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Original article

Clinical characteristics, interventions and outcomes of acute lower gastrointestinal bleeding: A multicenter study in Vietnam

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Abstract: ***Introduction:*** Despite many medical advances, acute lower gastrointestinal bleeding in Asia has been increasing gradually and has resulted in substantial mortality. The study aimed to describe the clinical characteristics, interventions, and outcomes of acute lower gastrointestinal bleeding in Vietnamese people. ***Methods:*** A multicenter cohort study was prospectively and retrospectively conducted in patients presenting with acute lower gastrointestinal bleeding in Vietnam. Severe lower gastrointestinal bleeding was defined as persistent bleeding within the first 24 hours and/or recurrent bleeding after 24 hours of stability accompanied by a reduction in hematocrit of ≥ 20% and/or transfusion of ≥ 2 units of red blood cells. The clinical characteristics, interventions, and adverse outcomes were recorded. ***Results:*** There were 811 patients with a male:female ratio of 1.07 and a mean age of 61 years. A total of 85.6% of patients presented with hematochezia. The common causes of acute lower gastrointestinal bleeding were hemorrhoids (28.6%), diverticulosis (9.7%), and unknown origin (16%). The rates of blood transfusion, endoscopic therapy, radiologic intervention, and surgery were 39.8%, 8.6%, 0.5%, and 7.3%, respectively. Severe lower gastrointestinal bleeding was observed in 222 (27.4%) patients. In-hospital deaths were recorded in 17 (2.1%) patients. The majority of in-hospital deaths were due to unstable comorbidities. ***Conclusions:*** Hemorrhoids were the most common cause of acute lower gastrointestinal bleeding. The rates of blood transfusion, endoscopic hemostasis, interventional radiology, and surgery were 39.8%, 8.6%, 0.5%, and 7.3%, respectively. A total of 27.4% of cases progressed to severe bleeding.

Keywords: lower gastrointestinal bleeding; colonoscopy; severe bleeding; mortality.

1. INTRODUCTION

Acute lower gastrointestinal bleeding (ALGIB) is traditionally defined as the site of bleeding distal to the ligament of Treitz [1]. The etiologies of ALGIB in some published studies are quite different between Europe and Asia. In Europe, diverticulosis, ischemic colitis, and inflammatory bowel disease (IBD) are common causes of ALGIB [2,3]. In Asia, colorectal polyp, IBD, and cancer, which are considered popular etiologies, were only found in a few studies [4,5]. Hematochezia or melena is the chief symptom among various clinical presentations of ALGIB [1]. Although ALGIB is usually self-limited, a significant proportion of patients (30%) progress to severe hemorrhage, especially elderly individuals and patients with comorbidities [6]. These cases need aggressive interventions, such as blood transfusion, hemostatic therapy, and surgery. The overall mortality rate of ALGIB in some published data is 2 - 10% [3,7,8].

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A thorough understanding of the clinical manifestations, etiologies, and progress of ALGIB is essential for the appropriate diagnosis and management of ALGIB. However, few studies have described the characteristics of Asian patients with ALGIB. Furthermore, no research on clinical presentations, etiologies, and outcomes in Vietnam is available. The guidelines for the diagnosis and treatment of ALGIB in Asia have not been published to date. Moreover, diagnostic modalities to determine the origin of gastrointestinal (GI) bleeding are still so complicated that the burden of healthcare cost and medical resource utilization have not been solved in developing countries. Therefore, the diagnosis and management of ALGIB in Asia, especially in Vietnam, are still challenges. The study aimed to 1) describe the clinical characteristics and interventions of ALGIB and 2) describe the outcomes of ALGIB (i.e., severe bleeding and in-hospital death) in Vietnamese people.

2. MATERIALS AND METHOD

A multicenter cohort study at seven tertiary hospitals in Vietnam (Gia Dinh People's Hospital, Cho Ray Hospital, Dong Nai General Hospital, Can Tho Central Hospital, Bach Mai Hospital, Hue Central Hospital, and Da Nang General Hospital) was prospectively and retrospectively conducted in consecutive patients from January 2016 to October 2021. Only two hospitals in Ho Chi Minh City are Gia Dinh People's hospital and Cho Ray hospital, where the administrative formalities of collecting previous data were likely more simple than in other hospitals. Therefore, all retrospective cases were recruited in Gia Dinh People's hospital and Cho Ray hospital from 2016 through 2018. Prospective cases were all collected at seven hospitals from 2018 through 2021.

The inclusion criteria were age ≥ 16 years, the performance of lower GI endoscopy, and symptoms suggesting ALGIB, such as bright blood per rectum, maroon-colored stool, stool with clots, or melena without hematemesis. In-hospital bleeding and/or upper GI bleeding lesions on esophagogastroduodenoscopy (EGD) were exclusion criteria. Demographic data, vital signs, history of ALGIB, stool color on digital rectal examination (DRE), laboratory results, blood transfusion, endoscopy and radiology reports, and operation protocol were recorded. Symptoms such as abdominal pain, syncope, diarrhea, and fever were found at admission. The use of nonsteroidal anti-inflammatory drugs (NSAIDs), aspirin, clopidogrel, dual antiplatelets, corticoid, and oral anticoagulants was identified. Important comorbidities, such as diabetes, cardiac disease, cancer, chronic liver disease, chronic obstructive pulmonary disease, stroke, and chronic kidney disease, were recorded. Both drug use and comorbidities were classified into single or multiple groups (i.e., two or more agents/diseases). Melena or hematochezia and concomitant hemodynamic instability were indications for EGD to exclude upper GI bleeding. Based on the suspicious location of the lesion, the availability of local medical resources at each hospital, severe comorbidities, and the progress of ALGIB, colonoscopy, sigmoidoscopy, and/or enteroscopy were performed. When the tumor was identified, an abdominal computed tomography (CT) scan and pathological examination were performed to plan for surgery. In cases of failure to investigate the bleeding origin by lower GI endoscopy, computed tomography angiography (CTA) was performed to detect contrast medium extravasation. Definite sources of bleeding were defined as lesions with stigmata of recent bleeding (i.e., active bleeding, visible vessel, or adherent clot), friable tumors, or colitis. Presumptive sources of bleeding were defined as suspected lesions without the above stigmata.

Endoscopic treatment, the first-line hemostatic intervention, was defined as the endoscopic procedures that intervened in the definite site of bleeding [1]. When failure or inability of therapeutic endoscopy occurred, angiographic embolization, and/or surgery were chosen according to the image on CTA and the consensus of multidisciplinary team meetings. All the above methods of management were classified as therapeutic interventions. The adverse outcomes consisted of severe bleeding and in-hospital death. Severe ALGIB was defined as persistent bleeding within the first 24 hours and/or recurrent bleeding after 24 hours of stability accompanied by a reduction in hematocrit of ≥ 20%, and/or requirement of ≥ 2 units of packed red blood cells [9]. In-hospital mortality was defined as dead cases due to uncontrollable bleeding or comorbidities during hospitalization.

Categorical data were reported as numerators and percentages. Quantitative variables are presented as the means ± standard deviation or medians (range). Qualitative variables were listed as absolute (n) or relative (%). Statistical analysis was carried out using the SPSS 19.0 software (SPSS Inc., Chicago, IL).

3. RESULTS

Characteristics of patients

A total of 811 patients, including 302 retrospective and 509 prospective cases, were included in the study. The baseline characteristics of all patients are summarized in table 1. ALGIB appeared to affect all ages (16-104 years old). Elderly individuals (≥ 60 years old) accounted for a significant proportion of ALGIB (57.5%). Multiple diseases were noted in 229 (28.2%) patients. Before admission, 163 (20.1%) patients were taking medications. Only a small fraction of patients (4.6%) used two or more agents. The proportions of blood transfusion in patients with prior drug usage and comorbid conditions were 44.8% and 47.6%, respectively.

Clinical presentations and biochemistry analysis of patients

Bright blood per rectum (61.4%) was the most common symptom [Table 1]. The sources of hematochezia were the colon and rectum (86.8%), small bowel (1.8%), and unknown origin (11.4%). Of 18 lesions originating from the small bowel, 14 lesions induced severe ALGIB. IBD, colitis, and tumors were more common in the abdominal pain group, whereas diverticulosis and polyps were more frequent in the nonabdominal pain group. Stable vital signs were noted in most patients, with a median heart rate of 86 beats/minute and median systolic blood pressure (SBP) of 120 mmHg. However, 26.9% of cases fulfilled clinical criteria of hemodynamic instability (syncope and/or SBP <100 mmHg and/or heart rate >100 beats per minute).

Most patients had normal coagulation function and normal kidney function. There were 53 (6.5%) cases with an international normalized ratio (INR) ≥ 1.5 and 4 (0.5%) cases with an INR ≥ 5. Of 53 patients presenting with INR ≥ 1.5, 14 (26.4%) patients required FFP and cryoprecipitate, 25 (47.1%) patients had chronic liver disease and 13 (24.5%) patients took anticoagulants.

Table 1. Baseline characteristics of recruiting patients

Characteristics	
Participating hospitals	
Gia-Dinh People's hospital, n (%)	226 (27.9)
Cho-Ray hospital, n (%)	356 (43.9)
Dong-Nai General hospital, n (%)	43 (5.3)
Can-Tho Central hospital, n (%)	55 (6.8)
Bach-Mai hospital, n (%)	51 (6.3)
Hue Central hospital, n (%)	40 (4.9)
Da-Nang General hospital, n (%)	40 (4.9)
Age (mean, SD)	61 (18.4)
Sex	
Male, n (%)	420 (51.8)
Previous admission with ALGIB, n (%)	196 (24.2)
Comorbidities	
Congestive heart failure, n (%)	26 (3.2)
Ischemic heart disease, n (%)	109 (13.4)
Chronic obstructive pulmonary disease, n (%)	11 (1.4)
Chronic liver disease, n (%)	86 (10.6)
Chronic kidney disease, n (%)	56 (6.9)
Stroke or transient ischemic attack, n (%)	44 (5.4)
Cancer, n (%)	69 (8.5)
Hypertension, n (%)	309 (38.1)
Diabetes, n (%)	113 (13.9)
Pre-admission medications	163 (20.1)
Aspirin, n (%)	25 (3.1)
Clopidogrel, n (%)	40 (4.9)
Dual antiplatelet, n (%)	25 (3.1)
Warfarin, n (%)	10 (1.2)
NOAC, n (%)	12 (1.5)
Corticosteroid, n (%)	16 (2)
NSAIDs, n (%)	42 (5.2)
Vital signs at admission	
Heart rate (beat per minute), median (range)	86 (50 - 140)
Heart rate ≥ 100/min, n (%)	157 (19.4)
Systolic blood pressure (mmHg), median (range)	120 (50 - 190)
Systolic blood pressure < 100 mmHg, n (%)	92 (11.3)
Presenting symptoms	
Melena, n (%)	124 (15.3)
Bright blood per rectum, n (%)	498 (61.4)
Maroon colored stool, n (%)	187 (23.1)

Stool with clots, n (%)	9 (1.1)
Abdominal pain, n (%)	224 (27.6)
Syncope, n (%)	4 (0.5)
Diarrhea, n (%)	119 (14.7)
Fever, n (%)	36 (4.4)
Blood on digital rectal examination, n (%)	332 (40.9)
Laboratory data at admission	
Hematocrit (%), median (range)	30.4 (5.0 - 62.9)
Hematocrit < 35%, n (%)	537 (66.2)
Haemoglobin (g/L), median (range)	98 (4 - 173)
Haemoglobin ≤ 100 g/L, n (%)	350 (51.54)
Platelet (x103/μL), median (range)	242 (10 - 948)
Platelet ≤ 150 × 103/μL, n (%)	131 (16.2)
INR, median (range)	1.07 (0.8 - 12.4)
INR ≥ 1.5, n (%)	53 (6.5)
Blood urea nitrogen (mg/dl), median (range)	14 (3 - 129)
Creatinine (mg/dl), median (range)	0.98 (0.2 - 13)
Creatinine ≥ 1.5 mg/dl, n (%)	73 (9)
BUN/creatinine, median (range)	14.8 (1.2 - 72)

Data are n (%) or median (interquartile range), SD: standard deviation, ALGIB: acute lower gastrointestinal bleeding, NOAC: novel oral anticoagulant, NSAIDs: non-steroidal anti-inflammatory drugs, INR: international normalized ratio, BUN: blood urea nitrogen .

Diagnostic modalities for determination of ALGIB origin

Various diagnostic modalities of ALGIB are presented in table 2. A total of 536 (66.1%) patients were recruited for colonoscopy. Of these cases, urgent and elective colonoscopy constituted 28% and 72%, respectively. Hemorrhoids (18.5%), diverticulosis (13.6%), and colorectal polyps (11.9%) were the dominant findings. Flexible sigmoidoscopy and proctoscopy were performed in 256 (31.6%) patients who had poor medical conditions or could not accomplish adequate bowel preparation. Preoperative enteroscopy was undertaken in 18 (2.2%) patients. Among them, small intestinal ulcers, diverticulosis, tumor, angiodysplasia, and Dieulafoy's lesion were found. Obvious lesions during lower GI endoscopy were noted in 84.6% of patients. The most frequent findings in the 203 patients who underwent abdominal CT scans were colorectal tumors, diverticula, and polyps. CTA showed positive results in 9 out of 15 (60%) patients with significant and persistent bleeding.

Etiologies of ALGIB

The overall causes of ALGIB were observed in 681 (84%) patients [Table 3]. Definitive sources were identified in 221 (27.3%) cases, whereas presumptive sources were found in 492 (60.7%) cases. The most frequent cause was hemorrhoids (28.6%), followed by diverticulosis (9.7%), IBD (9%), and colorectal polyps (8.8%). Approximately 16% of cases were established as unknown diagnoses even after complicated investigations, while up to 3.1% of cases had more than one potential bleeding source.

Therapeutic interventions and outcomes

Methods of intervention and outcomes are presented in table 2 and table 4, respectively. Four (1.2%) patients with severe ALGIB required transfusions of more than three blood components, and two out of four died during hospitalization. Although most patients (83%) met the criteria for indications of blood transfusion, a small proportion of patients (17%) were inappropriately managed. A total of 130 (16%) cases required more than four units of packed red cells.

Endoscopic hemostasis was successful in 70/155 (45.2%) patients with a definitive source on colonoscopy. Hemostatic clipping was the most frequent procedure (31.4%). Of 15 patients in whom CTA was performed, only four severe cases, including angioectasia, colon ulcer, post polypectomy, and duodenal pseudoaneurysm rupture, required angiographic embolization. Surgical treatment was performed in 59 (7.3%) patients. The surgical lesions encompassed resectable colorectal malignancy (18.6%), hemorrhoids (18.6%), small bowel ulcers, and tumors (10.2%). The effectiveness of hemostasis for the three methods of intervention was 94.6%.

There were 222 (27.4%) patients with severe ALGIB, consisting of 177 (21.9%) patients with ongoing bleeding and 45 (5.5%) patients with rebleeding. In-hospital deaths were recorded in 17 (2.1%) patients (7 due to uncontrollable ALGIB and 10 due to severe comorbidities).

Table 2. Interventions of lower gastrointestinal bleeding

Interventions	n (%)
Blood transfusion	323 (39.8)
Packed red cell, n (%)	318 (39.2)
Median units (range)	1.56 (0 - 26)
Fresh frozen plasma, n (%)	22 (2.7)
Cryoprecipitate, n (%)	4 (0.5)
Platelets, n (%)	10 (1.2)
Endoscopy	
Oesophagogastroduodenoscopy, n (%)	410 (50.6)
Colonoscopy, n (%)	536 (66.1)
Flexible sigmoidoscopy, n (%)	85 (10.5)
Proctoscopy, n (%)	171 (21.1)
Enteroscopy, n (%)	18 (2.2)
Endoscopic hemostasis, n (%)	70 (8.6)
Injection therapy, n (%)	3 (4.3)
Hemostatic clip, n (%)	22 (31.4)
Rubber band ligation, n (%)	8 (11.4)
Electro-coagulation, n (%)	16 (22.9)
Argon laser, n (%)	21 (30)
Radiology	
Computed tomography of the abdomen/pelvis, n (%)	203 (25)
Computed tomography angiography, n (%)	15 (1.8)
Radiologic intervention, n (%)	4 (0.5)
Surgery, n (%)	59 (7.3)
Data are n (%) or median (interquartile range).	

4. DISCUSSION

Characteristics of patients

ALGIB is predominantly distributed in the elderly in most studies [1,4,5,10]. Similarly, the mean age was 61 years ± 18.4, and half of the population (57.5%) was elder in our study. The incidence of ALGIB increased with age in our study population. This could be attributed to the high risk of diverticulosis and GI cancer, the overuse of drugs, and the rising incidence of comorbidities. The proportion of our patients using antiplatelets was significantly higher than those using another agent. Many patients on antiplatelet therapy may be related to coexistent cardiovascular diseases; meanwhile, NSAIDs were more frequently associated with upper GI bleeding than ALGIB. The use of harmful medications leads to a significant proportion of ALGIB cases [10]. NSAIDs, antiplatelets, and anticoagulants might directly damage the mucosa of the GI tract and/or induce bleeding from preexisting lesions through the antiplatelet effect [7,11]. It is noted that caution in choosing drugs for elderly individuals with multiple comorbidities, especially analgesic and antithrombotic agents, is very crucial for the prevention of ALGIB. Past history of ALGIB (24.2%) in our study's population was comparable with that reported in recent studies [7,8].

Clinical presentations and biochemistry analysis of patients

It has been hypothesized that the color of fecal blood can help physicians localize the anatomical position of bleeding [12], namely that the brighter the color of stool, the more distal the site of lesion on the GI tract and/or the more significant the blood loss. Our results were compatible with this hypothesis. Bright blood per rectum (61.4%) was the chief manifestation of most lesions originating from the left colon and rectum. Among the 18 patients with hematochezia due to small intestinal bleeding, there were 14 cases with severe ALGIB. However, the accurate description of stool color is not easily expressed by patients. Thus, DRE should be considered upon admission. According to Strate et al., a

nontender abdomen is associated with severe ALGIB due to diverticulosis and angioectasia, whereas abdominal pain may accompany mild ALGIB due to ischemic colitis and IBD [9]. This result is in harmony with our results. The rate of abdominal tenderness (27.6%) was nearly equal to the total rate of ulcer, inflammation, and tumor lesions. Therefore, abdominal pain and fecal blood color on DRE may help physicians predict the origin of bleeding lesions and the severity of ALGIB.

In our previous study, tachycardia, hypotension, hematocrit < 35%, INR ≥ 1.5, and platelet ≤ 50 G/l were independent risk factors for severe ALGIB and mortality [13]. Similarly, most severe cases in our study suffered from hemodynamic instability and coagulation disorders at admission. Hence, it is essential to pay careful attention to vital signs and comorbid conditions to predict the progression of GI bleeding. In the setting of ALGIB together with coagulation disorders, reconsideration of underlying diseases and the indication of administration of reversal agents may be tailored to individual circumstances based on the risk of significant bleeding and the risk of thromboembolic events.

Diagnostic modalities for determination of ALGIB origin

Depending on the severity of ALGIB, the patient's health, and suspected location of bleeding, the diagnostic procedure is established. Colonoscopy is recommended as the first-line diagnostic modality for evaluating ALGIB [1]. It reduces unnecessary surgery and spends costs less than other diagnostic procedures [1]. Despite its effectiveness, colonoscopy is still more complicated than flexible sigmoidoscopy. Sufficient bowel preparation is the main obstacle but the prerequisite for raising the diagnostic probability. Purgatives can dislodge blood clots and feces to enhance clear visualization of small or flat lesions on the mucosal surface. In practice, it may not be feasible to fully accomplish colonoscopy for all patients with poor clinical status or inadequate bowel preparation at admission. In addition, determining the proper timing of colonoscopy has remained another challenge for physicians. There is no advantage of urgent colonoscopy (within 12 - 24 hours) for diagnostic or therapeutic outcomes, length of hospital stay, and mortality [1]. In contrast, when the colonoscopic evaluation was performed too late after the episode of GI bleeding, it was difficult to approach the site of ongoing bleeding. In reality, colonoscopic performance may be delayed due to the necessity of adequate colon cleansing, the unavailability of human resources responsible for the procedure and sedation, and the possibility of 2-day weekends [8]. In these cases, flexible sigmoidoscopy may be another option. In our study, 66.1% of patients were recruited for colonoscopy, and only one-half of these cases (28%) underwent urgent colonoscopy. Flexible sigmoidoscopy and proctoscopy were performed in 31.6% of patients. Not all colonoscopy procedures implemented were analyzed due to the fact that our research was carried out in 7 hospitals with different levels of medical care and human resources. Consequently, lower GI endoscopy had the ability of 84.6% to localize the bleeding origin. Similar to our results, the study of Strate et al. also showed a diagnostic yield of 48 - 90% for colonoscopy [14,15]. Our study provides some insights on how to improve the diagnostic yield of lower GI endoscopy. Urgent colonoscopy after prompt bowel preparation should be considered only in patients with high-risk clinical features in conformity with the consultation of interdisciplinary specialists. Low-risk patients could be scheduled on the next day for elective colonoscopy after sufficient colon cleansing to minimize the risk of missing out lesions. In the case of a suspicious lesion in the rectum or anus, a flexible sigmoidoscopy followed by a complete colonoscopy could be performed to avoid erroneous interpretations.

CTA should be considered in patients unresponsive to medical resuscitation or incomplete colonoscopy [1]. Regarding its utility, CTA in the study showed positive results in 9 out of 15 (60%) patients with significant bleeding. Jacovides et al. revealed that the sensitivity of CTA in detecting the source of bleeding was 56.6%, which was quite similar to our result [16].

Etiologies of ALGIB

In our study, the definitive source (27.3%) and presumptive source (60.7%) were identified via all the complicated investigation methods. However, 16% of patients had an unclear origin. The result is in agreement with the range of 4 - 17% of unknown diagnoses found in most studies [5,7]. In fact, bleeding sites cannot always be determined. Firstly, the timing of colon performance is postponed due to objective and subjective factors, as mentioned above. Secondly, potential bleeding lesions are masqueraded because ALGIB is often self-limited. Finally, poor bowel preparation with abundant feces and blood clots leads to the invisibility of the bleeding origin. The most common cause was hemorrhoids (28%), followed by diverticulosis (9.7%), IBD (9%), and colorectal polyps (8.8%). These prevelant lesions responsible for ALGIB in Vietnam were somewhat different from those in Europe but consistent with those in Asia. Diverticulosis, ischemic colitis, and IBD are the major origins of ALGIB in Western countries [2,3]. In contrast, hemorrhoids, colorectal polyps, IBD, and cancer are the main sources in Asian countries [4,5]. This difference is attributed to food habitual intake, lifestyle, and dietary patterns. In the process of rapid industrialization and modernization, fast food intake and sedentary lifestyles have affected the increasing incidence of hemorrhoids, IBD, and colon cancer in Asia.

Therapeutic interventions and outcomes

Blood transfusion was administered in 39.8% of our patients. However, few indications of transfusion (17%) were considered inappropriate management according to the guidelines of the National Institute for Health and Care Excellence [17]. The study currently reflected the daily clinical practice in Vietnamese hospitals that were in accordance with the real-life strategy of management in some reports [3,7]. Endoscopic hemostasis (8.6%) was efficient in 45.2% of definitive sources on colonoscopy. Although CTA was only performed in 15 patients, interventional radiology for 4 patients (26.6%) achieved an efficacy of 100%. Surgery was performed in 7.3% of patients. These findings are in agreement with most published studies. Endoscopic and surgical therapy rates were 3 - 22% and 1.4%, respectively [7]. CTA was positive in 24% of patients [5].

The rate of severe ALGIB (27.4%) in our data was lower than that (49%) in the study by Strate et al. [9]. The result could be influenced by differences in the definition of severe ALGIB. We defined severe ALGIB as continued bleeding within 24 hours of hospitalization and recurrent bleeding after 24 hours of stability, whereas Strate et al. demonstrated severe ALGIB as two of the above kinds of ALGIB together with readmission for ALGIB within 1 week of discharge [9]. Nearly 21.9% and 5.5% of our patients experienced persistent bleeding and rebleeding, respectively. In the study by Oakland et al., continued bleeding and rebleeding constituted 11% and 13.6%, respectively [18].

The reason for the dissimilarity may be some missing data of cases with continued bleeding and inpatient bleeds eligible for the inclusion criteria of Oakland [18]. The overall mortality of ALGIB in some published literature ranges from 2 to 10% [3,7,18]. Most fatal conditions were attributed to unstable comorbid conditions rather than uncontrollable bleeding. Our in-hospital mortality rate (2.1%) was in line with the range. Of the 17 deaths, 7 were due to ongoing bleeding and 10 deaths due to severe comorbidities. The sharp increase in recurrence and mortality of ALGIB highlighted the urgent necessity of an appropriate strategy for the management of ALGIB and comorbidities, as well as the prevention of ALGIB in patients taking harmful drugs in Asia.

This is the first study on ALGIB in Vietnam. A strength of the study is that the research involved a large patient population from seven rural and municipal hospitals with different levels of healthcare and availability of medical equipment. The result therefore provides an overview of the clinical characteristics and outcomes of ALGIB in Vietnam.

However, the study has several limitations. First, some data in this study were retrospectively retrieved. Second, due to differences in the causes of ALGIB, local resources, and professional expertise among participating hospitals, the diagnostic and therapeutic protocols were not consistently standardized. The number of patients that underwent urgent colon endoscopy and computed tomography angiography in municipal hospitals were higher than in rural hospitals. In addition, rubber band ligation and interventional radiology were only performed in urban hospitals. Third, the actual origins of bleeding could not be examined in all recruited patients. Some lesions beyond the duodenum might have been easily missed because enteroscopy was indicated in only a small proportion of patients, and the bleeding was self-limited. Fourth, the long-term recurrence and outpatient mortality of ALGIB could not be recorded in this study.

Table 3. Sources of lower gastrointestinal bleeding

Sources of bleeding	n (%)
Hemorrhoids	232 (28.6)
Diverticulosis	79 (9.7)
Inflammatory bowel disease	73 (9.0)
Colorectal polyp	71 (8.8)
Colorectal malignancy	57 (7.0)
Benign anorectal disorder (except hemorrhoids)	37 (4.6)
Colon ulcer	37 (4.6)
Colitis	30 (3.7)
Angioectasia	28 (3.5)
Post polypectomy/ post haemorrhoidectomy	17 (2.1)
Small intestinal ulcer	15 (1.8)
Small bowel tumor	3 (0.4)
Duodenal pseudoaneurysm rupture	1 (0.1)
Dieulafoy's lesion	1 (0.1)
Unknown origin	130 (16)

Conclusion

This study demonstrated the current clinical management and outcomes of ALGIB in tertiary hospitals in Vietnam. Hemorrhoids are the most common cause of ALGIB in Vietnam. The rates of blood transfusion, endoscopic hemostasis, interventional radiology, and surgery were 39.8%, 8.6%, 0.5%, and 7.3%, respectively. Although the majority of ALGIB are self-limited, approximately one-quarter of cases progressed to severe bleeding. The majority of in-hospital deaths were due to severe comorbidities.

ETHICAL STATEMENT

This study was approved by the Board of Ethics in Biomedical Research of the University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam (numbered 146/DHYD-HDDD, signed on April 21st, 2018) and was performed according to the ethical guidelines of the 1975 Declaration of Helsinki. Informed consent was obtained from all patients who were prospectively recruited or their legal guardians.

Table 4. Adverse outcomes of lower gastrointestinal bleeding

Adverse outcomes	***n (%)***
Severe ALGIB	222 (27.4)
Ongoing gastrointestinal bleeding	177 (21.9)
Recurrent gastrointestinal bleeding	45 (5.5)
In-hospital death	17 (2.1)
Death due to uncontrollable ALGIB	7 (0.87)
Death due to severe comorbidities	10 (1.23)

ALGIB: acute gastrointestinal bleeding.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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AUTHORS' CONTRIBUTION

QD designed and supervised the study. VU, TN, LL, and VC performed the research and collected data. QD and VU analyzed the data, and wrote and revised the manuscript. All authors approved the manuscript. VU submitted the manuscript.

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