fit the normal distribution and the Mann-Whitney U-test when the data did not fit the normal distribution.

**RESULTS**

A total of 359 patients were included in the study, with 146 being female. The mean age of all patients was  $67.25 \pm 16.78$  years (Table 1).

According to the table, it can be concluded that the area difference between the ROC curves for the BAR and AIMS 65 variables is statistically significant, and the AIMS 65 variable outperforms the BAR variable in terms of classification ability. The classification ability of the AIMS 65 variable in predicting patient outcomes is statistically significantly higher than that of the BAR variable (Table 2).

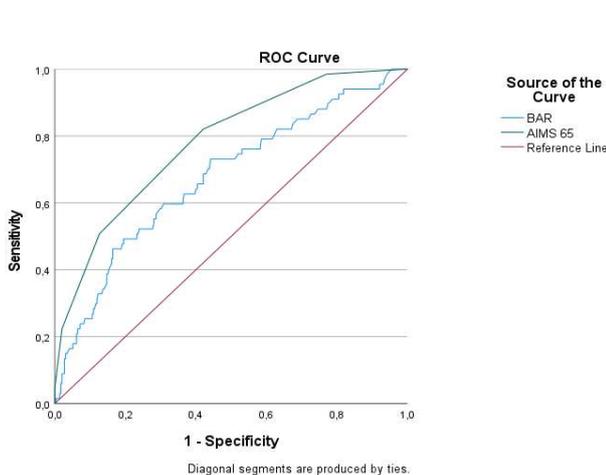
According to the table, it can be concluded that

the area difference between the ROC curves for the BAR and GBS variables is statistically significant, and the GBS variable outperforms the BAR variable in terms of classification ability. The GBS variable is statistically significantly higher than the BAR variable in predicting the discharge status (Figure 1 and 2).

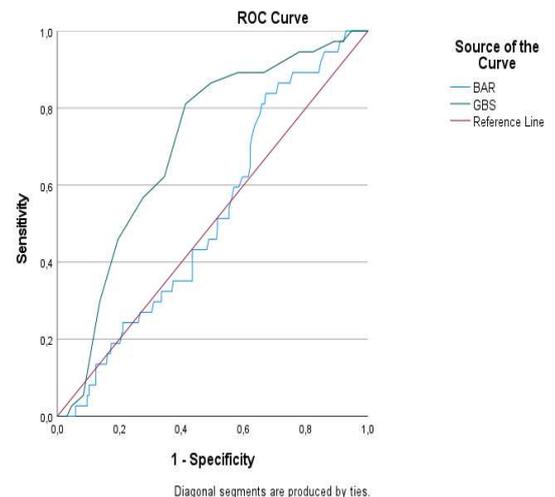
**DISCUSSION**

Acute upper gastrointestinal tract (GI) haemorrhage represents a serious clinical picture that constitutes a significant proportion of hospital admissions and requires urgent intervention. Different risk scores have been developed to predict prognosis and support clinical decision-making in these patients. In this study, the potential of BUN/Albumin Ratio (BAR) to predict mortality in upper GI haemorrhage was investigated and compared with existing scoring systems.

The findings of the study indicate that BAR may be a significant predictor of mortality in upper GI haemorrhage. However, according to the results of the ROC analysis, it was found that the AIMS65 score performed better than BAR in predicting mortality. This finding indicates that AIMS65 score is a more reliable method than BAR in predicting the outcome of patients. This may be due to the fact that the AIMS65 score, unlike the BAR, includes not only laboratory values but also components related to the clinical



**Figure 1.** ROC Analyses of BAR and AIMS 65 Variables



**Figure 2:** ROC Analyses of BAR and GBS Variables

evaluation of the patient. Previous studies have also demonstrated that the AIMS65 score is an effective scoring system in determining mortality rates [14,15]. Therefore, despite the potential for clinical use of BAR, its use as a stand-alone marker that can replace existing scoring systems is not yet supported.

In addition, ROC analyses between BAR and Glasgow-Blatchford Score (GBS) were also compared and it was found that GBS had a higher predictive power than BAR in predicting discharge status. It is known that GBS is widely used especially in the identification of low-risk patients and management of discharge decisions [16]. Therefore, the fact that BAR had a low predictive power compared to GBS in our study is compatible with the existing literature. However, the fact that BAR is an easily calculable parameter and especially the potential of biochemical indicators to reflect the severity of the disease requires a more detailed examination of the prognostic value of this ratio in the future.

Current literature reveals that blood urea nitrogen (BUN) and albumin levels have prognostic significance in various diseases. While BUN levels generally reflect hypovolemia and renal perfusion disorders, albumin levels are evaluated as an indicator of nutritional status and systemic inflammation. These two parameters, especially when considered together as the BUN/albumin ratio (BAR), stand out as a more powerful biomarker for predicting clinical outcomes. Studies have shown that high BAR is significantly associated with short- and long-term mortality in intensive care patients with sepsis [17], with the risk of in-hospital mortality in elderly emergency department patients [18], and with disease severity and poor prognosis in various clinical conditions such as acute pancreatitis [19] and COVID-19 [20]. BAR is considered as a practical tool in clinical decision-making processes because it is a low-cost and easily applicable parameter, as well as having similar accuracy to classical scoring. Low levels of albumin are generally associated with poor nutritional status and systemic diseases, whereas high BUN levels indicate impaired renal perfusion and poor clinical picture. In this context, both BUN and albumin levels and their ratio are effective and accessible biomarkers to predict mortality and morbidity risk in different patient groups. However, in our study including patients admitted with acute upper gastrointestinal bleeding, no statistically significant correlation was found between BUN/albumin ratio and patient outcome. This finding suggests that BAR may not have the same prognostic value in

every clinical picture and disease-specific physiological pathological mechanism may affect this relationship. In addition, factors such as severity of haemorrhage, volume replacement, accompanying comorbidities and the effect of other prognostic markers may have limited the power of BUN and albumin levels to reflect clinical outcomes. This study, for the first time, analyzed the usefulness of BAR in upper GI bleeding in detail and demonstrated that it should be evaluated as a prognostic marker in certain patient groups.

## CONCLUSION

In conclusion, although BAR has potential as a prognostic marker in upper GI haemorrhage, it has not demonstrated a strong enough predictive value to replace existing risk scores. However, since it is a parameter that is easy to use clinically and widely available, it should be investigated in more detail in larger patient groups in the future.

## Limitations

It should be noted that this study has some limitations. Firstly, due to its retrospective design, data were obtained retrospectively from hospital records and some missing information may have led to potential biases. In addition, the fact that the patient population consisted of a single-centre cohort may limit the generalisability of the findings. Future prospective and multicentre studies will help us to better understand the place of BAR in clinical practice.

## Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Ethical Approval

Ethical approval for this study was obtained from the İzmir Katip Çelebi University Ethics Committee (Protocol No: 0097).

## Authors' Contribution

Study Conception: SK; Study Design: MGE; Literature Review: UP; Critical Review: TDS; Data Collection and/or Processing: OSÇ; Analysis and/or Data Interpretation: SK; Manuscript preparing: MGE.

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