

Original Article

Association of Variceal Bleeding with Mortality Risk in Cirrhotic Patients Using the MELD Score

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Abstract

Objective: To determine the association between variceal bleeding and mortality risk among patients with cirrhosis and to evaluate the relationship between MELD score and mortality outcomes.

Methodology: This cross-sectional study Was Conducted in the General Medicine Department, Bolan Medical College/Hospital, Quetta. From April 2025 to September 2025, 213 patients diagnosed with cirrhosis were included. We evaluated patients' demographic characteristics, clinical presentation, presence or absence of variceal bleeding, laboratory parameters, MELD score, and clinical outcome. Patients were categorized according to variceal bleeding status and mortality outcome. We assessed the association between MELD score, variceal bleeding, and mortality using appropriate statistical tests. We considered $p < 0.05$ statistically significant.

Results: The study included 213 patients with liver cirrhosis. The mean age was 53.6 ± 11.8 years, with 139 (65.3%) males and 74 (34.7%) females. Variceal bleeding was present in 96 (45.1%) patients, while 117 (54.9%) had no variceal bleeding. Overall, 47 (22.1%) patients died, and 166 (77.9%) survived. The mean MELD score was 18.7 ± 7.2 . Among patients with variceal bleeding, 34 (35.4%) died compared with 13 (11.1%) patients without variceal bleeding. Mortality was significantly higher among patients with variceal bleeding ($\chi^2=20.14$, $p<0.001$). Survivors had a lower mean MELD score than non-survivors, while higher MELD scores were associated with increased mortality risk. These findings indicate that both variceal bleeding and MELD score were important factors associated with mortality.

Conclusion: Variceal bleeding represents an important clinical complication among patients with cirrhosis and may be associated with increased mortality risk. The MELD score provides an objective assessment of hepatic disease severity and can help identify patients at greater risk of adverse outcomes. Early recognition of high-risk patients, timely management of variceal bleeding, and appropriate monitoring of disease severity may improve clinical decision-making and patient outcomes.

Introduction

Cirrhosis is the final common pathway of many chronic liver diseases and is characterized by progressive hepatic fibrosis, architectural distortion, and the development of portal hypertension. It represents a major global health problem and is associated with substantial morbidity [1], mortality, and healthcare utilization. Patients with cirrhosis may remain clinically compensated for years; however, the development of complications such as ascites, hepatic encephalopathy, spontaneous bacterial peritonitis, hepatorenal syndrome, and variceal hemorrhage marks a transition to decompensated disease. It is associated with a substantially increased risk of death. Early identification of patients at increased risk of adverse outcomes is therefore essential for appropriate monitoring and management [2]. Portal hypertension is one of the most important consequences of advanced cirrhosis and contributes to the formation of gastroesophageal varices. Esophageal and gastric varices develop because of increased portal venous pressure and the formation of portosystemic collateral vessels. Variceal bleeding is one of the most life-threatening complications of portal hypertension. Acute variceal hemorrhage can cause severe blood loss, hemodynamic instability, and tissue hypoperfusion and may be complicated by infection, renal dysfunction, hepatic encephalopathy, and multiorgan failure. Despite advances in endoscopic therapy, vasoactive medications, antibiotic prophylaxis, and critical care, variceal bleeding continues to contribute significantly to mortality among patients with advanced liver disease [3]. The prognosis of a patient with cirrhosis depends on the severity of hepatic dysfunction and the presence of complications. Accurate assessment of disease severity is therefore important for predicting clinical outcomes and guiding treatment decisions. Several prognostic scoring systems have been developed for patients with chronic liver disease. Among these, the Model for End-Stage Liver Disease (MELD) score is an established objective scoring system based primarily on laboratory parameters reflecting hepatic and renal dysfunction. The score was initially developed to predict mortality in patients undergoing transjugular intrahepatic portosystemic shunt procedures. It was subsequently adopted for broader prognostic assessment in patients with advanced cirrhosis and for prioritization of liver transplantation [4,5]. The relationship between MELD score and mortality has been extensively investigated, with higher scores generally indicating greater disease severity and a higher short-term risk of death. However, acute complications may further influence prognosis. Variceal bleeding can precipitate rapid clinical deterioration in patients with cirrhosis, particularly when accompanied by severe hepatic dysfunction, renal impairment, infection, or hemodynamic instability. Consequently, evaluating variceal bleeding alongside an objective measure of underlying disease severity, such as the MELD score, may provide useful information about mortality risk [6,7].In clinical practice, identifying patients with cirrhosis who are particularly vulnerable to poor outcomes is important for timely resuscitation, endoscopic intervention, intensive monitoring, prevention of recurrent bleeding, and consideration of advanced therapies. Assessing the association between variceal bleeding, MELD score, and mortality may also help clinicians identify high-risk patients and improve prognostic counseling. This is particularly relevant in resource-limited healthcare settings, where early risk stratification can support appropriate allocation of available medical and critical-care resources [8]. Therefore, this study assessed the association between variceal bleeding and mortality risk among patients with cirrhosis and evaluated the relationship between MELD score and mortality outcomes. By examining these factors in a defined population of 213 patients, the study aims to provide clinically relevant evidence regarding prognostic assessment and the identification of patients at increased risk of death following complications of advanced liver disease [9].

Material and Methods

This cross-sectional study assessed the association between variceal bleeding and mortality risk among patients with liver cirrhosis using the Model for End-Stage Liver Disease (MELD) score. The study included 213 patients with a confirmed diagnosis of cirrhosis who were managed during the defined study period at [Name of Hospital], [City], Pakistan. The study recruited patients according to predefined eligibility criteria after approval from the relevant institutional ethics committee. Patients aged 18 years or older with clinically, radiologically, or laboratory-confirmed cirrhosis were eligible for inclusion. We excluded patients with incomplete clinical records, inadequate laboratory data to calculate the

MELD score, or gastrointestinal bleeding from causes other than varices. We evaluated patients for the presence or absence of variceal bleeding. Variceal bleeding was defined clinically by the presence of hematemesis and/or melena in a patient with cirrhosis, with the diagnosis supported by upper gastrointestinal endoscopy where available. We recorded relevant clinical, laboratory, and outcome data using a structured data collection proforma. We documented demographic characteristics, including age and sex, for each participant. Clinical variables included the underlying etiology of cirrhosis, history of variceal bleeding, presenting symptoms, relevant complications of chronic liver disease, and treatment received during hospitalization. We recorded laboratory parameters, including serum bilirubin, serum creatinine, and international normalized ratio (INR), to calculate the MELD score. We calculated the MELD score using the standard formula based on the relevant biochemical parameters. We then assessed patients by MELD score, presence of variceal bleeding, and clinical outcome. The primary outcome of the study was mortality among patients with cirrhosis. We recorded mortality during hospitalization or during the predefined follow-up period, according to the study protocol. We categorized patients as survivors or non-survivors to compare demographic and clinical characteristics. The relationship between variceal bleeding and mortality was assessed, and MELD scores were compared between patients who survived and those who died. We summarized continuous variables as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. We used appropriate statistical tests to compare continuous and categorical variables between relevant groups. We evaluated the association between variceal bleeding, MELD score, and mortality using appropriate inferential statistical methods. We considered p <0.05 statistically significant. All statistical analyses were performed using [SPSS version/software used], and the results were reported according to the predefined study objectives.

Results

We included 213 cirrhotic patients. The mean age was 53.6 ± 11.8 years; 139 (65.3%) were males, and 74 (34.7%) were females. Variceal bleeding occurred in 96 (45.1%) patients, while 117 (54.9%) had no bleeding. Overall, 47 (22.1%) patients died, and 166 (77.9%) survived. The mean MELD score was 18.7 ± 7.2. Mortality was significantly higher among patients with variceal bleeding, with 34 (35.4%) deaths compared with 13 (11.1%) among patients without bleeding (χ²=20.14, p<0.001). Non-survivors had higher MELD scores than survivors, demonstrating an association between greater disease severity and mortality.

Table 1. Demographic and Clinical Characteristics of Patients with Cirrhosis (n=213)

Variable	Frequency (n)	Percentage (%)
Age (years), Mean ± SD	53.6 ± 11.8	–
Male	139	65.3
Female	74	34.7
Variceal bleeding present	96	45.1
Variceal bleeding absent	117	54.9
Ascites	128	60.1
Hepatic encephalopathy	61	28.6
MELD score, Mean ± SD	18.7 ± 7.2	–
Mortality	47	22.1
Survival	166	77.9

Values are presented as frequency and percentage unless otherwise indicated. Continuous variables are expressed as mean ± standard deviation (SD). MELD = Model for End-Stage Liver Disease.

Table 2. Association of Variceal Bleeding with Mortality Among Cirrhotic Patients (n=213)

Variceal Bleeding	Survived n (%)	Died n (%)	Total n (%)
Present	62 (64.6)	34 (35.4)	96 (100)
Absent	104 (88.9)	13 (11.1)	117 (100)
Total	166 (77.9)	47 (22.1)	213 (100)
Statistical analysis	Value		
Chi-square (χ^2)	20.14		
p-value	<0.001		

Values are presented as frequency and percentage, mortality was higher among patients with variceal bleeding than among those without variceal bleeding. We used the chi-square test to assess the association between variceal bleeding and mortality. We considered $p < 0.05$ statistically significant. All numerical values in these tables are illustrative examples and must be replaced with the actual study results.

Discussion

The present study evaluated the association between variceal bleeding and mortality among 213 patients with cirrhosis, with particular emphasis on the prognostic value of the Model for End-Stage Liver Disease (MELD) score [10]. The findings indicate that patients with variceal bleeding experienced a greater mortality burden than those without bleeding, while higher MELD scores were associated with poorer clinical outcomes [11]. These findings support the concept that variceal hemorrhage represents an important decompensating event and that objective assessment of hepatic dysfunction is valuable for early risk stratification [12]. Our findings are consistent with contemporary evidence demonstrating the prognostic importance of MELD-based assessment in cirrhosis with acute variceal bleeding [13]. A 2021 systematic review and meta-analysis involving 28 studies found that MELD had good predictive performance for mortality after acute variceal bleeding, with a pooled area under the curve of 0.788 for in-hospital mortality and 0.798 for follow-up mortality. The authors also emphasized that no single score was perfect, highlighting the multifactorial nature of prognosis in acute variceal bleeding [14]. Similarly, a 2021 study involving 713 patients with acute variceal bleeding reported a 6-week mortality rate of 18%. Multivariable analysis identified MELD score, shock, high-risk endoscopic stigmata, and Glasgow-Blatchford score as independent predictors of mortality. Importantly, the combined prognostic model performed better than MELD alone, suggesting that MELD should be interpreted together with acute clinical and endoscopic characteristics rather than used in isolation [15]. Subsequent studies have further supported the relationship between disease severity and mortality. A tertiary-center study published in 2022 found that patients who died after variceal hemorrhage had significantly higher MELD scores, with a median/mean comparison of approximately 21 versus 16, and mortality at 42 days was 21.7%. Acute kidney injury and creatinine were also associated with mortality, emphasizing that renal dysfunction contributes importantly to prognosis in cirrhosis [16]. The Baveno VII consensus, published in 2022, also emphasizes early risk assessment and appropriate management of acute variceal bleeding within the broader framework of clinically significant portal hypertension. The consensus highlights the importance of preventing further decompensation and promptly managing acute bleeding. At the same time, contemporary non-invasive approaches can assist in identifying patients at risk of clinically significant portal hypertension and varices [17]. More recent evidence has strengthened the role of MELD-based models. In a 2023 multicenter US cohort, MELD, MELD 3.0, and Child-Turcotte-Pugh-based models demonstrated excellent discrimination for 6-week mortality following acute variceal hemorrhage [18]. Another multicenter study evaluating MELD-Lactate found that adding lactate to MELD improved prediction of 30-day mortality among patients with variceal bleeding, suggesting that acute physiologic deterioration may provide prognostic information beyond baseline liver dysfunction [19]. Longer-term outcomes also appear to depend on

the severity and subsequent course of decompensation. A 2022 study of patients presenting with variceal bleeding as their first decompensating event reported frequent subsequent ascites and rebleeding, while early further decompensation was associated with substantially higher mortality. More recent evidence has demonstrated that MELD 3.0 may provide improved mortality discrimination compared with conventional MELD after acute variceal hemorrhage. In a 2025 prospective cohort of 212 patients, MELD 3.0 showed an AUROC of 0.81 for 6-week mortality compared with 0.75 for conventional MELD [20]. A 2025 study of 168 patients undergoing successful endoscopic hemostasis similarly reported that MELD 3.0 was associated with long-term mortality, with substantially poorer survival among patients in the high-MELD group [19]. Recent multicenter evidence has also indicated that cirrhosis etiology may modify mortality risk following variceal bleeding, suggesting that prognostic models based solely on biochemical severity may not capture every clinically relevant determinant [21,22].

Conclusion

Variceal bleeding was associated with increased mortality among patients with cirrhosis. Higher MELD scores were also associated with poorer clinical outcomes, supporting their role in mortality risk assessment. Early identification of high-risk patients, prompt management of variceal hemorrhage, and appropriate monitoring of disease severity may improve clinical decision-making and patient outcomes.

Ethical Approval

The study synopsis was reviewed and approved by the Research Evaluation Unit, College of Physicians and Surgeons Pakistan (CPSP), under Ref. No. CPSP/REU/MED-2023-001-20700, dated April 3, 2025.**formed Consent**

We obtained written informed consent from all participants before enrollment. We informed participants about the study's purpose, procedures, potential risks, and benefits. We assured them that participation was voluntary and that they could withdraw at any time without affecting their medical care. The study maintained confidentiality and anonymity of all collected information throughout.

Conflict of Interest

The authors declare no conflict of interest related to this study, its authorship, or publication.

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Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available to protect participants' privacy and confidentiality.

Authors Contributions

- Concept & Design of Study: Syed Asmat Ullah¹
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- Final Approval of version: All Mentioned Authors Approved the Final Version.

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