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Addressing acute gastrointestinal emergencies: From hemorrhage to obstruction

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Abstract--Background: Gastrointestinal bleeding (GIB) has traditionally been divided into upper and lower gastrointestinal bleeding (UGIB and LGIB). Advances in diagnostic technologies, including capsule endoscopy and balloon-assisted enteroscopy, have refined our understanding of small bowel bleeding, leading to a revised classification system encompassing upper, mid, and lower GIB. The rising incidence of LGIB is attributed to an aging population and increased antithrombotic use. Despite improvements in UGIB management, effective preventive strategies for LGIB remain insufficient, with significant hospitalization and mortality rates. **Aim:**

This review aims to consolidate current knowledge on the initial management of acute LGIB, addressing advancements in predictive scoring systems, risk stratification, and the role of early colonoscopy. **Methods:** A comprehensive literature review was conducted, focusing on recent advancements and guidelines, including the 2016 American College of Gastroenterology guidelines for acute LGIB and the American Society for Gastrointestinal Endoscopy guidelines on antithrombotic management. **Results:** The review highlights the challenges in managing acute LGIB, including the diverse etiology of bleeding, the need for effective risk stratification tools, and the optimization of colonoscopy timing. New predictive models, such as the NOBLADS score and other risk scoring systems, provide valuable insights into severe LGIB outcomes. The benefits of early colonoscopy in enhancing bleeding source localization are discussed, although its impact on critical outcomes like rebleeding and mortality remains debated. **Conclusion:** Effective management of acute LGIB requires a multifaceted approach involving advanced diagnostic tools, risk stratification models, and timely interventions. While early colonoscopy shows promise in identifying bleeding sources, further research is needed to confirm its impact on long-term outcomes. Adhering to updated guidelines and incorporating predictive models can enhance patient care and optimize resource utilization in acute LGIB management.

Keywords---Gastrointestinal bleeding, lower gastrointestinal bleeding, colonoscopy, predictive models, risk stratification, early intervention.

Introduction

Traditionally, gastrointestinal bleeding (GIB) has been categorized into upper gastrointestinal bleeding (UGIB) and lower gastrointestinal bleeding (LGIB). LGIB was previously defined as bleeding originating from lesions distal to the ligament of Treitz, encompassing the small and large intestines. Recent advancements in diagnostic technologies, such as capsule endoscopy and balloon-assisted enteroscopy, have enhanced the understanding of the etiological factors associated with small bowel bleeding. Consequently, contemporary reports have introduced a triadic classification of GIB: upper, mid, and lower GIB [1]. The incidence of acute LGIB has risen, driven by the aging population and increased use of antithrombotic agents [2-4]. While many UGIB events can be mitigated through proton pump inhibitors (PPIs) and the eradication of *Helicobacter pylori*, effective preventive measures for LGIB recurrence remain limited. The hospitalization rate for LGIB is estimated at 33-87 per 100,000 population [2,5,6], with mortality rates ranging from 2.5% to 3.9% during hospitalization [7-9], and rebleeding rates of 13% to 19% after one year [10,11].

Managing acute hematochezia suspected to be acute LGIB presents several challenges. Firstly, the etiology of bleeding can vary widely from colonic diseases to UGIB and small-bowel bleeding. Many cases resolve spontaneously with conservative treatment; however, patients with vascular conditions, such as

diverticular bleeding and angioectasia, often experience persistent or recurrent bleeding, necessitating hemostatic intervention and blood transfusion [9,12]. Although rare, some patients may die during hospitalization. Therefore, risk stratification tools for severe LGIB are crucial for determining the need for emergency hospitalization or early intervention. Unlike UGIB, predictive clinical scores for severe acute LGIB are not well-established. Secondly, colonoscopy, which is pivotal for diagnosing and treating LGIB [13], necessitates bowel preparation to identify the source of bleeding, in contrast to upper endoscopy. The timing of colonoscopy, which is both time-consuming and labor-intensive, should be optimized; however, the benefits of early colonoscopy remain debated.

Thirdly, the management of antithrombotic agents, including dual antiplatelet therapy and direct-acting oral anticoagulants (DOACs), must balance the conflicting risks of ongoing or recurrent bleeding and thromboembolic events. Therefore, effective decision-making is essential in managing acute LGIB. Fortunately, recent advancements have provided new insights into this field, including predictive scores for severe bleeding, the clinical relevance of contrast-enhanced computed tomography (CE-CT) prior to colonoscopy, the benefits of early colonoscopy, and the management of DOACs. This literature review aims to consolidate findings on the initial management of acute LGIB, in accordance with the 2016 American College of Gastroenterology guidelines for acute LGIB and the 2016 American Society for Gastrointestinal Endoscopy guidelines on the management of antithrombotic agents in gastrointestinal endoscopy [13,14].

Initial Assessment:

The initial evaluation of patients with suspected acute lower gastrointestinal bleeding (LGIB) involves a thorough history-taking, physical examination, and laboratory testing. The necessity for intravenous fluid resuscitation and blood transfusion should be assessed based on hemodynamic status, which includes the patient's history of syncope, level of consciousness, and vital signs, including changes in posture. Hematochezia accompanied by hemodynamic instability requires careful evaluation, as brisk upper gastrointestinal bleeding (UGIB) can also present with similar stool characteristics. Indicators of UGIB include a blood urea nitrogen/creatinine (BUN/Cr) ratio greater than 30 (likelihood ratio of 7.5) and nasogastric aspirate or lavage revealing blood or coffee grounds (likelihood ratio of 9.6) [15]. Additionally, in cases of hematochezia, UGIB is associated with significantly lower systolic blood pressure compared to LGIB (mean pressure of 114 mmHg vs. 133 mmHg) [16]. If UGIB is highly suspected based on these factors, upper endoscopy is recommended.

Specific symptoms can provide clues to the source of LGIB [13]. Patients with colitis (e.g., ischemia, infection, or inflammatory bowel disease) frequently present with diarrhea and abdominal tenderness. Conversely, individuals with vascular conditions such as diverticular bleeding, hemorrhoids, angioectasia, and rectal ulcers often do not exhibit lower gastrointestinal symptoms. Weight loss and changes in bowel habits may indicate malignancy.

Risk Stratification:

While most patients with acute LGIB achieve spontaneous hemostasis, some experience severe, persistent hemorrhage and rebleeding. The frequency of adverse outcomes varies depending on the underlying cause of LGIB. In Western countries, the causes of acute LGIB are reported as follows [17]: diverticular bleeding (30%-65%), ischemic colitis (5%-20%), hemorrhoids (5%-20%), colorectal polyps/neoplasms (2%-15%), angioectasia (5%-10%), post-polypectomy bleeding (2%-7%), inflammatory bowel disease (3%-5%), infectious colitis (2%-5%), rectal ulcer (0-5%), colorectal varices (0-3%), radiation proctitis (0-2%), drug-induced colitis (0-2%), and Dieulafoy's lesion (rare). In contrast, tropical countries commonly see colorectal polyps/neoplasms (29%-53%) and colitis (23%-38%) as major causes, with diverticular bleeding being less prevalent (4%-19%) [16,18]. The rebleeding rate for diverticular bleeding ranges from 22% to 38% [12]. Ischemic colitis patients generally require fewer blood transfusions (4%) compared to other LGIB forms [19].

Physicians need to recognize predictive factors for severe LGIB to improve patient triage for emergency hospitalization or early intervention. Multiple studies have explored risk factors associated with adverse outcomes (such as rebleeding, severe bleeding, need for emergent hospitalization, need for intervention, adverse events, or mortality) in acute LGIB patients [7,8,20-28]. Key predictive factors include older age, presenting symptoms (e.g., absence of abdominal tenderness, no diarrhea, altered mental status, or blood on rectal examination), vital signs, comorbidities, medication use (e.g., nonsteroidal anti-inflammatory drugs [NSAIDs] and antithrombotic agents), and laboratory results (e.g., hemoglobin [Hb], hematocrit, albumin, BUN, creatinine [Cr], and prothrombin time [PT]). A previously reported predictive model for severe LGIB, known as the NOBLADS score, incorporates NSAID use, absence of diarrhea, lack of abdominal tenderness, systolic blood pressure ≤ 100 mmHg, albumin level < 3.0 g/dL, non-aspirin antiplatelet drug use, Charlson comorbidity index score ≥ 2 , and syncope [24]. Several predictive models have been validated in various settings [21,22,24,27,28]. Implementing these models in managing LGIB could enhance clinical outcomes and optimize resource use. However, predictive models for severe LGIB, unlike those for severe UGIB [29,30], such as the Blatchford score, require further validation and improvements in accuracy.

Risk Factors and Odds Ratios for Various Outcomes According to 11 Studies [7,8,20-28]

Several studies have identified various risk factors associated with different outcomes in patients experiencing gastrointestinal bleeding. Older age has been associated with increased odds of severe or recurrent bleeding (odds ratio [OR] = 2.31), in-hospital complications (OR = 4.21), and mortality (OR = 4.92) [7,8,20-28]. Male sex shows a notable increase in the risk of mortality (OR = 1.5-1.6), while a lower body mass index has been linked to a higher likelihood of mortality (OR = 2.0) [7,8,20-28]. Smoking is associated with adverse outcomes, specifically a reduced risk of bleeding (OR = 0.5), but does not significantly impact other outcomes [7,8,20-28].

Comorbidities play a significant role in patient outcomes. A Charlson comorbidity index score greater than 2 is correlated with an increased risk of severe or recurrent bleeding (OR = 1.7-1.9) and mortality (OR = 3.0) [7,8,20-28]. Unstable comorbid conditions present a higher risk of in-hospital complications (OR = 2.9). Cardiovascular disease and dementia are associated with increased mortality rates (OR = 6 and OR = 5.2, respectively) [7,8,20-28]. Additionally, metastatic cancer, chronic kidney disease, liver disease, and chronic pulmonary disease are linked with elevated mortality risks, ranging from OR = 1.5 to 5.0 [7,8,20-28]. A history of colonic diverticulosis and/or angiodysplasia is associated with increased mortality (OR = 6) [7,8,20-28].

Symptoms at presentation also provide insight into outcomes. Patients who present with syncope or altered mental status have higher odds of severe or recurrent bleeding (OR = 2.5-3.3) and mortality (OR = 6) [7,8,20-28]. Absence of diarrhea and abdominal tenderness are linked to a higher likelihood of severe bleeding (OR = 2.2 and OR = 2.4-3.0, respectively), while ongoing bleeding and bleeding within the first four hours are significant predictors of adverse outcomes [7,8,20-28]. Medication use also affects outcomes. Nonsteroidal anti-inflammatory drugs (NSAIDs) and antiplatelet drugs (non-aspirin) are associated with higher odds of severe bleeding (OR = 2.5 and OR = 2.0, respectively) [7,8,20-28]. Aspirin use shows a moderate increase in the risk of severe bleeding (OR = 1.9-2.1), whereas anticoagulants are linked to higher mortality (OR = 1.5) [7,8,20-28].

Physical examination findings, such as blood pressure ≤ 100 mmHg or ≤ 115 mmHg, and heart rate ≥ 100 /min are correlated with severe bleeding (OR = 2.3-3.5 and OR = 3.7, respectively) [7,8,20-28]. Abnormal vital signs and hemodynamic parameters also predict adverse outcomes (OR = 4.3 and OR = 2.1, respectively) [7,8,20-28]. Gross blood on rectal examination is associated with increased mortality (OR = 3.5-3.9) [7,8,20-28]. Laboratory data further informs risk assessment. Hemoglobin levels below 10 g/dL and albumin levels below 3.0 g/dL are linked to increased risks of severe bleeding (OR = 3.6 and OR = 2.0-2.9, respectively) [7,8,20-28]. Elevated creatinine levels and low hematocrit are associated with higher mortality (OR = 6 and OR = 4.7-6.3, respectively) [7,8,20-28]. Prothrombin time greater than 1.2 times the control is a predictor of in-hospital complications (OR = 2.0) [7,8,20-28]. In the clinical course, rebleeding and intestinal ischemia are associated with adverse outcomes (OR = 1.9 and OR = 3.5, respectively) [7,8,20-28]. Coagulation defects, hypovolemia, and blood transfusion are linked to higher mortality, with odds ratios ranging from 1.6 to 2.8 [7,8,20-28]. The need for intervention and in-hospital onset of LGIB also correlate with increased mortality (OR = 2.3-2.4) [7,8,20-28].

Risk Scoring Systems for Severe Acute Lower Gastrointestinal Bleeding:

Several risk scoring systems have been developed and validated for assessing severe acute lower gastrointestinal bleeding (LGIB), each utilizing a distinct set of risk factors and demonstrating varying degrees of predictive accuracy.

Strate et al. [21] developed a scoring system aimed at predicting severe bleeding, which was validated in a prospective cohort of 275 patients (original cohort n = 252). Key risk factors include syncope, absence of abdominal tenderness, aspirin

use, heart rate ≥ 100 /min, systolic blood pressure ≤ 115 mmHg, and bleeding per rectum within the first 4 hours. The model achieved a Receiver Operating Characteristic - Area Under the Curve (ROC-AUC) of 0.76 during derivation and 0.75 in the validation study [21]. **Das et al. [22]** focused on rebleeding and developed a model based on 19 factors, including age and the need for intervention. This scoring system demonstrated an impressive ROC-AUC of 0.92 in the derivation cohort (n = 120) and was further validated with a ROC-AUC of 0.93. An artificial neural network-based model by Das et al. also predicted in-hospital mortality, incorporating comorbidity (5 factors), history (4 factors), features at presentation (2 factors), initial assessment (2 factors), and initial laboratory data (5 factors), achieving a ROC-AUC of 0.95 [22].

Aoki et al. [24] proposed the NOBLADS score to predict severe bleeding, validated in a prospective cohort of 161 patients and a retrospective cohort of 511 patients. This model includes factors such as NSAID use, absence of diarrhea, absence of abdominal tenderness, systolic blood pressure ≤ 100 mmHg, albumin level < 3.0 g/dL, use of non-aspirin antiplatelet drugs, disease score ≥ 21 , and syncope. The ROC-AUC for the derivation cohort was 0.77, with a validation ROC-AUC of 0.76 and 0.74 for the prospective and retrospective cohorts, respectively [24]. **Oakland et al. [27]** developed a risk scoring system to determine safe discharge, focusing on factors such as age, sex, presence of blood on rectal examination, heart rate, systolic blood pressure, hemoglobin level, and previous LGIB admission. This model, validated in a cohort of 288 patients, achieved a ROC-AUC of 0.84 during derivation and 0.79 in the validation study [27]. **Sengupta et al. [28]** created a model for predicting 30-day mortality using factors such as age, dementia, metastatic cancer, chronic kidney disease, chronic pulmonary disease, anticoagulant use, hematocrit level, and albumin level. This retrospective cohort study (n = 4044) achieved a ROC-AUC of 0.81 during derivation and 0.72 in the validation cohort [28].

Receiver Operating Characteristic - Area Under the Curve:

ROC-AUC, or **Receiver Operating Characteristic - Area Under the Curve**, is a statistical measure used to evaluate the performance of a binary classification model. Here's a breakdown of what it entails:

1. **Receiver Operating Characteristic (ROC) Curve:**
 - The ROC curve is a graphical plot that illustrates the diagnostic ability of a binary classifier system as its discrimination threshold is varied.
 - It plots the True Positive Rate (Sensitivity) against the False Positive Rate (1 - Specificity) at various threshold settings.
2. **Area Under the Curve (AUC):**
 - The AUC quantifies the overall ability of the model to discriminate between the positive and negative classes.
 - An AUC value ranges from 0 to 1:
 - **0.5:** The model has no discriminative power, equivalent to random guessing.
 - **1.0:** The model has perfect discriminative power, correctly distinguishing between positive and negative cases in all instances.

- **AUC** provides a single scalar value that summarizes the performance of the model across all classification thresholds.

In summary, the ROC-AUC is a key metric for assessing the performance of a classification model, with a higher AUC indicating better performance in distinguishing between the two classes. It is particularly useful for comparing different models or evaluating their effectiveness in various applications.

Initial Management:

Intravenous fluid resuscitation using crystalloids should be promptly administered, especially in patients exhibiting hemodynamic instability [13,31]. A review of fluid resuscitation strategies for patients experiencing hemorrhage did not reveal an optimal approach regarding the timing, volume, or type of fluid administered [32]. Additionally, another review focusing on critically ill patients found that colloids did not offer a survival benefit and were more costly compared to crystalloids [33].

Although blood transfusions are frequently necessary for patients with lower gastrointestinal bleeding (LGIB) [9], specific transfusion protocols for LGIB have not been thoroughly investigated. A recent meta-analysis of five randomized controlled trials (RCTs) comparing restrictive versus liberal transfusion strategies in acute upper gastrointestinal bleeding (UGIB) demonstrated that a restrictive approach (hemoglobin threshold of 7-8 g/dL) was associated with a reduced risk of all-cause mortality [relative risk (RR): 0.65, 95% confidence interval (CI) 0.44-0.97] and rebleeding [RR: 0.58, 95% CI 0.40-0.84] compared to a liberal strategy (hemoglobin threshold of 9-10 g/dL) [34]. This evidence has been incorporated into the LGIB guidelines [13].

It is important to note that previous RCTs and a meta-analysis indicated higher mortality and cardiovascular events in patients with cardiovascular disease under restrictive transfusion protocols compared to liberal ones [35,36]. Consequently, the LGIB guidelines suggest considering a liberal transfusion approach in cases of massive bleeding or in patients with cardiovascular disease [13]. Regarding platelet transfusions, a systematic review concluded that there is insufficient data to establish optimal therapeutic platelet count targets in the context of acute gastrointestinal bleeding (GIB) [37]. According to expert opinion and standard hematology practice, a platelet count of $50 \times 10^9/L$ is recommended as the threshold in LGIB guidelines [13,38].

Diagnosis and Treatment

Colonoscopy:

Colonoscopy is the primary diagnostic and therapeutic procedure for nearly all patients with acute LGIB [13]. It is effective in identifying common causes such as diverticular bleeding, ischemic colitis, angiodysplasia, and post-polypectomy bleeding, as well as less common conditions including rectal ulcers, infectious colitis, inflammatory bowel disease, colorectal polyps/neoplasms, radiation proctitis, and hemorrhoids [13]. A critical aspect of diagnostic colonoscopy is the identification of stigmata of recent hemorrhage (SRH), which includes active

bleeding, a non-bleeding visible vessel, and an adherent clot [39,40]. SRH serves as an indication for endoscopic hemostasis; a prospective study demonstrated that patients with SRH who did not receive endoscopic therapy had a 66% rebleeding rate within 30 days, whereas those without SRH did not experience rebleeding [40].

Timing of Colonoscopy:

The optimal timing for performing colonoscopy remains a subject of debate. Most studies define early colonoscopy as occurring within 24 hours of presentation, although some prospective trials use a 6-12 hour timeframe [41-45]. Two RCTs and three meta-analyses have evaluated the efficacy of early colonoscopy compared to elective colonoscopy in the context of acute LGIB. These investigations suggest that early colonoscopy may enhance the identification of the bleeding source and increase the rate of endoscopic interventions compared to elective colonoscopy. However, there is no definitive evidence that early colonoscopy significantly impacts critical clinical outcomes, such as rebleeding or mortality.

Utility of Early Colonoscopy Compared with Elective Colonoscopy:

Several studies have explored the efficacy of early colonoscopy compared to elective colonoscopy in managing acute lower gastrointestinal bleeding. In a randomized controlled trial conducted by Green et al. [41], which included 100 participants, early colonoscopy demonstrated a significant improvement in the localization of the bleeding source, with an odds ratio of 2.6 (95% confidence interval [CI] 1.1-6.2). However, this study did not report on endoscopic interventions, the need for surgery, rebleeding rates, length of hospital stay, adverse events, or mortality. Laine et al. [42] performed a randomized controlled trial involving 72 patients but did not provide data on bleeding source localization, endoscopic interventions, or surgery requirements. Additionally, they did not report on rebleeding, length of stay, adverse events, or mortality. Sengupta et al. [44], in their meta-analysis of 901 patients, found that early colonoscopy improved bleeding source localization with an odds ratio of 2.97 (95% CI 2.11-4.19) and increased the likelihood of endoscopic intervention with an odds ratio of 3.99 (95% CI 2.59-6.13). The analysis did not provide information on the need for surgery, rebleeding rates, length of stay, adverse events, or mortality. Kouanda et al. [43], in their meta-analysis of 24,396 patients, reported an odds ratio of 1.70 (95% CI 1.08-2.67) for endoscopic intervention with early colonoscopy. However, this study did not present data on bleeding source localization, the requirement for surgery, rebleeding, length of stay, adverse events, or mortality. Seth et al. [45] conducted a meta-analysis involving 23,419 patients and found that early colonoscopy improved the detection of stigmata of recent hemorrhage (SRH) with an odds ratio of 2.85 (95% CI 1.90-4.28). They did not report on endoscopic interventions, the need for surgery, rebleeding rates, length of stay, adverse events, or mortality.

Limitations of Previous Studies and Ongoing Multicenter RCT:

Past research on early versus elective colonoscopy for acute lower gastrointestinal bleeding (LGIB) has several limitations that may influence the reported outcomes. Prior randomized controlled trials (RCTs) were predominantly single-center studies that were prematurely terminated due to challenges in reaching the targeted sample size. To address these limitations, a multicenter RCT is currently underway to assess whether early colonoscopy offers a superior approach compared to elective colonoscopy in patients with acute LGIB [46]. The primary endpoint of this trial is the identification of stigmata of recent hemorrhage (SRH). Secondary endpoints include 30-day rebleeding rates, the necessity for transfusions, and 30-day mortality. This trial aims to provide robust evidence regarding the benefits of early colonoscopy.

Safety of Early Colonoscopy:

The safety profile of early colonoscopy in the acute LGIB setting has been examined in recent studies. Propensity score-matching analysis revealed no significant difference in complication rates associated with bowel preparation between early colonoscopy (1.8%) and elective colonoscopy (1.2%) [47]. Additionally, a literature review reported low complication rates for both early colonoscopy (0.6%) and elective colonoscopy (0.3%) [48].

Indications for Early Colonoscopy:

The LGIB guidelines advocate for early colonoscopy, ideally within 24 hours of presentation, for patients exhibiting high-risk clinical features and signs of ongoing bleeding [13]. Extravasation observed on a CT scan is one such sign that should prompt early colonoscopy. However, there is uncertainty regarding the clinical factors readily available at presentation that could indicate the need for early colonoscopy. Although the NOBLADS score, a predictive tool for severe LGIB, suggested an association with the need for intervention in the derivation cohort ($P = 0.001$ for trend) [24], it was not a significant predictor in an externally validated cohort ($P = 0.060$ for trend; area under the curve, 0.54) [49]. Recent studies have indicated that all seven existing models for predicting severe gastrointestinal bleeding are ineffective in distinguishing patients who require therapeutic intervention [27]. Therefore, there is a need for improved models and novel strategies to guide early colonoscopy decisions.

Procedure Recommendations:

To maximize the effectiveness of early colonoscopy, identifying the bleeding site and performing endoscopic hemostatic therapy are paramount. Recommendations for enhancing SRH identification include adequate colon preparation, employing an experienced colonoscopist, using a cap, and utilizing a water-jet scope, particularly for diverticular bleeding [39,50]. Since over half of SRH cases are located in the right colon (71%) [51], cecal intubation with proper colon preparation is essential, even for early colonoscopy. For patients unable to tolerate rapid colon preparation, a nasogastric tube may be used [39,41].

Role of Computed Tomography:

Computed tomography (CT) has proven to be highly sensitive (85.2%) and specific (92.1%) for diagnosing acute gastrointestinal bleeding [52]. The American College of Gastroenterology guidelines recommend considering CT angiography for localizing the bleeding site before proceeding with angiography or surgery, particularly when hemodynamic instability precludes endoscopic evaluation or when bowel preparation is not feasible [13]. Recent studies have evaluated the clinical relevance of performing CT prior to colonoscopy. A retrospective study of acute LGIB found that vascular lesions were detected more frequently with CT preceding colonoscopy compared to colonoscopy alone (35.7% vs. 20.6%, $P = 0.01$), leading to an increased rate of endoscopic interventions (34.9% vs. 13.4%, $P < 0.01$) [53]. Further research has examined the relationship between CT-detected extravasation and definitive diverticular bleeding on colonoscopy. The colonoscopic detection rate of bleeding diverticula is notably higher in patients with CT evidence of extravasation compared to those without (60%-76% vs. 18%-31%) [54-56], supporting the use of CT as a reasonable indicator for urgent colonoscopy. However, due to the low rate of positive extravasation (15%-25%) documented in prospective studies of diverticular bleeding [56,57], CT is not recommended universally. The intermittent nature of diverticular bleeding may reduce CT sensitivity. A prospective multicenter study suggested that patients examined within 4 hours of the last hematochezia are more suitable candidates for urgent CT, given the higher sensitivity in this group compared to those examined later (64.7% vs. 33.3%, $P < 0.01$) [56].

Clinical Significance of Contrast-Enhanced Computed Tomography:

The utility of performing contrast-enhanced computed tomography (CT) prior to colonoscopy for detecting colonic diverticular bleeding has been investigated in various studies. The findings underscore the significance of CT in improving the detection of stigmata of recent hemorrhage (SRH) and guiding subsequent colonoscopic intervention.

1. **Obana et al. [57]:** This prospective study involving 52 patients reported a 15% detection rate of extravasation on CT. Among those with CT-detected extravasation, the SRH detection rate during colonoscopy (CS) was 50%, whereas it was 36% in those without extravasation. Predictors for extravasation included a history of diverticular bleeding and examination within 2 hours of the last hematochezia.
2. **Nakatsu et al. [54]:** In this retrospective study of 346 patients, the rate of extravasation detection on CT was 30%. The SRH detection rate during colonoscopy following extravasation was 68%, compared to 20% when no extravasation was observed.
3. **Nagata et al. [53]:** This retrospective study of 77 patients found a 31% detection rate of extravasation on CT. SRH detection rates on colonoscopy were 63% following extravasation and 38% when no extravasation was detected. Predictors for extravasation included a history of diverticular bleeding.
4. **Sugiyama et al. [55]:** This retrospective study of 55 patients revealed a 36% extravasation detection rate on CT, with an SRH detection rate of

60% on colonoscopy after detecting extravasation, compared to 31% in the absence of extravasation.

5. **Wada et al. [118]:** In this retrospective study of 100 patients, the extravasation detection rate was 23%, and the SRH detection rate was 70% among those with extravasation. The study did not specify predictors for extravasation.
6. **Umezawa et al. [56]:** This prospective study involving 202 patients reported a 25% rate of extravasation detection on CT. The SRH detection rate during colonoscopy was 76% after extravasation and 18% when no extravasation was detected. Predictors for extravasation included examination within 4 hours of the last hematochezia.

These studies collectively illustrate that performing CT before colonoscopy can enhance the identification of SRH, particularly in patients with visible extravasation. However, the variability in detection rates and predictors highlights the need for further research to refine the use of CT in managing colonic diverticular bleeding.

Angiography and Embolization:

Angiography and embolization offer a significant advantage in managing severe gastrointestinal bleeding by controlling hemorrhage without requiring bowel preparation. A systematic review found that super-selective angiographic embolization effectively achieves immediate hemostasis in 40% to 100% of cases involving diverticular bleeding, although there is a 15% rate of rebleeding [58]. However, this approach has notable disadvantages, including the necessity for active bleeding and potential risks such as bowel ischemia and contrast-induced nephropathy. Recent studies have reported bowel ischemia rates of 1% to 4% following embolization [59,60]. According to guidelines, this intervention should be considered primarily for patients experiencing very brisk, ongoing bleeding who are inadequately responding to hemodynamic resuscitation and are unlikely to tolerate bowel preparation and early colonoscopy [13]. Angiography is effective in localizing the source of lower gastrointestinal bleeding (LGIB) in 24% to 70% of cases [59,61]. Successful localization generally requires a bleeding rate of over 0.5 mL/min [62]. Factors predicting positive angiography include transfusion of more than 5 units of red blood cells or 4 units of fresh frozen plasma within 24 hours, hemodynamic instability during the procedure, and older age [63,64]. Additionally, CT angiography serves as a useful noninvasive diagnostic tool prior to angiography due to its higher sensitivity, identifying bleeding at rates as low as 0.3 mL/min [65]. In a retrospective analysis of colonic diverticular bleeding with stigmata of recent hemorrhage (SRH) observed during colonoscopy, the rate of requiring interventional radiology or surgery due to unsuccessful repeated colonoscopic hemostasis was higher for bleeding originating from the ascending colon (19%) compared to other colonic regions (0%) [51]. Consequently, patients with ascending colon bleeding face an elevated risk of needing interventional radiology post-colonoscopy.

Surgery:

Recent studies on surgical intervention for acute LGIB have become less frequent, likely due to advancements in endoscopic hemostasis and interventional radiology techniques. Surgical procedures for acute LGIB have high complication and mortality rates, with complications reaching up to 60% and mortality up to 16% [66]. Therefore, surgery should be reserved for cases of brisk, ongoing LGIB. Indications for emergency surgery include: (1) a clearly identified bleeding source that has not been controlled by non-surgical methods and (2) persistent bleeding despite substantial transfusion (6 units of red blood cells) and thorough diagnostic work-up including endoscopy and radiography [48,67]. Effective localization of the bleeding lesion before surgical resection is crucial to prevent rebleeding from an unresected source and to avoid unnecessary mortality associated with blind total colectomy. Studies on surgical management of acute LGIB have shown that the rebleeding rate is higher following limited colonic resection (4% to 18%) compared to total colonic resection (0% to 4%) [68-71]. Conversely, mortality rates are generally lower after limited colonic resection (7% to 22%) compared to total colonic resection (20% to 40%) [68-70].

Therapeutic Barium Enema for Diverticular Bleeding:

High-dose barium impaction therapy, utilizing concentrated (200%) barium sulfate, has been reported for the management of diverticular bleeding. Although the evidence supporting its effectiveness for initial hemostasis is limited—primarily consisting of case reports or case series—these reports suggest potential benefits for controlling bleeding in patients with uncontrolled or recurrent diverticular hemorrhage [72-75]. A novel approach involves using an enteroscopic overtube with a balloon to administer barium pressure to the deep colon, specifically for right-sided diverticular bleeding, which may enhance the efficacy of the therapy [76]. The efficacy of barium impaction therapy in preventing long-term rebleeding has been confirmed by a randomized controlled trial (RCT). This study found that the hazard ratio (HR) for rebleeding in the barium therapy group, compared to conservative management after spontaneous cessation of diverticular bleeding, was 0.34 (95% confidence interval [CI]: 0.12-0.98) [77].

Medication Management in LGIB:

Managing medication in patients with lower gastrointestinal bleeding (LGIB) involves balancing the risks of bleeding and thromboembolic events [13,14]. Antithrombotic agents should be discontinued in cases of life-threatening bleeding, with resumption recommended once hemostasis is achieved. Multidisciplinary input is crucial, especially for patients on dual antiplatelet agents or anticoagulants. Non-aspirin NSAIDs are known to increase both the risk and recurrence of LGIB [11,78-80]. A cohort study indicated that NSAID use doubles the recurrence risk [11], and a prospective study found significantly higher recurrence rates in NSAID users [81]. Thus, NSAIDs should be discontinued after acute LGIB. Switching from non-selective to COX-2 selective NSAIDs does not mitigate the risk [79,82]. Antiplatelet agents, similarly, elevate LGIB risks [11,79,80,83]. Evidence suggests that discontinuing aspirin leads to more cardiovascular events but fewer recurrent LGIB cases [86]. In contrast, the

evidence on short-term interruption in single antiplatelet users is inconclusive, showing no significant difference in rebleeding rates [83]. Dual antiplatelet therapy should be continued for patients at high risk of myocardial infarction or death, whereas the second agent can be paused for up to 7 days in lower-risk scenarios [89,90]. For anticoagulants, which include warfarin and direct oral anticoagulants (DOACs), the management guidelines are less clear [13,14]. Endoscopic guidelines suggest maintaining an INR < 2.5, but higher INR does not necessarily increase rebleeding risk [91-93]. Reversal of anticoagulants is recommended for severe bleeding, using agents like vitamin K, fresh frozen plasma, or prothrombin complex concentrate for warfarin, and oral charcoal, hemodialysis, or specific reversal agents for DOACs [97-102]. Heparin bridges may be ineffective in preventing rebleeding and may increase major bleeding risks [103,104]. Resuming anticoagulants reduces thrombotic events and mortality without significantly raising rebleeding rates [105-108]. The optimal timing for resumption is still debated, with some studies suggesting risks vary depending on how soon anticoagulants are restarted after LGIB [107]. Tailoring anticoagulant choices and doses based on individual bleeding risk is crucial, with newer scoring models potentially offering better predictive accuracy for acute GIB [117-119].

Conclusion

The management of acute lower gastrointestinal bleeding (LGIB) presents a complex challenge due to the diverse etiological factors and varying patient responses. This review underscores the importance of a systematic approach to diagnosing and treating LGIB, emphasizing the need for advanced diagnostic techniques and predictive tools. Recent advancements in diagnostic technology, such as capsule endoscopy and balloon-assisted enteroscopy, have significantly improved our understanding of small bowel bleeding, leading to a more nuanced classification system of GIB. Despite these advancements, the management of LGIB remains fraught with difficulties. The rising incidence of LGIB, driven by an aging population and increased use of antithrombotic agents, underscores the need for effective preventive measures and timely intervention. Risk stratification plays a critical role in managing acute LGIB. The development of predictive models, such as the NOBLADS score and other risk scoring systems, provides valuable insights into the likelihood of severe outcomes, such as rebleeding and mortality. These models integrate various factors, including patient demographics, clinical presentation, and laboratory results, to guide clinical decision-making. However, the predictive accuracy of these models requires further validation, and their implementation should be tailored to individual patient circumstances. The role of early colonoscopy in the management of LGIB has been a subject of debate. While early colonoscopy may improve the identification of bleeding sources and facilitate endoscopic interventions, its impact on critical outcomes such as rebleeding and mortality remains inconclusive. The timing and benefits of early colonoscopy should be evaluated on a case-by-case basis, considering the overall clinical picture and patient stability. Effective management of acute LGIB necessitates a comprehensive approach that includes accurate risk assessment, appropriate use of diagnostic tools, and timely therapeutic interventions. Adhering to updated guidelines and incorporating predictive models into clinical practice can enhance patient outcomes and optimize resource utilization. Future research should focus on further validating

predictive models and exploring the long-term effects of early colonoscopy to refine management strategies for acute LGIB.

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معالجة الطوارئ الهضمية الحادة: من النزيف إلى الانسداد

الملخص:

الخلفية: تقليدياً، تم تقسيم النزيف الهضمي إلى نزيف هضمي علوي ونزيف هضمي سفلي. لقد أدت التقدمات في تقنيات التشخيص، بما في ذلك التنظير الكبسولي والتنظير الباليوني المساعد، إلى تحسين فهمنا لنزيف الأمعاء الدقيقة، مما أدى إلى نظام تصنيف مُعدل يشمل النزيف الهضمي العلوي والمتوسط والسفلي. يُعزى الارتفاع في حدوث النزيف الهضمي السفلي إلى شيخوخة السكان وزيادة استخدام الأدوية المضادة للتخثر. على الرغم من التحسينات في إدارة النزيف الهضمي العلوي، فإن الاستراتيجيات الوقائية الفعالة للنزيف الهضمي السفلي لا تزال غير كافية، مع معدلات استشفاء ووفيات كبيرة.

الهدف: يهدف هذه المراجعة إلى توحيد المعرفة الحالية حول الإدارة الأولية للنزيف الهضمي السفلي الحاد، مع التركيز على التقدم في أنظمة التقييم التنبؤية، تصنيف المخاطر، ودور التنظير المبكر.

الطرق: تم إجراء مراجعة أدبية شاملة، ركزت على التقدمات الحديثة والإرشادات، بما في ذلك إرشادات الكلية الأمريكية لأمراض الجهاز الهضمي لعام 2016 للنزيف الهضمي السفلي الحاد وإرشادات الجمعية الأمريكية للتنظير الهضمي حول إدارة الأدوية المضادة للتخثر.

النتائج: تسلط المراجعة الضوء على التحديات في إدارة النزيف الهضمي السفلي الحاد، بما في ذلك التنوع في أسباب النزيف، الحاجة إلى أدوات تصنيف المخاطر الفعالة، وتحسين توقيت التنظير. توفر النماذج التنبؤية الجديدة، مثل درجة NOBLADS وأنظمة التقييم الأخرى، رؤى قيمة حول نتائج النزيف الهضمي السفلي الحاد. يتم مناقشة فوائد التنظير المبكر في تعزيز تحديد مصدر النزيف، على الرغم من أن تأثيره على النتائج الحرجة مثل إعادة النزيف والوفيات لا يزال محل نقاش.

الاستنتاج: تتطلب إدارة النزيف الهضمي السفلي الحاد نهجاً متعدد الأوجه يشمل أدوات التشخيص المتقدمة، نماذج تصنيف المخاطر، والتدخلات في الوقت المناسب. بينما يظهر التنظير المبكر وعدداً في تحديد مصادر النزيف، هناك حاجة إلى مزيد من البحث لتأكيد تأثيره على النتائج طويلة الأجل. يمكن أن يُحسن الالتزام بالإرشادات المحدثة ودمج النماذج التنبؤية رعاية المرضى وتحسين استخدام الموارد في إدارة النزيف الهضمي السفلي الحاد.

الكلمات المفتاحية: النزيف الهضمي، النزيف الهضمي السفلي، التنظير، النماذج التنبؤية، تصنيف المخاطر، التدخل المبكر.