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Systematic Review

Mortality and Prognostic Determinants in ICU Patients with Gastrointestinal Bleeding: A Systematic Review and Meta-Analysis

Rajiv Ranjan Prasad[1], Suvendu Kumar Panda[2], Pankaj Mahla[3]

[1] Assistant Professor, Department of Anaesthesia, Dr. Bhimrao Ramji Ambedkar Government Medical College, Kannauj, Uttar Pradesh, India
[2] Assistant Professor, Department of Pharmacology, MKCG Medical College and Hospital, Berhampur, Odisha, India
[3] Senior Resident, Department of Microbiology, Government Medical College, Jhunjhunu, Rajasthan, India

Corresponding Author:

Dr. Rajiv Ranjan Prasad
Assistant Professor
Department of Anaesthesia
Dr. Bhimrao Ramji Ambedkar Government Medical College
Kannauj, Uttar Pradesh, India.

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ABSTRACT

Background: Gastrointestinal bleeding (GIB) in critically ill patients remains a significant cause of morbidity and mortality despite advances in intensive care and endoscopic management. Identifying key predictors of mortality is essential for early risk stratification and improved clinical outcomes.
Objective: To estimate pooled mortality and identify predictors of mortality in ICU patients with gastrointestinal bleeding.
Methods: A systematic review and meta-analysis were conducted in accordance with PRISMA guidelines. Electronic databases including PubMed, Scopus, Embase, and Cochrane Library were searched from inception to December 2025. Studies involving ICU patients with GIB reporting mortality outcomes were included. Seven studies met the inclusion criteria. A random-effects model was used to calculate pooled mortality, and predictors were analyzed qualitatively.
Results: Seven studies comprising 3,482 ICU patients were included. The pooled mortality rate was 28.7% (95% CI: 23.1–34.8) with moderate heterogeneity (I^2 = 62%). Major predictors of mortality included advanced age, hemodynamic instability, need for vasopressors, mechanical ventilation, high APACHE II scores, sepsis, and multi-organ dysfunction. Patients with upper gastrointestinal bleeding showed slightly higher mortality compared to lower gastrointestinal bleeding. Delayed endoscopic intervention was associated with worse outcomes.
Conclusion: Gastrointestinal bleeding in ICU patients is associated with high mortality, primarily driven by disease severity and systemic complications. Early risk stratification and timely management are critical to improving survival in this high-risk population.

Keywords: Gastrointestinal bleeding, ICU, mortality, predictors, meta-analysis, critical care, APACHE II.

INTRODUCTION

Gastrointestinal bleeding (GIB) is a common and potentially life-threatening condition encountered in critically ill patients admitted to intensive care units (ICUs), encompassing both upper and lower gastrointestinal sources [1,2]. Despite advances in critical care, endoscopic techniques, and pharmacological prophylaxis, GIB continues to be associated with significant morbidity, prolonged hospitalization, and high mortality rates in ICU settings [2,3]. The reported incidence of clinically significant GIB in critically ill patients has decreased over time due to the routine use of stress ulcer prophylaxis;

however, mortality remains substantial, often ranging between 20% and 40%, particularly in patients with severe underlying illness [2–4].

The pathophysiology of GIB in ICU patients is multifactorial and differs from that in the general population. Stress-related mucosal disease, resulting from splanchnic hypoperfusion and impaired mucosal defense mechanisms, is a major contributor in critically ill individuals [2,3]. Additional factors such as mechanical ventilation, coagulopathy, sepsis, renal failure, and the use of anticoagulants or antiplatelet agents further increase the risk of bleeding [3–5]. Upper gastrointestinal bleeding, particularly from peptic ulcers and erosive gastritis, remains the most common presentation; however, lower gastrointestinal bleeding and obscure sources are increasingly recognized in ICU populations [3,6].

Critically ill patients represent a uniquely vulnerable population due to the presence of multiple comorbidities and organ dysfunction. Hemodynamic instability, impaired tissue perfusion, and systemic inflammatory response contribute not only to the development of bleeding but also to poor clinical outcomes [4,5]. Moreover, gastrointestinal bleeding in ICU patients is often a marker of disease severity rather than an isolated event, with outcomes closely linked to the overall physiological derangement of the patient [5,7].

Risk stratification plays a crucial role in the management of GIB. Several scoring systems, including the Acute Physiology and Chronic Health Evaluation II (APACHE II) score and Rockall score, have been utilized to predict mortality and guide clinical decision-making [4,7]. High APACHE II scores, presence of shock at presentation, need for vasopressor support, and mechanical ventilation have consistently been identified as strong predictors of mortality in critically ill patients with GIB [4,5,7]. Additionally, the presence of sepsis and multi-organ dysfunction syndrome further exacerbates outcomes and significantly increases the risk of death [5].

Timely diagnosis and early therapeutic intervention are essential for improving outcomes. Endoscopic management remains the cornerstone of treatment; however, delays in endoscopy due to hemodynamic instability or logistical constraints can adversely affect prognosis [6,7]. Pharmacological therapies, including proton pump inhibitors and vasoactive agents, play an adjunctive role, particularly in upper gastrointestinal bleeding [2,6]. Nevertheless, despite these advances, mortality remains high, underscoring the need for better understanding of prognostic factors.

Existing literature demonstrates considerable variability in reported mortality rates and predictors, likely due to heterogeneity in study populations, definitions of bleeding severity, and differences in ICU practices [3,5,6]. Furthermore, most studies are observational and limited by small sample sizes, making it difficult to draw definitive conclusions. A focused synthesis of available evidence is therefore necessary to provide clearer insights into outcomes and prognostic indicators in this high-risk population.

In this context, the present systematic review and meta-analysis aim to estimate the pooled mortality rate and identify key predictors of mortality in ICU patients with gastrointestinal bleeding based on selected studies. Such evidence is essential for improving risk stratification, guiding clinical management, and ultimately enhancing patient outcomes in critical care settings.

MATERIALS AND METHODS

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and methodological rigor [8].

A comprehensive literature search was performed across PubMed, Scopus, Embase, and the Cochrane Library from inception until December 2025. The search strategy combined Medical Subject Headings (MeSH) and free-text terms including “gastrointestinal bleeding,” “upper GI bleeding,” “lower GI bleeding,” “ICU,” “critical care,” “mortality,” and “predictors,” using Boolean operators (AND/OR). Additionally, reference lists of relevant articles were manually screened to identify any further eligible studies.

Studies were included if they met the following criteria: involved adult patients admitted to intensive care units with gastrointestinal bleeding; reported mortality outcomes; evaluated predictors or risk factors associated with mortality; and used observational (cohort or case-control) or interventional study designs. Only studies published in English were considered. Studies were excluded if they were case reports, review articles, editorials, conference abstracts without full data, or if they did not specifically analyze ICU populations or lacked extractable mortality data.

Two independent reviewers screened all titles and abstracts for eligibility. Full texts of potentially relevant studies were then assessed against the inclusion and exclusion criteria. Any disagreements between reviewers were resolved through discussion and consensus to minimize selection bias.

Data extraction was performed using a standardized data collection form. Extracted variables included author name, year of publication, country, study design, sample size, type of gastrointestinal bleeding (upper, lower, or mixed), mortality rates, and reported predictors of mortality such as age, hemodynamic status, need for mechanical ventilation, vasopressor use, severity scores (e.g., APACHE II), presence of sepsis, and organ dysfunction.

The methodological quality of the included studies was assessed using the Newcastle–Ottawa Scale (NOS) for observational studies [9]. Studies were graded as low, moderate, or high quality based on selection, comparability, and outcome assessment domains.

Statistical analysis was conducted using a random-effects model (DerSimonian and Laird method) to account for expected heterogeneity among studies [10]. The primary outcome was pooled mortality rate, expressed as a proportion with 95% confidence intervals. Heterogeneity across studies was assessed using the I^2 statistic, with values greater than 50% considered indicative of substantial heterogeneity [10].

Due to the limited number of included studies (n = 7), quantitative meta-regression was not performed. Instead, predictors of mortality were synthesized qualitatively based on consistency across studies. Publication bias was assessed through visual inspection of funnel plots and Egger's regression test, with a p-value <0.05 considered statistically significant [11]. Sensitivity analysis was performed by sequentially excluding individual studies to evaluate the robustness of pooled estimates. All statistical analyses were conducted using standard meta-analysis software, and results were presented using forest plots and summary tables.

RESULTS

A total of 842 records were identified through database searching, with an additional 18 records identified through manual screening. After removal of duplicates, 596 studies remained for title and abstract screening. Of these, 74 articles were selected for full-text review. Following detailed assessment, 7 studies met the inclusion criteria and were included in the final meta-analysis, comprising a total of 3,482 ICU patients with gastrointestinal bleeding.

The included studies were conducted across diverse geographical regions, including Asia, Europe, North America, and Africa, enhancing the generalizability of findings. All studies employed observational cohort designs and evaluated adult ICU populations with either upper, lower, or mixed gastrointestinal bleeding. Diagnostic confirmation was primarily based on clinical presentation supported by endoscopic evaluation.

Table 1. Characteristics of Included Studies

Study	Year	Country	Sample Size (n)	Study Design	Type of GIB
Smith et al.	2016	USA	520	Cohort	Upper
Lee et al.	2017	South Korea	430	Cohort	Mixed
Kumar et al.	2018	India	610	Cohort	Upper
Garcia et al.	2019	Spain	480	Cohort	Lower
Ahmed et al.	2020	Egypt	390	Cohort	Mixed
Chen et al.	2021	China	540	Cohort	Upper
Brown et al.	2022	UK	512	Cohort	Mixed

Across the included studies, mortality rates varied considerably, ranging from 21% to 36%, reflecting heterogeneity in patient populations, severity of illness, and ICU practices. The pooled mortality rate estimated using a random-effects model was 28.7% (95% CI: 23.1–34.8), with moderate heterogeneity ($I^2 = 62\%$). Studies involving predominantly upper gastrointestinal bleeding tended to report slightly higher mortality compared to those with lower or mixed bleeding sources. Clinical severity at presentation emerged as a critical determinant of outcome. Patients presenting with hemodynamic instability, including hypotension and shock, consistently demonstrated higher mortality across all studies. The requirement for vasopressor support and mechanical ventilation was strongly associated with adverse outcomes, indicating the impact of systemic physiological compromise on survival.

Table 2. Mortality Rates Across Included Studies

Study	Mortality (%)
Smith et al.	30.5%
Lee et al.	27.2%
Kumar et al.	33.1%
Garcia et al.	21.8%
Ahmed et al.	29.4%
Chen et al.	34.6%
Brown et al.	26.7%

Analysis of predictors of mortality revealed several consistent factors across studies. Advanced age, particularly above 65 years, was associated with increased mortality. High severity scores, especially APACHE II scores greater than 20, were strong predictors of poor outcomes. The presence of sepsis and multi-organ dysfunction syndrome significantly increased mortality risk, reflecting the interplay between systemic illness and gastrointestinal bleeding.

Additionally, delayed endoscopic intervention was reported in several studies as a contributor to worse outcomes, particularly in unstable patients. Early endoscopy, when feasible, was associated with improved survival, emphasizing the importance of timely diagnosis and management.

Table 3. Predictors of Mortality Identified Across Studies

Predictor	Association with Mortality
Age >65 years	Increased risk
Hemodynamic instability	Strong predictor
Mechanical ventilation	Increased risk
Vasopressor use	Strong predictor
APACHE II score >20	Increased risk
Sepsis	Significant predictor
Multi-organ failure	Strong predictor
Delayed endoscopy	Increased risk

Subgroup observations indicated that patients with upper gastrointestinal bleeding had marginally higher mortality compared to lower gastrointestinal bleeding, likely due to the severity and rapid progression of upper GI hemorrhage. Furthermore, studies with higher proportions of patients requiring intensive organ support reported correspondingly higher mortality rates.

Assessment of publication bias using funnel plot analysis showed no significant asymmetry, and Egger's test was not statistically significant, suggesting a low likelihood of publication bias. Sensitivity analysis demonstrated that no single study significantly altered the pooled mortality estimate, confirming the robustness of the findings.

Overall, the results indicate that gastrointestinal bleeding in ICU patients is associated with substantial mortality, driven primarily by underlying disease severity and systemic complications rather than the bleeding event alone.

DISCUSSION

This systematic review and meta-analysis synthesizes evidence from seven studies to evaluate mortality outcomes and predictors in ICU patients with gastrointestinal bleeding (GIB). The pooled mortality rate of 28.7% underscores the substantial clinical burden associated with GIB in critically ill populations. These findings are consistent with earlier reports indicating mortality rates ranging between 20% and 40% in ICU settings, suggesting that despite advances in critical care and endoscopic management, outcomes remain suboptimal [1-3]. The studies included in this analysis consistently demonstrated high mortality across diverse geographic regions, reflecting the global relevance of this clinical problem [12–18].

A key observation from this analysis is that mortality in ICU patients with GIB is largely driven by the severity of underlying illness rather than the bleeding event alone. Hemodynamic instability at presentation, including hypotension and shock, emerged as one of the most consistent predictors of mortality across all included studies [12–18]. This aligns with established evidence that systemic hypoperfusion and circulatory failure significantly impair organ function and increase the risk of death in critically ill patients [4,5]. The requirement for vasopressor support further reflects the severity of shock and was uniformly associated with poor outcomes in the included cohorts.

Mechanical ventilation was another strong predictor of mortality identified in this analysis. Patients requiring ventilatory support often represent a subgroup with severe respiratory failure or multi-organ dysfunction, both of which are independently associated with increased mortality [5,7]. Similarly, elevated APACHE II scores were consistently linked to adverse outcomes, reinforcing the importance of validated severity scoring systems in risk stratification [4]. These findings support the utility of early prognostic assessment tools in identifying high-risk patients who may benefit from aggressive monitoring and intervention.

The presence of sepsis and multi-organ dysfunction syndrome (MODS) was also significantly associated with mortality in this meta-analysis. Sepsis exacerbates coagulopathy, impairs tissue perfusion, and contributes to gastrointestinal mucosal injury, thereby increasing both the risk and severity of bleeding [5]. Moreover, MODS reflects advanced systemic deterioration and has been widely recognized as a major determinant of mortality in ICU patients [5,7]. Several included studies highlighted that patients with concurrent sepsis and GIB had markedly worse outcomes compared to those without infection [13,15,17].

Age was identified as an important demographic predictor, with elderly patients exhibiting higher mortality rates. This is likely due to the presence of multiple comorbidities, reduced physiological reserve, and impaired response to acute stress in older individuals [6]. Additionally, age-related changes in coagulation and vascular integrity may further predispose to severe bleeding and poor recovery.

The type of gastrointestinal bleeding also appeared to influence outcomes. Studies included in this analysis suggested that upper gastrointestinal bleeding (UGIB) was associated with slightly higher mortality compared to lower gastrointestinal bleeding (LGIB) [12,14,16]. This may be attributed to the more rapid onset and severity of UGIB, particularly in cases of variceal hemorrhage or peptic ulcer disease. Furthermore, UGIB often presents with significant hemodynamic compromise, necessitating urgent intervention.

Timing of endoscopic intervention emerged as an important modifiable factor influencing outcomes. Delayed endoscopy was associated with increased mortality in several studies, likely due to ongoing bleeding, delayed hemostasis, and prolonged hemodynamic instability [13,18]. Early endoscopic evaluation and intervention have been shown to improve outcomes by enabling prompt diagnosis and therapeutic management [3,6]. However, in ICU settings, logistical challenges and patient instability may limit the feasibility of early procedures.

The moderate heterogeneity observed in this analysis ($I^2 = 62\%$) likely reflects differences in study populations, ICU settings, definitions of bleeding severity, and variations in management protocols. Despite this, the consistency of key predictors across studies strengthens the validity of the findings. Sensitivity analyses further confirmed the robustness of pooled estimates, as no single study significantly influenced the overall mortality rate.

This study has several strengths, including a focused analysis of ICU populations, inclusion of multicentric data, and identification of clinically relevant predictors. However, certain limitations must be acknowledged. The relatively small number of included studies ($n = 7$) limits the ability to perform detailed subgroup analyses and meta-regression. Additionally, all included studies were observational in nature, which may introduce inherent biases. Variability in reporting of predictors and outcomes across studies may also affect the precision of estimates.

Despite these limitations, the present meta-analysis provides important insights into the outcomes of gastrointestinal bleeding in critically ill patients. The findings emphasize that mortality is closely linked to systemic illness severity and highlight the need for early risk stratification, aggressive hemodynamic stabilization, and timely intervention.

In summary, gastrointestinal bleeding in ICU patients remains associated with high mortality, driven primarily by factors such as hemodynamic instability, organ dysfunction, and severity of illness. Future research should focus on prospective multicenter studies and standardized protocols to better define optimal management strategies and improve survival outcomes in this high-risk population [18].

CONCLUSION

Gastrointestinal bleeding in ICU patients is associated with a high mortality rate, largely driven by underlying disease severity rather than the bleeding event alone. Key predictors of mortality include hemodynamic instability, need for vasopressor support, mechanical ventilation, high APACHE II scores, sepsis, and multi-organ dysfunction. Early risk stratification and prompt management, including timely endoscopic intervention and aggressive supportive care, are essential to improve outcomes. Further large-scale prospective studies are needed to establish standardized management strategies and reduce mortality in this high-risk population.

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