

Article

Predictive Factors and Treatment Outcomes in Patients with Acute Variceal Bleeding

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Abstract

Background/Objectives: The study aimed to determine the demographic and clinical characteristics of patients with acute variceal bleeding and identify predictive factors associated with treatment outcomes. **Methods:** The retrospective study included 91 adults hospitalised for oesophageal and/or gastric variceal bleeding at the Department of Gastroenterology, University Hospital of Split. Data were collected on patients' demographics, clinical characteristics and laboratory findings, as well as treatment outcomes, including length of hospital stay, need for repeat endoscopy, rebleeding, infection incidence, and six-week mortality. **Results:** Of the 91 patients included, 85.7% were male, and the mean age was 61 ± 9 years. Liver cirrhosis was present in 94.5% of patients, with alcoholic aetiology in 76.7% of cases. The median MELD-Na score was 15 (IQR 11–21), and more than 40% of patients were classified as Child–Pugh B. The median length of hospital stay was 8 days (IQR 5–10.5). Diagnostic EGD was performed in 94.5% of patients, with 80.2% undergoing the procedure within 12 h of admission. Vasoactive therapy was administered to 65.9% of patients, while antibiotic prophylaxis was given in 82.4%. In-hospital mortality was 16.5%, and the cumulative six-week mortality was 25.3%. The severity of liver disease (expressed by MELD-Na and Child–Pugh scores) was associated with a higher risk of in-hospital mortality ($p = 0.0045$ and $p = 0.009$, respectively). Early endoscopic intervention did not result in a statistically significant reduction in in-hospital mortality (8.7% vs. 23.5%; $p = 0.104$). The use of antibiotic prophylaxis, vasoactive drugs, and endoscopic ligation was not associated with lower rates of infections, repeated endoscopies, or mortality. **Conclusions:** There was a positive correlation between the severity of decompensated liver cirrhosis and in-hospital mortality. Early endoscopic intervention (within 12 h of admission) was not statistically significant in reducing mortality. The use of antibiotic prophylaxis was not associated with reduced mortality or lower incidence of infections. Vasoactive therapy did not significantly reduce the need for repeat endoscopic intervention. Endoscopic ligation did not decrease the likelihood of rebleeding during hospitalisation, in-hospital mortality, or the length of hospital stay.



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1. Introduction

Variceal bleeding represents one of the most severe complications of liver cirrhosis and is associated with a high risk of mortality, even with current treatments and guideline-

based management [1]. Gastroesophageal varices affect nearly half of patients with liver cirrhosis [1]. The presence of dilated submucosal veins in the stomach and oesophagus reflects the development of a portosystemic collateral network and correlates with the severity of PH. A hepatic venous pressure gradient (HVPG) of 10 mmHg or greater is associated with a significantly increased risk of variceal formation [2,3]. Oesophageal varices are more common than gastric varices [4].

Given the high risks associated with variceal bleeding, timely diagnosis is crucial. Esophagogastroduodenoscopy (EGD) is the gold standard for diagnosing and screening patients with gastroesophageal varices [5]. However, the latest Baveno VII guidelines recommend endoscopic screening for varices in selected patients with liver cirrhosis: those with liver stiffness measurement ≥ 20 kPa and a platelet count $\leq 150 \times 10^9/L$ [3]. On the other hand, according to the guidelines of the European Association for the Study of the Liver (EASL), endoscopy should be performed in all patients with decompensated cirrhosis [2]. During endoscopic examination, it is essential to document the presence of varices, their size, and the presence of high-risk stigmata (red colour signs), thus stratifying patients' risk of bleeding [4–8].

The European Society of Gastrointestinal Endoscopy (ESGE) recommends primary prophylaxis for all patients with advanced liver disease and high-risk varices [2]. Therapeutic options include non-selective beta blockers (NSBBs), such as carvedilol, and endoscopic band ligation (EVL) [2]. When bleeding does occur, the management of patients with acute variceal bleeding consists of effective resuscitation, prompt diagnosis, control of bleeding, and prevention of complications [1]. Following stabilisation, empirical administration of vasoactive agents should begin as soon as acute variceal bleeding is suspected [1,3]. Therapeutic options are terlipressin, somatostatin, or octreotide. The recommended duration of vasoactive therapy is up to five days [3]. If endoscopic haemostasis is successful, vasoactive therapy may be discontinued after 24–48 h [3]. Alongside vasoactive therapy, empirical antibiotic therapy should be initiated. According to the latest guidelines, the antibiotic of choice is ceftriaxone at a dose of 1 g/day for up to 7 days [3]. Antibiotic selection should be adjusted based on local antimicrobial resistance patterns and the patient's prior allergic reactions.

With these initial therapies underway, endoscopic evaluation should be conducted as soon as possible in stable patients, ideally within 12 h [3]. Endoscopic management of oesophageal and gastric variceal bleeding differs slightly. Variceal ligation is preferred for oesophageal bleeding. Cardiofundal varices (GOV2 and IGV1) are treated with cyanoacrylate. GOV1 bleeding can be managed with either approach [1,3].

Timely endoscopic intervention is also emphasised in recent guidelines. According to these recommendations, upper endoscopy should be performed within 12 h of presentation in all patients with suspected acute variceal bleeding, preferably after haemodynamic resuscitation [3]. Previous results showed that overall mortality is significantly lower in patients who received early endoscopy (≤ 12 h) than in those who receive delayed endoscopy (>12 h) [9]. However, the optimal timing of upper GI endoscopy in patients with variceal bleeding remains unclear.

Although multiple detailed guidelines and classification systems exist, the optimal therapeutic approach in specific clinical scenarios and the timing of more invasive interventions remain subjects of ongoing debate [10–12]. This highlights the necessity for individualised patient management. Despite advances in therapeutics and improved outcomes compared to previous years, mortality from variceal bleeding remains substantial. Acute variceal bleeding results in death within six weeks in up to 22% of cases [13,14]. In clinical practice, diverse approaches to managing acute variceal bleeding persist, particularly regarding the timing of index endoscopy and the selection of therapeutic interventions.

Variations in management algorithms are partly attributable to differences in available resources. The clinical and practical applicability of these recommendations is crucial. Additionally, the literature identifies potential predictive factors for oesophageal variceal bleeding, though their reliability is limited by study design and bias [15,16]. Scoring systems such as MELD (Model for End-Liver Disease) and CTP are highlighted in the literature as possible non-invasive tools for predicting the outcomes of patients with acute variceal bleeding [17–19]. Correct identification of predictive factors may help better stratify patients who would benefit more from, for example, early endoscopy, antibiotic prophylaxis, or determination of the length of vasoactive therapy. The objective of this study was to analyse the clinical characteristics of patients with acute variceal bleeding and to identify predictive factors associated with treatment outcomes, including mortality, rebleeding, and length of hospitalisation.

2. Materials and Methods

2.1. Study Design and Participants

This retrospective study was conducted at the Department of Gastroenterology, University Hospital of Split, from March to June 2025. All patients aged 18 or older who were hospitalised for bleeding from oesophageal and/or gastric varices at University Hospital of Split between 1 January 2022, and 31 December 2024, Inclusion criteria were data of acute variceal bleeding and age >18 years. Exclusion criteria were age <18 years and incomplete medical documentation.

Case identification was made according to history taking (anamnesis), physical findings, laboratory findings, and/or endoscopic report if one was performed.

Ethical approval for the study was granted by the University Hospital of Split Ethics Committee (Resolution number: 520-03/25-01/62) on 27 February 2025. The research complied with the Act on the Protection of Patients' Rights (Official Gazette 169/04, 37/08), the Act on Implementation of the General Data Protection Regulation (Official Gazette 42/18), the Code of Medical Ethics and Deontology (Official Gazette 55/08, 139/15), and the Declaration of Helsinki WMA 1964–2013 as referred to in the Code. Informed consent was waived by the Ethics Committee of the University Hospital of Split because this retrospective study used fully de-identified patient data, and no identifiable personal information was accessed.

2.2. Variables and Data Collection Methods

We obtained the necessary data by reviewing medical records of the target patient group, including electronic records in the Hospital Information System, archived histories, and Department of Gastroenterology protocols at Split University Hospital Centre. Patients were followed up after discharge with regular check-up examination.

The following data on the demographic, clinical and laboratory characteristics of the patients were collected: patient's gender and age, date and time of admission, length of hospitalisation, heart rate, systolic and diastolic blood pressure on arrival, laboratory parameters (haemoglobin, platelets, prothrombin time with INR, urea, creatinine, albumin, total bilirubin, sodium), anamnestic data of the aetiology of liver cirrhosis (alcoholic, hepatitis B/C, autoimmune disease), data of the presence of portal vein thrombosis, presence of ascites, portal encephalopathy, hepatorenal syndrome, spontaneous bacterial peritonitis, hepatocellular carcinoma, history of previous bleeding, history of previous variceal ligation, data on previous prophylaxis with beta-blockers, presence of melena and/or syncope, history of heart or renal failure, data of the use of antiplatelet therapy, data of antibiotic prophylaxis and use of vasoactive drugs, data of oesophagogastroduodenoscopy performed upon admission, time of endoscopic examination, data of the localisation of varices, in-

formation on endoscopic therapy (ligation/sclerotherapy), information of recurrence of bleeding, data of repeat endoscopic examination, data of death during hospitalisation, data of death within 6 weeks of initial admission, data of infection during hospitalisation, and data of re-hospitalisation.

The diagnosis of liver cirrhosis was established based on a combination of clinical findings, laboratory parameters, imaging studies, and endoscopic evidence of portal hypertension. Histological confirmation or elastography was not systematically available for all patients due to the retrospective nature of the study.

Haemodynamic instability at admission was defined as systolic blood pressure <90 mmHg or the need for fluid resuscitation and/or blood transfusion upon presentation.

Institutional protocol was the same for patients with suspected and confirmed variceal bleeding regarding admission and time of endoscopy. However, choice of therapy was physician-level discretion.

Vasoactive therapy was initiated upon clinical suspicion of variceal bleeding according to the institutional practice. Terlipressin was administered at a dose of 2 mg every 4 h initially, followed by dose adjustment based on clinical response. Somatostatin was administered as a continuous intravenous infusion after an initial bolus. The choice of agent was at the discretion of the treating physician.

2.3. Study Endpoints

Primary endpoint of the study was in-hospital mortality among patients admitted with acute variceal bleeding.

Secondary endpoints included six-week mortality, early rebleeding (within 5 days), need for repeat endoscopic intervention, occurrence of in-hospital infection, length of hospitalisation, and rehospitalisation due to recurrent bleeding.

2.4. Statistical Data Processing

All data were collected retrospectively and analysed using Python 3.10 (pandas 1.5, SciPy 1.10, statsmodels 0.14, and lifelines 0.27). Continuous variables were tested for normality with the Shapiro–Wilk test. Variables meeting normality assumptions were summarised as arithmetic mean and standard deviation and compared using the independent *t*-test. Non-normally distributed variables were described by median and interquartile range (IQR) and compared using the Mann–Whitney U test. Categorical variables were summarised as absolute and relative frequencies, and group differences were assessed using the chi-square test or Fisher’s exact test as appropriate. Fisher’s exact test was applied when at least one cell had an expected frequency less than five.

A binary logistic regression model was employed to identify factors associated with in-hospital mortality. Adjusted odds ratios (aORs) with 95% confidence intervals were reported. Variables were included in the multivariate model if they had a $p < 0.10$ in univariate analysis or were deemed clinically relevant. Multicollinearity was evaluated using variance inflation factors (VIFs), with values less than 5 considered acceptable. Model fit was evaluated with the Hosmer–Lemeshow test, and discriminatory ability was assessed by the area under the receiver operating characteristic (ROC) curve (AUC) and its 95% confidence interval. Survival up to six weeks was analysed using the Kaplan–Meier method, with group differences tested by the log-rank test. A Cox proportional hazards model was constructed to estimate adjusted hazard ratios (HRs). The potential competing-risk effect of hospital discharge was examined using the Fine–Gray approach in sensitivity analyses.

Length of hospitalisation, a positively skewed variable, was modelled using a generalised linear model with a gamma distribution and log-link function. Negative binomial

regression was also considered as an alternative. Binary logistic regression models were applied to non-constant aggregate outcomes, including rebleeding, re-endoscopy, and re-hospitalisation. Missing values, representing less than 10% per variable, were imputed using the IterativeImputer method. Five imputed datasets were generated, and results were combined according to Rubin's rule. All statistical tests were two-tailed, with significance set at $p < 0.05$.

3. Results

3.1. Demographic and Clinical Characteristics of Patients

A total of 91 patients were included in the analysis, of whom 85.7% were male, with a median age at admission of 61 years. Nearly all patients in our cohort had liver cirrhosis (94.5%), predominantly of alcoholic aetiology (76.7%). The underlying cause of portal hypertension remained undetermined in five patients. HCV infection was detected in 11% (10/91), while hepatocellular carcinoma was present in 14.3% (13/91). Portal vein thrombosis was present in 11 patients. Varices most commonly occurred in the oesophagus (75.8%). In this group, 22% had a history of previous bleeding, and 18.7% had undergone prior endoscopic treatment. Table 1 summarises the demographic and clinical characteristics of the patients. Haemodynamic instability at admission was documented in 23 patients (25%).

Table 1. Demographic and clinical characteristics of patients.

Parameter	N (%) or Median (IQR)
Age	Median 61 (IQR 52–70)
Sex (male)	78/91 (85.7%)
Liver cirrhosis	86/91 (94.5%)
Alcoholic cirrhosis	66/86 (76.7%)
HCV infection	10/91 (11%)
Hepatocellular carcinoma	13/91 (14.3%)
Oesophageal varices	69/91 (75.8%)
Previous bleeding	20/91 (22%)
Prior endoscopic treatment	17/91 (18.7%)

Data are presented as counts (percentages) and median (IQR, interquartile range). Abbreviation: HCV, hepatitis C virus.

The severity of liver disease ranged from moderate to advanced: the median MELD-Na score was 15 points (IQR 11–21), and over 40% of patients were classified as Child–Pugh B. In 19.8% of patients (17/86), data were missing to calculate the CTP score. The remaining patients were distributed across Child–Pugh classes A and C, with a slight predominance of advanced cirrhosis (25.6% vs. 18.6%), as summarised in Table 2.

Table 2. Severity of liver disease according to MELD-Na score.

Parameter	N (%) or Median (IQR)
MELD-Na	Median 15 (IQR 11–21)
Child–Pugh A	16/86 (18.6%)
Child–Pugh B	36/86 (41.9%)
Child–Pugh C	22/86 (25.6%)

Data are presented as counts (percentages) and median (IQR, interquartile range). Abbreviation: MELD-Na, Model for end-stage liver disease including sodium.

Of the total cohort, 60 patients (65.9%) received vasoactive therapy. Terlipressin was administered to 58.3% of these patients (35/60), corresponding to 38.5% of the overall cohort (35/91), while 21.7% received somatostatin. In 20% of cases, a combination of terlipressin and somatostatin was used. Among patients receiving vasoactive therapy, the treatment duration was ≤ 5 days in 83.3% (50/60) and ≤ 4 days in 70% (42/60).

Antibiotic prophylaxis was administered to 75/91 patients (82.4%), with a median treatment duration of 5.5 days (IQR 5–9.5).

Diagnostic EGD was performed in 86 out of 91 patients (94.5%). According to available data, in 14 cases oesophageal varices grade 1 (by Japanese Research Society for Portal Hypertension classification, (8)) were present; in 26 cases varices grade 2; and in 31 patients varices grade 3. In 7 patients gastric-oesophageal varices (GOV according to Sarin classification (5)) type 1 were verified; in 5 patients GOV type 2; and in 4 patients isolated gastric varices (IGV) type 1 were registered. Endoscopic intervention was performed during the procedure in 55 out of 86 (64.0%). Variceal ligation was used as the haemostatic method in 51 out of 55 patients (92.7%), representing 51 out of 91 in the total study cohort (56.0%).

3.2. Treatment Outcomes

During hospitalisation, 15 patients died, corresponding to an in-hospital mortality rate of 16.5%. The broader 42-day (six-week) outcome showed a total of 23 deaths, representing a cumulative mortality of 25.3%. Treatment outcomes are summarised in Table 3.

Table 3. Treatment outcomes.

Outcome	N (%) or Median (IQR)
In-hospital mortality	15/91 (16.5%)
Six-week mortality	23/91 (25.3%)
Length of hospitalisation	Median 8 days (IQR 5–10.5)
Rebleeding $\leq$ 5 days	12/91 (13.2%)
Repeat endoscopic intervention	47/91 (51.6%)
Rehospitalisation due to bleeding	27/91 (29.7%)
In-hospital infection	6/91 (6.6%)

Data are presented as counts (percentages) and median (IQR, interquartile range).

3.3. Impact of Timing of Endoscopic Intervention on Treatment Outcomes

Diagnostic EGD was performed in 94.5% of patients (86/91). Early endoscopy (within 12 h of admission) was performed in 69 patients, corresponding to 75.8% of the total cohort and 80.2% of those who underwent EGD. A total of 17 patients (18.7% of the total cohort; 19.8% of those with EGD) underwent endoscopy more than 12 h after presentation, primarily due to severe coagulopathy and haemodynamically instability. EGD was not performed in five patients. The reason for this was due to haemodynamically instability.

Early endoscopic intervention did not significantly reduce in-hospital mortality (8.7% vs. 23.5%; $p = 0.104$, Fisher's exact test). Patients with endoscopy within 12 h had a median stay of 7 days, while those with late endoscopy had a median stay of 12 days ($p = 0.056$, Mann–Whitney test), as shown in Figure 1.

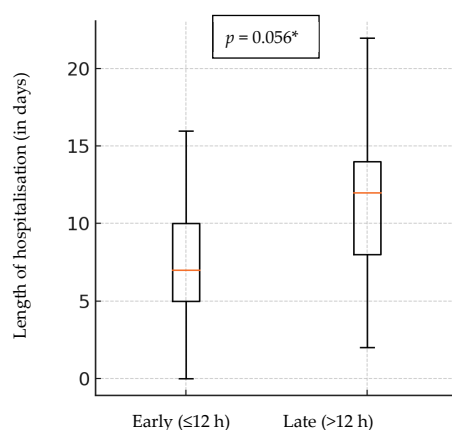


Figure 1. Comparison of hospitalisation duration according to early versus late endoscopic intervention. Data are presented as counts. * Mann–Whitney U test.

Early endoscopic intervention did not reduce the need for repeated endoscopic procedures, nor did it decrease the incidence of rebleeding (Table 4).

Table 4. Outcomes according to timing of endoscopic intervention (early ≤ 12 h vs. late > 12 h).

Outcome	Early ≤ 12 h N (%)	Late > 12 h N (%)	p^*
Repeated endoscopic intervention	38/69 (55.1%)	9/17 (52.9%)	0.874
Rebleeding (within 5 days)	10/69 (14.5%)	2/17 (11.8%)	0.771

* χ^2 test.

3.4. Impact of Liver Disease Severity on Treatment Outcomes

Analysis of the association between cirrhosis severity and outcomes demonstrated that both the MELD-Na and Child–Pugh scores were significantly higher in patients who died during hospitalisation. Specifically, for each additional point in the MELD-Na score, the relative risk of in-hospital death increased by 16% (OR 1.16; 95% CI 1.05–1.27; $p = 0.0026$). In addition, a similar trend was observed for the Child–Pugh score (OR 1.54; 95% CI 1.12–2.14; $p = 0.009$). Finally, the ROC curve illustrates the discriminative ability of MELD-Na to predict in-hospital mortality, with an area under the curve of 0.74 (Figure 2).

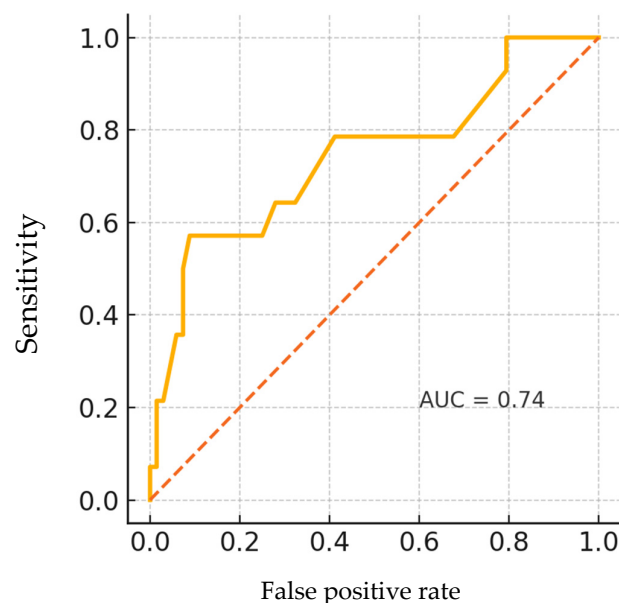


Figure 2. ROC curve of MELD-Na for predicting in-hospital mortality.

Analysis of the association between cirrhosis severity (expressed by CTP/MELD-Na scores) and length of hospitalisation did not reveal a statistically significant correlation: length of hospitalisation vs. cirrhosis severity (CTP score), Spearman's $\rho = 0.163$, $p = 0.165$; length of hospitalisation vs. cirrhosis severity (MELD-Na score), Spearman's $\rho = 0.190$, $p = 0.087$.

3.5. Impact of Antibiotic Prophylaxis, Vasoactive Drugs, and Variceal Ligation on Treatment Outcomes

Antibiotic prophylaxis, vasoactive drugs, and ligation as a haemostatic method did not lower the infection rates, repeat endoscopic procedures, or mortality (Table 5). In a multivariable logistic regression model, only MELD-Na independently predicted in-hospital mortality after adjusting for age, sex, early endoscopy, antibiotic prophylaxis, and vasoactive therapy. Early endoscopic intervention showed a protective trend but was not statistically significant (aOR 0.29; 95% CI 0.05–1.57; $p = 0.151$; Table 6).

Table 5. Univariate analyses according to the antibiotic prophylaxis, use of vasoactive drugs, and ligation.

Association	Outcome	<i>p</i> *
Antibiotic prophylaxis vs. infection	6.7% vs. 6.3%	1.00
Antibiotic prophylaxis vs. in-hospital mortality	12.5% vs. 31.3%	0.130
Vasoactive drugs vs. repeat endoscopy	55% vs. 45%	0.387
Ligation vs. rebleeding ≤ 5 days	11.4% vs. 14.9%	0.760

* Fisher's exact test.

Table 6. Logistic regression, multivariable model—in-hospital mortality.

Variable	Adjusted OR (95% CI)	<i>p</i> *
MELD-Na (per 1 point)	1.12 (1.01–1.25)	0.026
Early endoscopy (≤12 h)	0.29 (0.05–1.57)	0.151
Antibiotic prophylaxis	0.27 (0.04–1.87)	0.186
Vasoactive drugs	2.00 (0.31–12.9)	0.466
Ligation (vs. none)	0.59 (0.11–3.23)	0.540

* *p* values are derived from two-sided Wald tests of the coefficients in the multivariable binary logistic regression; OR = exp(β), 95% CI calculated from the standard error (MLE).

4. Discussion

The purpose of this study was to analyse the clinical and demographic characteristics of patients with acute variceal bleeding and to examine the impact of liver disease severity and therapeutic interventions on treatment outcomes.

The cohort had a relatively high cumulative mortality rate of 25.3%, comparable to rates reported in other studies [20,21]. This outcome is likely attributable to the high proportion of patients with advanced decompensated liver cirrhosis, with 41.9% classified as CTP class B and 25.6% as CTP class C, conditions known to be associated with poorer clinical outcomes [22,23].

The first hypothesis of our study postulated a positive correlation between the severity of decompensated liver cirrhosis (expressed by the MELD-Na and Child–Pugh scores) and clinical outcomes. Statistical analysis of the collected data confirmed this assumption. Both scoring systems were significantly higher in patients who died during hospitalisation ($p = 0.0045$ and $p = 0.009$). Numerous studies have demonstrated the predictive value of these scoring systems for adverse outcomes [20,24–26]. Given their simplicity of use, it is evident why they have been incorporated into recent clinical guidelines as reliable tools for risk assessment and stratification [2,3]. Specifically, the ESGE recommends that patients presenting with acute variceal bleeding be stratified by Child–Pugh and MELD scores and by documentation of active/inactive bleeding at the time of upper GI endoscopy [27]. Due to the expected high mortality rate in practice, patients with high MELD-Na presenting with suspected variceal bleeding should be intensively monitored, with expectation of earlier escalation of care if needed with a lower threshold for ICU triage.

Fortune et al. found a six-week mortality rate of 26% among 70 patients [24]. The CTP class distribution was 18% A, 46% B, and 36% C, with a median MELD of 14.5 [24]. Our 91-patient cohort had similar features and a 25.3% six-week mortality. Fortune et al. also showed that CTP scoring best predicted six-week mortality [24]. The same finding was supported by Conejo et al., who identified CTP class C and MELD ≥ 19 as strong predictors of mortality [25]. Our results showed the ROC curve discriminative ability of MELD-Na to predict in-hospital mortality. Furthermore, in a prospective study, Rudler et al. showed that the recalibrated MELD-based score was accurate in predicting 6-week mortality (AUROC = 0.787), with better performance compared to the MELD score [28].

Contrary to expectations and previous studies, early EGD in our cohort did not demonstrate a statistically significant improvement in clinical outcomes [12,27]. EGD was performed within 12 h of presentation in 80.2% of patients, whereas only 19.8% underwent endoscopy later. Current guidelines favour early endoscopy to improve clinical outcomes [3,27]. However, in our study, there was no statistically significant reduction in in-hospital mortality among patients who underwent early EGD ($p = 0.104$). Patients who received early EGD had a median hospital stay of seven days compared with nearly twice as long (twelve days) in the late endoscopy group, but this difference did not reach statistical significance ($p = 0.056$). A possible explanation for these divergent results is the small number of patients in the late endoscopy group (less than one-fifth of the cohort), which limits the validity of outcome comparisons between groups.

Discrepancies regarding the ideal timing of the initial endoscopic evaluation are also reflected in the guidelines [29–32]. While the Baveno VII consensus emphasises the benefits of early endoscopy, Chinese guidelines recommend performing endoscopy between 12 and 24 h after presentation [29]. Mostly, these recommendations are based on expert opinion rather than large observational or multicentre studies. However, in a large nationwide cohort study of 3319 patients presenting with acute variceal bleeding across 34 university hospitals, the authors compared the 5-day treatment failure rate and in-hospital mortality among patients with endoscopy performed at <12 h and 12–24 h [30]. The data suggest that endoscopy performed within 6–12 or 24 h of presentation among patients with cirrhosis and AVB led to similar treatment failure outcomes [30]. Moreover, Yoo et al., in a retrospective study on 274 patients with acute variceal bleeding, demonstrated in multivariate analyses that the timing of endoscopy was not associated with 6-week mortality (hazard ratio, 1.297; 95% confidence interval, 0.806–2.089; $p = 0.284$) [31]. The same study reported a 6-week mortality rate of 22.5% in the urgent endoscopy group (<12 h of admission) and 29.7% in the non-urgent endoscopy group (≥ 12 h of admission) [31].

The limited effectiveness of early endoscopic intervention shown in our results may be due to massive bleeding, a relatively high share of patients with severe disease CTP B and C, and thus worse prognosis. However, we can also debate technical aspects of the procedure, such as the timing of the endoscopy (day versus night shift) and the availability of staff trained in variceal haemostatic interventions. These aspects should be highlighted in future research.

Vasoactive drugs are the primary therapy for variceal bleeding. The optimal therapy duration is still debated [33–37]. European guidelines advise starting these drugs immediately on suspected bleeding, usually for up to five days [2,3]. Many studies show vasoactive therapy reduces mortality, improves bleeding control, and shortens stays [33,34]. A meta-analysis by Wells et al. supports these benefits [35]. In our study, vasopressor therapy did not significantly affect in-hospital mortality ($p = 0.466$) or the need for repeated endoscopy ($p = 0.387$). This lack of effect may be related to our cohort's high proportion of advanced decompensated liver cirrhosis (41.9% CTP B; over one-quarter CTP C). The efficacy of vasoactive therapy in variceal bleeding is known to depend on the severity of liver disease [20]. Most patients (83.3%) received therapy for ≤ 5 days, and 70% for ≤ 4 days. Given this distribution of severity, extending therapy to a full five days might have allowed a clearer assessment of the vasoactive drugs' impact. Notably, Dhoop et al. found that shortened vasoactive therapy only resulted in similar rebleeding rates when patients with severe liver disease were excluded [36].

EVL is the recommended treatment for acute variceal bleeding and has been shown in numerous studies to outperform other therapeutic options [38,39]. In a meta-analysis of 36 randomised controlled trials involving 3593 patients, Onofrio et al. demonstrated that EVL was associated with significantly better bleeding control and lower mortality than

sclerotherapy, which is now reserved for exceptional cases [39]. Our study demonstrated high adherence to guidelines for selecting endoscopic therapy for variceal bleeding, with ligation as the therapeutic modality in 92.7% of cases. However, contrary to expectations, EVL did not demonstrate superiority in the management of acute variceal bleeding with respect to in-hospital mortality ($p = 0.540$) or the likelihood of re-bleeding within 5 days of presentation ($p = 0.760$). It is important to note that the term “endoscopic ligation” is relatively broad in the literature compared with routine clinical practice. Additionally, it can be assumed that most physicians are aware of the need for follow-up endoscopy, typically three to four weeks after initial ligation, to reassess and, if necessary, place additional or alternative ligatures in accordance with current recommendations [2,3].

Antibiotic prophylaxis with ceftriaxone at a dose of 1 g/day for up to seven days is recommended for all patients with acute variceal bleeding [3]. These patients are at increased risk of bacterial infections, particularly respiratory tract infections [40]. Bacterial infections are associated with a higher risk of rebleeding and increased overall mortality [1,40]. In our study, we did not observe a significant effect of antibiotic prophylaxis in reducing the infection rates or mortality. Only 6.6% of patients in our cohort developed in-hospital infections, and the median duration of antibiotic therapy was 5.5 days. Nevertheless, prescribing antibiotic prophylaxis is part of standard practice at our centre, as it was administered to over 82% of patients. However, it should be pointed out that those with greater illness (for example, higher MELD-Na score) are more likely to receive it. Still, in a minority of patients, antibiotic prophylaxis was not administered, mainly due to early clinical stabilisation, transfer from other departments, and incomplete documentation in retrospective records. Some authors have problematised the use of routine antibiotic prophylaxis, especially due to concerns about rising antibiotic resistance [40,41]. In a large, 13-year observational study, Ichita et al. evaluated the effectiveness of antibiotic prophylaxis in patients with acute variceal bleeding undergoing EVL [42]. Results from a total of 980 patients showed no significant differences in outcomes (6-week mortality, 4-week rebleeding, 4-week onset of SBP, and in-hospital mortality) between the prophylactic and non-prophylactic groups [42]. The approach to antibiotic prophylaxis remains unclear.

Our study had several limitations. First, it is a retrospective study conducted at a single centre. However, it is a tertiary care hospital serving a wide regional area, so the patient sample can be considered representative. On the other hand, given that it is life-threatening, prospective studies are rare when it comes to acute variceal bleeding. Third, a possible limitation is the modest number of included patients, which could be addressed in the future by including more centres in the research. Furthermore, the study included heterogeneous group of patients. However, the heterogeneity of the patient population reflects real-world clinical practice in the management of acute variceal bleeding and may therefore enhance the external validity of the findings. Nevertheless, we agree that this may influence the interpretation of the findings. Moreover, recommendations for endoscopy within 12 h are based on guideline level evidence and higher quality studies, and our cohort may not be sufficiently powered to detect clinically relevant differences, especially given the imbalance between early and late endoscopy groups and the low number of outcome events. Unfortunately, due to the retrospective design of the study, detailed documentation regarding the presence of active bleeding during the initial oesophagogastroduodenoscopy and requirement for massive red blood cell transfusion was not consistently available in the medical records. Therefore, these variables could not be reliably analysed in the present study. Finally, the outcomes were largely due to a higher proportion of patients with more severe disease, which we could not influence. We suggest that a multicentre, prospective study with a larger number of patients would be optimal to further objectify the results.

5. Conclusions

Taken together, our results are only partly consistent with the existing literature. The severity of liver cirrhosis is significantly correlated with clinical outcomes in patients with variceal bleeding, particularly with respect to in-hospital mortality. Early endoscopic evaluation may reduce hospitalisation length. Overall, these findings provide valuable insight into the demographic and clinical characteristics of patients with oesophageal and gastric variceal bleeding, which may serve as a foundation for future studies involving larger patient cohorts. Such research could improve both the prevention and clinical outcomes of patients with variceal bleeding.

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Abbreviations

The following abbreviations are used in this manuscript:

CTP	Child–Turcotte–Pugh
EASL	European Association for the Study of the Liver
EGD	Oesophagogastroduodenoscopy
ESGE	European Society of Gastrointestinal Endoscopy
EVL	Endoscopic variceal ligation
GOV	Gastroesophageal varices
HVPG	Hepatic venous pressure gradient
IGV1	Isolated gastric varices
JRSPH	The Japanese Research Society for Portal Hypertension
MELD	Model for end-liver disease
NSBB	Non-selective beta blockers
PH	Portal hypertension
TIPS	Transjugular intrahepatic portosystemic shunt

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