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# Prognostic Significance of the Hemoglobin-Albumin Ratio in Upper Gastrointestinal Bleeding

# Üst Gastrointestinal Sistem Kanamalarında HAR Hemoglobin-Albumin Oranı) Skorunun Prognostik Önemi

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**Öz**

**Amaç:**Üst gastrointestinal sistem kanaması ciddi ve hayatı tehdit eden bir hastalık olup takip ve prognoz önemlidir. Bu çalışmada HAR (Hemoglobin-Albumin Oranı) skoru ile endoskopik risk skorlama sistemlerinin prognostik değeri karşılaştırıldı.

**Metod:**2022-2024 yılları arasında kliniğimizde üst gastrointestinal sistem kanamasıyla izlenen 153 hastanın dosyaları geriye dönük incelendi. Endoskopik risk skorlama sistemleri (Rockall skoru (RS), Glasgow-Blatchford skoru (GBS), Forrest sınıflaması hesaplandı. Kan parametrelerinden oluşan Hemoglobin-albumin oranı (HAR) skoru hesaplandı. HAR skoru, klinik bulgular, endoskopik skorlar ve kötü prognostik risk faktörleri (hastanede kalma süresi, tekrar kanama öyküsü, kan transfüzyonu öyküsü, operasyona verilme öyküsü, mortalite) ile karşılaştırıldı

**Bulgular:**Hastaların 122'si (%79.7) erkek, 31'i (%20,3) kadındı. Endoskopik olarak en fazla duodenal ülser (% 43,7) saptandı. Ortalama GBS 10,69±3,89, RS 4,37±2,27, HAR skoru 2,88±0,64 olarak hesaplandı. HAR skoru ile Glasgow Blatchford skoru arasında düşük düzeyde anlamlı bir ilişki vardı (r= -0,254, p=0,002). Düşük hemoglobin değeri, düşük HAR skoru ve yüksek GBS'nun kötü prognozla ilişkili olduğu saptandı.

**Sonuç:**Endoskopik skorlardan yüksek GBS ile düşük HAR skorunun ilişkili olduğu saptandı. Düşük HAR ve yüksek GBS olanlarda prognozun daha kötü olduğu saptandı. HAR skoru ile gastrointestinal sistem kanama öyküsü arasında sınırda anlamlı ilişki vardı. HAR skoru ile hastanede kalma süresi, tekrar kanama öyküsü, kan transfüzyonu öyküsü, operasyona verilme öyküsü arasında anlamlı bir ilişki yoktu. HAR skoru endoskopik skorlama sistemlerine benzer etkili ve güvenilir belirteçlerdir. HAR skoru basit, hızlı, pratik ve daha kolay hesaplanabilir olduğundan dolayı rutin pratikte kullanılabilecektir.

**Anahtar kelimeler:** Gastrointestinal sistem kanama, endoskopik skorlama sistemi, HAR, prognoz

**Abstract**

**Objective:**Upper gastrointestinal bleeding is a serious and life-threatening condition where monitoring and prognosis are crucial. This study aimed to compare the prognostic value of the hemoglobin-albumin ratio (HAR) with endoscopic risk scoring systems.

**Methods:**The medical records of 153 patients with upper gastrointestinal bleeding treated at our clinic between 2022 and 2024 were retrospectively reviewed. Endoscopic risk scoring systems, including the Rockall score (RS), Glasgow-Blatchford score (GBS), and Forrest classification, were calculated. The HAR score, consisting of hematologic parameters, was computed. HAR score was compared with clinical findings, endoscopic scores and

poor prognostic risk factors (duration of hospital stay, history of rebleeding, history of blood transfusion, history of operation, mortality)
**Results:**Of the patients, 122 (79.7%) were male and 31 (20.3%) were female. A duodenal ulcer was the most common endoscopic finding (43.7%). The mean GBS was 10.69±3.89, RS was 4.37±2.27, and HAR was 2.88±0.64. There was a low-level significant correlation between the HAR score and the Glasgow Blatchford score (r=-0.254, p=0.002). Low hemoglobin levels, a low HAR score, and a high GBS were associated with a poor prognosis.
**Conclusion:**Among endoscopic scores, it was found that high GBS and low HAR scores were associated. Prognosis was found to be worse in those with low HAR and high GBS. There was a borderline significant relationship between HAR score and history of gastrointestinal bleeding. There was no significant relationship between HAR score and length of hospital stay, history of rebleeding, history of blood transfusion, history of being referred for surgery. HAR scores are effective and reliable indicators similar to endoscopic scoring systems. Since HAR score is simple, fast, practical and easier to calculate, it can be used in routine practice.

**Keywords:** Gastrointestinal bleeding, endoscopic scoring system, HAR, prognosis

## 1. Introduction

Upper gastrointestinal system (GIS) bleedings are among the emergencies in gastroenterology. The incidence ranges from 40 to 150 per 100,000 cases. The majority of these bleeds stop spontaneously. Despite radiological and endoscopic advancements, approximately 10% of cases follow a fatal course. Hospitalization and the need for blood transfusions incur high costs [1,2]. Therefore, numerous risk scoring systems have been developed to predict bleeding risk and mortality. Among these, the most commonly used are the Rockall score (RS), which incorporates pre-endoscopic and endoscopic findings, and the Glasgow-Blatchford score (GBS), which predicts low-risk patients based solely on clinical and laboratory findings. Risk scoring systems are crucial for predicting rebleeding risk, the need for blood transfusion and endoscopic intervention, and mortality [3,4]. While these risk scoring systems are clinically effective and reliable, their complex calculations render them impractical for routine clinical use. Thus, there is a need for personalized prognostic factors for predicting risk, survival, and mortality.

Scoring systems derived from hematological and biochemical parameters are utilized for prognostic evaluation in various diseases [4,5]. Serum hemoglobin and albumin levels, indicative of tissue hypoxia, are important prognostic parameters used in emergency departments and intensive care units. Hemoglobin is a prognostic factor associated with systemic inflammation, hypoxia, and anemia in both malignant and non-malignant diseases. Albumin, on the other hand, is a prognostic factor associated with nutritional status and inflammation [6,7]. In this study, endoscopic scores, namely the GBS, RS, and the Forrest classification, were evaluated in patients with upper GIS bleeding. In addition, the hemoglobin-albumin ratio (HAR) score, composed of blood parameters, was calculated. The endoscopic scoring systems were compared with the HAR score in terms of predicting in-hospital mortality, endoscopic treatment, and rebleeding risk.

## 2. Materials And Methods

The data for the study was retrospectively collected by reviewing the medical records of 153 patients who were followed up for upper GIS bleeding at the gastroenterology clinic of the Manisa Celal Bayar Üniversitesi Faculty of Medicine Hospital between 2022 and 2024. Patients over the age of 18 were included in the study. Those with liver cirrhosis, pregnancy, lower GIS bleeding, malignancy, sepsis, and a history of blood transfusion within the last six months were excluded from the study. Demographic data (age, gender, etc.), comorbidities, medication use, physical examination findings, laboratory parameters (hemoglobin, urea, creatinine, prothrombin time, international normalized ratio, and albumin), need for blood transfusion, endoscopic findings, requirement for surgical or endoscopic interventions, and in-hospital mortality parameters were recorded. An upper GIS bleeding diagnosis was established based on bleeding symptoms, such as hematemesis, melena, and hematochezia, at admission. When gastric, duodenal, or gastro-duodenal ulcers were identified during endoscopy, this condition was defined as peptic ulcer disease. Active bleeding, a decrease in hemoglobin of at least 2 mg/dL, or recurrent hematemesis and/or hematochezia during follow-up were considered rebleeding. Endoscopic hemostasis methods included saline + adrenaline injection, hemoclips, or thermal therapies (heater probe and argon plasma coagulation) [8]. Each patient's GBS, RS, and Forrest scores were calculated [9-11]. These

scores were calculated with a formula similar to that in previous studies. The HAR score was calculated by dividing the hemoglobin value by the albumin value. Patients were classified as having either a low HAR or high HAR score based on the median HAR value [27].

### 3. Statistical Analysis

Descriptive statistics were presented as median (minimum-maximum) for numerical variables, and as mean ± standard deviation or count (n) and percentage (%) for nominal variables. Continuous variables were evaluated for normal distribution using the Shapiro-Wilk test. Differences between groups in terms of the HAR score were investigated using the Mann-Whitney U and Kruskal-Wallis tests. Relationships between the HAR score and numerical variables were examined using Spearman's correlation coefficient. Results were considered statistically significant at $p < 0.05$.

**3.1 Ethical considerations:** All data was obtained in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all patients included in the study prior to endoscopic procedures. Ethical approval was obtained from the Health Sciences Ethics Committee of the XXX Faculty of Medicine on March 13, 2024, with decision number 2286.

### 4. Results

Of the patients, 122 (79.7%) were male, and 31 (20.3%) were female. The median age (min-max) was 63.0 (16.0-96.0) years. Smoking was present in 44.4% of the patients, while 38.6% had hypertension and coronary artery disease. Among the patients, 62 (40.5%) were using aspirin, 10 (6.5%) were using clopidogrel, 19 (12.4%) were using warfarin, and 33 (21.6%) were using non-steroidal anti-inflammatory drugs. The most common presenting complaint was melena (84.9%). A history of GIS surgery was present in nine (5.9%) patients, while 38 (24.8%) had a history of previous GIS bleeding. Endoscopic findings revealed that 43.7% (67) had duodenal ulcers, 10.4% (16) had gastric ulcers, 4% (6) had malignant tumors, 6.5% (10) had normal findings, and the remainder had other conditions (e.g., Mallory-Weis syndrome and erosive gastritis). Rebleeding occurred in 17 (11.2%) patients during follow-up. Blood transfusion was administered to 93 (61%) patients, emergency endoscopy was performed in 53 (34.6%) patients, endoscopic hemostasis treatment was applied to 88 (57%) patients, five (3.3%) patients underwent surgical operations, and four (2.6%) patients died. Demographic findings are presented in Table 1, and the distribution of the HAR score across different groups is provided in Table 2. The mean GBS value was calculated as 10.69 ± 3.89, RS as 4.37 ± 2.27, and HAR score as 2.88 ± 0.64. The HAR score had a moderate positive correlation with hemoglobin ($r = 0.647$, $p < 0.001$), a moderate negative correlation with albumin ($r = -0.470$, $p < 0.001$), and a low negative correlation with the GBS ($r = -0.254$, $p = 0.002$). There was no significant correlation between the HAR score and the RS ($r=-0.006$, $p=0.942$) or between the HAR score and the Forrest classification categories ($p = 0.844$). The GBS had a higher predictive value. It was found that the prognosis was worse in patients with a low HAR score and a high GBS. There was a borderline significant association between the HAR score and a history of GIS bleeding ($p = 0.050$). No significant correlation was observed between the HAR score and the length of hospital stay, history of rebleeding, history of blood transfusion, history of surgery, or recovery.

**Table-1:** Demographic characteristics of the patients

| **Variables (n = 153)** | |
|---|---|
| Age (n = 153)<br>Median (min-max)<br>Mean ± SD | <br>63.00 (16.00-96.00)<br>57.68 ± 18.72 |
| Hemoglobin (g/dl) | 10.00 (5.00-14.00)<br>9.97 ± 2.07 |
| Albumin (g/dl) | 3.00 (2.00-5.00)<br>3.52 ± 0.61 |
| Hemoglobin-albumin ratio | 3.00 (1.67-4.33)<br>2.88 ± 0.64 |
| Glasgow-Blatchford score | 11.00 (2.00-21.00)<br>10.69 ± 3.89 |
| Rockall score | 4.00 (0.00-11.00)<br>4.37 ± 2.27 |
| Forrest classification<br>0<br>1A<br>1B<br>2B<br>2C<br>3 | <br>3 (2.2%)<br>6 (4.3%)<br>23 (16.5%)<br>11 (7.9%)<br>8 (5.8%)<br>88 (63.3%) |

SD: standard deviation

**Discussion**

Endoscopic risk scoring systems are crucial for predicting rebleeding risk, the need for blood transfusion, and the requirement for endoscopic intervention in upper GIS bleeding cases. Although these risk scoring systems are clinically effective and reliable, their practical application is hindered by the complexity of the calculation [12]. Accurate risk classification is of paramount importance in improving clinical outcomes and guiding treatment decisions. The HAR score is a newly developed parameter that offers simplicity and practicality by utilizing only blood parameters. Therefore, this study aimed to investigate the effectiveness and prognostic value of the HAR score. Studies have generally reported a higher incidence of upper GIS bleeding in males compared to females [13]. In our study, 122 out of the total patients (79.7%) were male, which is consistent with the literature. The mean age of the patients was determined to be 57.68 ± 18.72 years, also aligning with existing literature findings. In the follow-up and prognosis of patients presenting with upper GIS bleeding, the systolic blood pressure, hemoglobin, and hematocrit values at admission are crucial. Zaragoza et al. reported that initial hematocrit values below 30% and systolic blood pressure below 100 mmHg were associated with a poor prognosis [14]. In our study, the mean hemoglobin level was 9.97 ± 2.07. A correlation was observed between a poor prognosis and low HAR and hemoglobin levels. Melena is the most common presenting symptom in upper GIS bleeding, accounting for over 70% of cases. In a study by Kayataş et al., melena and hematemesis were the most frequently reported complaints, while presyncope/syncope was reported in 9.9% of cases [15]. In our study, the frequency of melena was 84.9%, indicating its prominence as a readily identifiable and distressing symptom prompting patients to seek prompt medical attention. Comorbidities are also significant risk factors affecting mortality in upper GIS bleeding, reported in the literature at an incidence of 50-70% [16]. We found that coronary artery disease was the most common comorbidity (38.6%) in our study population. Numerous studies have compared various endoscopic scoring systems for their prognostic utility. For instance, Kim et al. reported higher predictive values for rebleeding and mortality with the Forrest classification and RS [17]. In a study by Gökçek et al., 51.1% of patients received blood transfusions, with the GBS demonstrating a better predictive value for transfusion requirement [18]. Martínez-Cara et al. found that 62% of patients received blood transfusions, and both the RS and GBS were useful in predicting the need for transfusion [19]. Dicu et al. reported a transfusion rate of 35.7%, with the GBS outperforming the RS in predicting transfusion requirement [20]. Similarly, Stanley et al. found the GBS to be more significant than the RS in predicting the need for transfusion and endoscopic intervention (21). Consistent with these findings, in our study, blood transfusions were administered to 93 (61%) of the patients. A history of GIS bleeding and the need for transfusion were associated with a poor prognosis. Mortality rates in studies on gastrointestinal bleeding range from 8% to 20.3%. The mortality rate was reported to be 5.7% by Gökçek et al. [18] and 2.6% by Robertson et al. [22]. In our study, the in-hospital mortality rate was 2.67% (ranging from 2.33% to 3.67%). Kalkan et al. demonstrated that the

**Table-2:** Distribution of the HAR score across groups

| Groups | HAR Median (min-max) | p-value |
|---|---|---|
| Gender | | |
| Male (n = 122) | 3.00 (1.67-4.33) | 0.206* |
| Female (n = 31) | 3.25 (1.67-4.33) | |
| GIS bleeding history | 3.00 (1.67-4.33) | 0.050* |
| Absent (n = 115) | 2.67 (1.67-4.00) | |
| Present (n = 38) | | |
| Forrest classification | 2.75 (2.50-3.00) | 0.844** |
| 0 (n = 3) | 2.54 (2.00-3.25) | |
| 1A (n = 6) | 3.00 (2.00-4.00) | |
| 1B (n = 23) | 2.67 (1.75-4.00) | |
| 2B (n = 11) | 2.75 (1.75-4.33) | |
| 2C (n = 8) | 3.00 (1.67-4.33) | |
| 3 (n = 88) | | |
| Rebleeding | 3.00 (1.67-4.33) | 0.735* |
| Absent (n = 135) | 2.75 (1.75-4.00) | |
| Present (n = 17) | | |
| Blood transfusion | 3.00 (1.67-4.33) | 0.274* |
| Absent (n = 56) | 3.00 (1.67-4.00) | |
| Present (n = 97) | | |
| Surgery | 3.00 (1.67-4.33) | 0.204* |
| Absent (n = 148) | 2.50 (1.75-3.33) | |
| Present (n = 5) | | |
| Recovery | 2.67 (2.33-3.67) | 0.787* |
| Absent (n = 4) | 3.00 (1.67-4.33) | |
| Present (n = 149) | | |

HAR: hemoglobin-albumin ratio, GIS: gastrointestinal system, SD: standard deviation

*Mann-Whitney U Test

** Kruskal-Wallis Test

RS was superior to the GBS in predicting in-hospital mortality [23,24], while Akhila Arya et al. showed that the GBS better predicted the risk of bleeding and the need for transfusion [25,26]. The first study investigating the prognostic importance of the HAR score was conducted by Hu et al., who found that a low HAR score was associated with a poor prognosis in operable gastric cancer patients, suggesting the prognostic utility of this parameter in postoperative follow-up for this patient population [27]. Our findings revealed an association between low hemoglobin, low HAR, and high GBS values and a poor prognosis. Additionally, a history of previous GIS bleeding was also associated with a poor prognosis. The retrospective, single-center nature of our study represents its limitations. Due to its retrospective nature, only in-hospital mortality rates could be evaluated, and post-discharge rebleeding events were unknown. There is a need for prospective studies involving multiple centers and a larger number of patients.

In conclusion, prognostication in the follow-up of patients with upper GIS bleeding is crucial. Endoscopic scoring systems are often combined rather than used alone. This study is important due to its investigation into the prognostic significance of the HAR score in patients with upper GIS bleeding, marking the first of its kind. This parameter as an effective and reliable marker akin to endoscopic scoring systems. Previous studies have shown that the HAR score is a poor prognostic factor in gastric cancer-related bleeding. İn this study, no significant prognostic relationship was found between the HAR score and non-variceal upper gastrointestinal bleeding. However, among endoscopic scores, it was found that high GBS and low HAR scores were associated. Therefore, multicenter studies with a larger number of patients are necessary. Endoscopic scores can be cumbersome to calculate, whereas the HAR score is simple, rapid, practical, and easily calculable, making it suitable for routine clinical practice. It can guide clinicians in predicting the need for early endoscopy, length of hospitalization, risk of rebleeding, and mortality. We believe that these findings will contribute to the literature and provide guidance for future studies.
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**Author Contributions**
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**Data availability statement:** The authors declare that materials described in the manuscript, including all relevant raw data, will be freely available to any scientist wishing to use them for non-commercial purposes without breaching participant confidentiality.

**Declaration of Interests:** The authors declare that they have no competing interest.

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