The diagnostic yield of urgent colonoscopy in acute lower gastrointestinal bleeding

M. Mosli[1], A. Aldabbagh[2], H. Aseeri[1], S. Alqusair[1], H. Jawa[1], M. Alsahafi[1], Y. Qari[1]

(1) Department of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia ; (2) Department of Medicine, Dr. Soliman Fakeeh Hospital, Jeddah, Saudi Arabia.

Abstract

Background and aims **: Lower Gastrointestinal Bleeding (LGIB) is one of the leading causes of ER visits. Colonoscopy is indicated in all patients with LGIB, yet the time frame for performing colonoscopy remains unclear. Whether or not urgent endoscopic evaluation improves outcomes of LGIB has been questioned. We therefore aimed to examine the success of urgent colonoscopy in identifying the source of LGIB.**

Patients and methods **: A retrospective study was conducted in which timing of colonoscopy was divided into urgent (performed within the first 24 hours of presentation) and delayed (performed following 24 hours of hospitalization). Data on clinical presentation, investigations and endoscopic findings was collected. Risk ratios were calculated and regression analysis was used to examine associations and identify predictors of endoscopic success.**

Result **: A total of 183 patients underwent colonoscopies. 55.4% of colonoscopies were performed within 24 hours of presentation. A source of LGIB was identified in 55.7% of first attempt colonoscopies. Endoscopic intervention was required in 10.9% of cases and rebleeding occurred in 24.6%, of which 6.5% required hospital re-admission. 2.7% required emergency colectomy and the calculated mortality rate was 1%. Risk ratios comparing urgent to delayed colonoscopy for source of LGIB identification, colectomy and mortality were 1.01, 4.8 and 1.2, respectively. Age and timing of colonoscopy appeared to be predictive of colectomy on regression analysis.**

Conclusions **: Urgent colonoscopy for LGIB did not improve the rate of identification of the source of bleeding, colectomy rate or mortality rate and was predictive of the need for emergency colectomy.** (Acta gastroenterol. belg., **2020**, 83, **265-270**).

Key Words : urgent, colonoscopy, acute, lower gastrointestinal bleeding, LGIB.

Introduction

Acute lower gastrointestinal bleeding (LGIB) is defined as bleeding distal to the ligament of Treitz and may be due to a variety of etiologies (1). LGIB accounts for approximately 20% of all cases of gastrointestinal bleeding (2). In the United States, there are more than 342,000 emergency department visits annually because of acute LGIB (3). The incidence of LGIB has been rising with increasing age with a rise of 17% reported within the last 10 years (4). LGIB is predominantly a disease of the elderly, with a greater than 200-fold increase in incidence seen between the second and eighth decades of life (5). The mean age of patients presenting with LGIB ranges from 63 to 77 years (6). Although the majority of patients have a self-limited illness and an uncomplicated course of hospitalization, the reported mortality rate ranges from 2% to 4% (5,6). Acute LGIB is distinct clinically from upper gastrointestinal hemorrhage in epidemiology, prognosis, management, and outcome. LGIB encompasses a wide clinical spectrum ranging from trivial hematochezia to massive hemorrhage with shock, which often leads to emergency hospitalization (3). Diverticular bleeding comprises around 30% to 50% of all LGIB cases ; other causes include angiodysplasia, colon ischemia, hemorrhoids, polyps and post-polypectomy bleeding, rectal or colonic ulcers, and colorectal cancer (7).

An individual with acute LGIB typically presents with a sudden onset of hematochezia (maroon or fresh red blood per rectum). However, a patient with bleeding from the cecum or right colon can also present with melena (black, tarry stools). In addition, hematochezia can be seen in patients with brisk upper gastrointestinal bleeding as approximately 15% of patients with presumed LGIB are ultimately found to have an upper GI source of bleeding (2). Recognition of the severity of the patient's presentation along with proper selection of the initial intervention method has important implications for both the quality of care for treating LGIB and the associated costs inflicted on healthcare systems.

Data on urgent diagnostic colonoscopy for LGIB is sparse and the results are contradicting. A single previous randomized trial included data of inpatient colonoscopies performed on 144 patients, 14 were performed within <12 hours, 55 within 12 to 24 hours, 46 within 24 to 48 hours, and 29 after >48 hours. After controlling for confounders, earlier colonoscopy was significantly associated with a shorter length of hospital stay (hazards ratio [HR] = 2.02 ; 95% confidence interval [CI] = 1.5-2.6 ; p<0.0001). The absence of visible blood or active bleeding at the time of colonoscopy was also independently associated with a shorter length of hospital stay (HR = 1.5 ; 95% CI = 1.1 to 2.0 ; p=0.01) (8). Conversely, results from a systematic review and meta-analysis that was published by Seth et al. (7) did not support the role of urgent colonoscopy in the routine management of acute LGIB as has been conventionally assumed. This meta-analysis included six studies (2 RCTs and 4 observational studies) with 23419 patients (9498 urgent colonoscopy, 13921 elective colonoscopy) and

Correspondence to : Mahmoud Mosli, MBBS FRCPC MSc, Assistant Professor, Department of Medicine, King Abdulaziz University, Hospital, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.
E-mail : mmosli@kau.edu.sa

Submission date : 05/08/2019
Acceptance date : 29/12/2019

demonstrated that urgent colonoscopy does not reduce rates of mortality, re-bleeding, identification of bleeding source or requirement for surgery among patients with acute LGIB. Although stigmata of recent hemorrhage are more likely to be identified with urgent as opposed to elective colonoscopy, this did not appear to translate into any demonstrable reduction in rates of mortality or re-bleeding (7).

We therefore aimed to examine the diagnostic yield of urgent colonoscopy in cases of LGIB and identify predictors of successful identification of a source of LGIB.

Patients and methods

We conducted a retrospective study involving all adult patients (>18 years old) that underwent inpatient colonoscopy for acute LGIB at our hospital between January 2011 and December 2017. LGIB was defined as hematochezia i.e. maroon or fresh red blood per rectum, with or without melena. The data collected included patient demographics, presenting symptoms, stage of shock at presentation, timing of colonoscopy, endoscopic findings, bowel preparation, and outcomes. Patients were categorized based on the timing of colonoscopy into urgent (within 24 hours of presentation) and delayed (after 24 hours of presentation). Follow up for 30 days was recorded.

Outcomes

The main primary outcome was the risk ratio (RR) of success in identifying a source of bleeding comparing urgent vs. delayed colonoscopy. Secondary outcomes included RRs for the need of emergency colectomy and 30-day mortality.

Sample size calculation and statistical analysis

For sample size calculation, we hypothesized that a source of LGIB can be identified in 30% of delayed colonoscopies (2,3,5). Assuming a type 1 error of 0.05 and 80% power to detect a LGIB on colonoscopy, we estimated that a total of 180 patients (90 in each group) would be needed to detect a RR of at least 2 (two-sided).

For all baseline variables, descriptive statistics were computed. Means and standard deviations (SD) were reported for continuous variables while frequencies were used to summarize categorical variables. Student t test was used to compare means and Chi Square testing to compare frequencies.

Associations between independent variables and the primary outcome (success in identifying a source of bleeding) were evaluated using simple and multiple logistic regression analysis, where appropriate. Outcomes were adjusted for age, bowel preparation, and stage of shock. Similarly, predictors of secondary outcomes were studied. Odds ratios (OR) and RRs were reported and 95% confidence intervals (CIs) were used to determine precision of point estimates. STATA 11.2 (StataCorp, Texas, USA) was used for our analysis. A p-value of <0.05 was considered statistically significant.

Ethical considerations

Prior to conducting the study, ethical approval was granted from research ethics committee (REC) at our Hospital (Reference number 560-17 dated 5/ December /2017). Informed consent was obtained from all patients during the time of the procedure.

Results

Baseline characteristics

A total of 183 patients were identified. Baseline characteristics are summarized in Table 1. Mean age was 51.7 years (±17.9) and 85% of patients presented with fresh bleeding per rectum. 79% underwent colonoscopy after receiving bowel preparation. 55.4% of procedures were performed within 24 hours of presentation and 16% were aborted due to inability to visualize. A source of LGIB was identified during 55.7% of first attempt colonoscopies. The commonest source of LGIB was internal hemorrhoids in (23.5%) followed by a bleeding polyp (18.6%), then a bleeding mass (18.6%) and diverticular bleeding (14.7%) ; other sources of bleeding are listed in table 1.A second look colonoscopy was performed for 15/27 (55.6%) cases where a source was not identified leading to identification of a source in 13/27 (48%). Endoscopic intervention was necessary for 20/183 (10.9%) of cases and rebleeding occurred in 45/183 (24.6%) of which 8/123 (6.5%) required hospital re-admission ($p<0.001$). Two out of 183 (1%) presented with severe shock, 123/183 (67%) was discharged immediately following colonoscopy, 5/183 (2.7%) required emergency colectomy, and 2/183 (1%) died during admission.

Urgent vs. delayed colonoscopy

The RRs comparing urgent to delayed colonoscopy for source of LGIB identification, colectomy and mortality were 1.01 (95% CI = 0.73-1.40, p = 0.94), 4.8 (95% CI = 0.55-42.3, p = 0.11) and 1.2 (95% CI = 0.08-18.9, p = 0.89), respectively (Table 2).

Predictors of Outcomes

Age (OR = 1.1, 95% = 1-1.2, p = 0.05), timing of colonoscopy (OR = 0.24, 95% CI = 0.1-0.9, p = 0.03) appeared to be predictive of colectomy on multiple logistic regression analysis ; otherwise no significant predictors of outcomes were identified ; as shown in (Table 3).

Table 1. — **Baseline characteristics of the study population**

Characteristic	N	%
Age group		
18-30	22	12.02
31-40	25	13.66
41-50	47	25.68
>50	89	48.63
Clinical presentation		
Melena	28	15.30
Rectal bleeding	155	84.70
Bowel preparation		
Unprepared	38	20.88
Fully prepared	144	79.12
Timing of colonoscopy		
12 hours	1	0.55
18 hours	28	15.30
24 hours	54	29.51
>24 hours	100	54.64
Aborted procedure		
Yes	30	16.39
No	153	83.61
Detection of the bleeding source		
Yes	102	55.74
No	81	44.26
Source of bleeding in 1st Colonoscopy		
Diverticulosis	15	14.71
Ulcer	12	11.76
Mass	19	18.63
AVM*	4	3.92
Bleeding Polyp	19	18.63
Rectal Varices	2	1.96
Colitis	5	4.90
Hemorrhoids	24	23.53
Visible vessel	2	1.96
Repeat procedure required		
Yes	27	14.75
No	156	85.25
Bowel preparation in 2nd procedure		
Unprepared	8	32.00
Fully prepared	17	68.00
Detection of bleeding source in 2nd Colonoscopy		
Yes	13	52.00
No	12	48.00
Source of bleeding in 2nd Colonoscopy		
Diverticulosis	2	15.38
Ulcer	2	15.38
Mass	1	7.69
AVM	3	23.08
Bleeding Polyp	5	38.46
Endoscopic intervention		
Yes	20	10.93
No	163	89.07
Type of intervention		
Clip	4	20.00
APC	2	10.00
Banding	1	5.00
Polypectomy	13	65.00
Re-bleeding		
Yes	45	24.59
No	138	75.41
Need for blood transfusion		
Yes	52	28.42
No	131	71.58
Stage of shock at presentation		
1	134	73.22
2	28	15.30
3	19	10.38
4	2	1.09
Outcome		
Discharge	123	67.21
Ward Admission	37	20.22
ICU Admission	16	8.74
Colectomy	5	2.73
Death	2	1.09
Colectomy		
No	178	97.27
Yes	5	2.73
Total	183	100.00%

*AVM : Arterio-venous malformation ; APC : Aragon plasma coagulation ; ICU : intensive care unit.

Table 2. — **Primary and secondary outcomes comparing early to delayed colonoscopy for lower gastrointestinal bleeding**

Outcome	Risk ratio (95% confidence interval)	P value
Source identification	1.01 (95% CI = 0.73-1.40)	0.94
Colectomy	4.8 (95% CI = 0.55-42.3)	0.11
30 day mortality	1.2 (95% CI = 0.08-18.9)	0.89

Discussion

The management of acute LGIB includes hemodynamic resuscitation, followed by attempts to localize and treat the bleeding source with endoscopic or angiographic interventions, and surgery in refractory cases. Evaluation of hemodynamic status and resuscitation are the cornerstones in the initial treatment of LGIB (9). They

Table 3. — **Predictors of primary and secondary study outcomes**

	Source identification OR (95% CI)		Colectomy OR (95% CI)		30 day mortality OR (95% CI)	
	Simple	Multiple	Simple	Multiple	Simple	Multiple
Age	0.9 (0.9-1.0)	0.9 (0.9-1.0)	**1.1 (1.0-1.1)**	**1.1 (1-1.2)**	1.0 (0.9-1.1)	1.0 (0.9-1.1)
Bowel Preparation	0.8 (0.6-1.0)	0.8 (0.6-1.0)	0.7 (0.4-1.3)	0.6 (0.3-1.3)	--------	--------
Timing of colonoscopy	1.1 (0.7-1.6)	1.1 (0.7-1.6)	**0.3 (0.1-0.9)**	**0.2 (0.1-0.9)**	0.6 (0.1-2.9)	0.6 (0.1-2.8)
Stage of shock	1.2 (0.8-1.8)	1.1 (0.7-1.7)	1.4 (0.5-4)	0.9 (0.2-3.2)	2.2 (0.6-9.1)	2.1 (0.4-10.1)

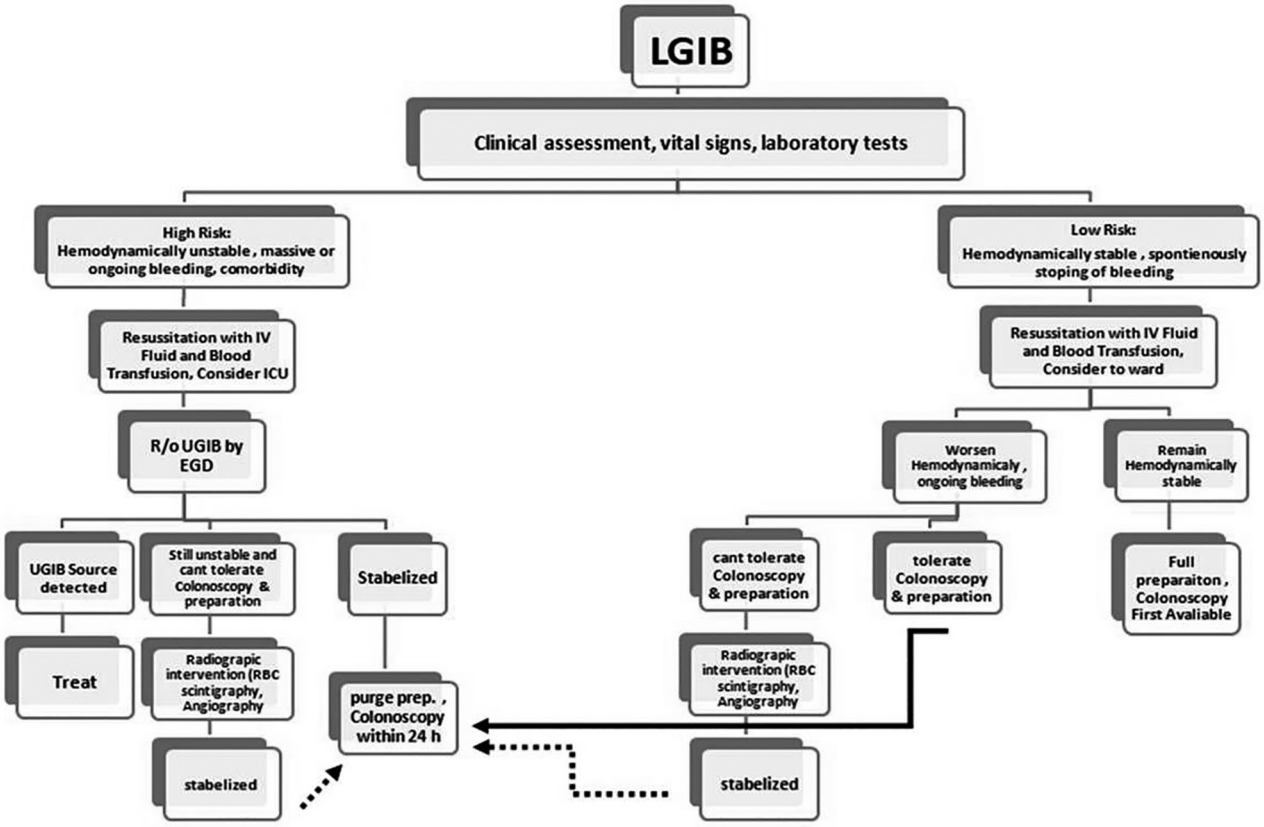

Figure 1.

should take place concomitantly with history taking and examination. Postural changes, chest pain, palpitations, syncope, pallor, dyspnea and tachycardia suggest hemodynamic compromise. Diagnostic approaches include endoscopy, radionuclide red blood cell scan, CT angiography and mesenteric angiography. Colonoscopy, with its high diagnostic yield, is considered the initial procedure of choice for most cases. However, it remains controversial whether early colonoscopy – performed within 12–24 hours of admission – provides any clinical benefits (10). A suggested algorithmic approach for the management of the patients with LGIB is presented in Figure 1.

According to recent guidelines for the management of LGIB by the American College of Gastroenterology (ACG)(2) and the American Society for Gastrointestinal Endoscopy (ASGE)(1), urgent upper endoscopy is mandated in patients presenting with severe hematochezia and hemodynamic instability, because approximately 11% to 15% of such patients could be harboring bleeding from the upper gastrointestinal tract (1,2). However, extrapolation of the results of urgent EGD in upper GI bleeding may not be valid for the management of LGIB (7). Thus, the role of urgent colonoscopy in LGIB remains controversial ; the same guidelines (1,2) recommend early colonoscopy (within the initial 24 hours) in high-risk patients, based on a low quality of evidence. Most data were derived from retrospective studies with a limited number of randomized control trials (RCTs)(1,2).

The limitations of the number of high-quality evidence regarding urgent colonoscopy in management of LGIB are driven by multiple factors. First ; although RCTs are regarded as the most scientifically rigorous method available and the gold standard for evaluating the effectiveness of interventions, they are sometimes unfeasible or unethical to perform. In fact, enrollment was terminated in two RCTs before the pre specified sample size had been reached because of difficulties inpatient recruitment. In addition, another study required 6 years to complete (11). Conducting RCTs in the setting of acute LGIB may therefore be challenging (12). Second ; although observational studies with large patient samples could replace RCTs, they are potentially affected by several biases including variations in physician preferences for conducting urgent or elective colonoscopy for elderly patients, patients with severe bleeding, co- morbidities, hemodynamic instability, or other gastrointestinal (GI) symptoms, or patients admitted on the weekend for example (13). Third ; most patients with LGIB will stop bleeding spontaneously – specifically LGIB from diverticular disease remains the single most common cause – and therefore would not benefit from urgent therapeutic Interventions, which is not the case in upper GI bleeding (7,13).

One of the largest systemic review and meta-analysis that was published recently by Roshanafshar et al. and reviewed 21studies (n=25,935), demonstrated that early colonoscopy in acute LGIB does not decrease the rates

of rebleeding, mortality or need for surgery, and rather was associated with an increased success of detecting definitive sources of bleeding (OR = 4.12, 95% CI = 2-8.49), and led to a shorter length of hospital stay (95% CI = -2.54 to -0.50 days), and a low incidence of complications. The quality of evidence was determined to be low, highlighting the need for additional high-level of quality studies (14). Another Systematic review and meta-analysis (8) included twelve studies, with a total sample size of 10,172 patients in the urgent colonoscopy arm and 14,224 patients in the elective colonoscopy arm ; the primary outcomes of this study were localization of a bleeding site and use of therapeutic interventions to treat bleeding. The authors concluded that urgent colonoscopy is a safe approach but does not appear to alter important clinical outcomes. In the same study, urgent colonoscopy was associated with an increased use of endoscopic therapeutic intervention (RR = 1.70 ; 95% CI = 1.08-2.67). There were no significant differences in bleeding source localization (RR = 1.08 ; 95% CI = 0.92-1.25), adverse event rates (RR = 1.05 ; 95% CI = 0.65-1.71), rebleeding rates (RR = 1.14 ; 95% CI = 0.74-1.78), transfusion requirement (RR = 1.02 ; 95% CI = 0.73-1.41), or mortality (RR= 1.17 ; 95% CI = 0.45-3.02)(8). Our results highly support these findings.

In regard to the effectiveness of urgent colonoscopy, specifically in critically ill patients, a retrospective chart review (15) showed rather conflicting results, as early colonoscopy significantly decreased the rate of identifying a source of bleeding (58% vs. 82%, p = 0.008) and hemostasis (19% vs. 49%, p=0.011) compared with late colonoscopy ; mainly due to a higher rate of poor bowel preparation and blood interference (38.9% vs. 6.1%, p = 0.035), as a result the study concluded that the effectiveness of early bedside colonoscopy in ICU patients was limited compared with late onset colonoscopy. This supports that early colonoscopy should only be performed after adequate bowel preparation (15).

Another single center retrospective study (16) of fifty-seven patients also concluded that the use of urgent colonoscopy, as an initial approach to investigate acute LGIB, did not result in significant differences in the length of ICU stay, re-bleeding rates, the need for additional diagnostic or therapeutic interventions, or 30-day mortality compared with elective colonoscopy (16). However, another retrospective study that analyzed data from 538 patients reported an opposing result by showing that early colonoscopy allows for better identification of the bleeding source, and reduces hospital stay (12). Moreover, compared with elective colonoscopy, early colonoscopy does not appear to reduce mortality and may actually increase the risk for rebleeding (12). Again, results from our current study supports data from the latter report.

Whether patient's co-morbidity would affect colonoscopy findings or its outcomes was clearly addressed by a retrospective cohort study by Cremone et al.(17).This study demonstrated that the greatest advantage of urgent colonoscopy is observed in patients with red blood hemorrhage, diarrhea, and colonic distension when symptoms were not associated with multi-organ failure, heart transplantation, or septic shock (17). On the other hand ; ischemic colitis was associated with a bad prognosis, as such patients experienced a higher rate of early mortality regardless of whether they had undergone urgent colonic surgery or not (17,18). In fact, colonic ischemia appeared in this study to be one of the main independent risk factors of mortality following heart transplant, multi-organ failure, and severe sepsis (17-20). This emphasizes that physicians should take into consideration the feasibility risk–benefit analysis of the procedure, especially in patients with established co-morbidities (20-22).

Our retrospective study evaluated the utility of urgent colonoscopy in the management of acute LGIB, results showed no statically significant difference between urgent and elective colonoscopy in cases of LGIB in terms of detection of the source of bleeding, rebreeding rate or mortality rate. However ; age (OR = 1.1, 95% = 1-1.2, p = 0.05) and early colonoscopy (OR = 0.24, 95% CI = 0.1-0.9, p = 0.03) appeared to be predictive of colectomy in our statistical analysis ; this finding was not reported by previous studies or meta-analysis. The association between urgent colonoscopy and occurrence of colectomy could be a reflection of severity such that patients with severe refractory bleeding often require early colonoscopy and ultimately surgery. Age on the other hand has been previously included in different scoring systems that have been used for risk stratification of patients presenting with LGIB and is considered well established predictor of colectomy after consistently correlating with bleeding severity and need for colectomy (2).

Regarding the patients in this cohort who underwent colectomy, all patients (N=5) were above the age of 51 years and presented to the hospital with fresh bleeding per rectum. Three of them were in stage 1 of shock at the time of presentation ; one patient was in stage 2 and one presented in stage 3. Three of these patients underwent full colonoscopy preparation and the other two were not prepared. The timing of colonoscopy was within 18 hours for 3, within 24 hours for one and after 24 hours for one patient. The bleeding source was identified in all patients in the first colonoscopy and none of them needed to undergo repeat colonoscopy to identify the source of bleeding. Three patients were found to have an actively bleeding mass, one patient had a bleeding polyp ; one patient had a bleeding ulcer and one patient had bleeding diverticulosis. Endoscopic intervention failed to control the bleeding in all patients and two of them required blood transfusion.

Our study is however limited by its retrospective design and susceptibility to information and selection bias. These results raise the need for larger prospectively conducted studies to address this clinically relevant issue.

Conclusions

In this cohort of patients that underwent colonoscopy to investigate LGIB, the majority of procedures were performed within 24 hours of presentation. Urgent colonoscopy for LGIB led to expedited discharge and timing of colonoscopy appears to be predictive of the need for emergency colectomy.

Conflict of Interests

The Authors disclosed no conflict of interests.

References

1. PASHA SF, SHERGILL A, ACOSTA RD, *et al.* The role of endoscopy in the patient with lower GI bleeding. *Gastrointest Endosc.,* 2014, **79** : 875-85.
2. STRATE LL, GRALNEK IM. ACG Clinical Guideline : management of patients with acute lower gastrointestinal bleeding. *Am J Gastroenterol.,* 2016, **111** (4) : 459-74.
3. GREEN BT, ROCKEY DC. Lower gastrointestinal bleeding -management. *Gastroenterol Clin North Am*., 2005, **34** (4) : 665-78.
4. PEERY AF, CROCKETT SD, MURPHY CC, *et al*. Burden and Cost of Gastrointestinal, Liver, and Pancreatic Diseases in the United States : Update 2018. *Gastroenterology.* 2019, **156** (1) : 254-272. e11.
5. DAVILA RE, RAJAN E, ADLER DG, *et al.* ASGE Guideline : the role of endoscopy in the patient with lower-GI bleeding. *Gastrointest Endosc.,* 2005, **62** (5) : 656-60.
6. FARRELL JJ, FRIEDMAN LS. Gastrointestinal bleeding in the elderly. *Gastroenterol Clin North Am.,* 2001, **30** : 377-407.
7. SETH A, KHAN MA, NOLLAN R, *et al.* Does Urgent Colonoscopy Improve Outcomes in the Management of Lower Gastrointestinal Bleeding?. *Am J Med Sci.,* 2017, **353** (3) : 298-306.
8. STRATE LL, SYNGAL S. Timing of colonoscopy : impact on length of hospital stay in patients with acute lower intestinal bleeding. *Am J Gastroenterol.,* 2003, **98** (2) : 317-22.
9. THOMAS J.S., DENNIS M.J. Gastrointestinal bleeding. *In* : FELDMAN M, FRIEDMAN LS, SLEISENGER MH, editors. Sleisenger and Fortran's gastrointestinal and liver disease. Volume 1. 10th ed. Philadelphia : Saunders, an imprint of Elsevier Inc. 2016, 445-436.
10. ROSHAN A.I, SADR MS, STRATE LL, MARTEL M, MENARD C, BARKUN AN. The role of early colonoscopy in patients presenting with acute lower gastrointestinal bleeding : a systematic review and meta-analysis. *Therap Adv Gastroentero*l., 2018, **11** : 1756283X18757184.
11. LAINE L, SHAH A. Randomized trial of urgent vs. elective colonoscopy in patients hospitalized with lower GI bleeding. Am *J Gastroenterol.,* 2010, **105** (12) : 2636-41.
12. NAGATA N, NIIKURA R, SAKURAI T, *et al.* Safety and Effectiveness of Early Colonoscopy in Management of Acute Lower Gastrointestinal Bleeding on the Basis of Propensity Score Matching Analysis. *Clin Gastroenterol Hepatol.,* 2016, **14** (4) : 558-64.
13. STRATE LL. Editorial. Urgent colonoscopy in lower GI bleeding : not so fast. *Am J Gastroenterol.,* 2010, **105** (12) : 2643-5.
14. ROSHAN A.I, SADR MS, STRATE LL, MARTEL M, MENARD C, BARKUN AN. The role of early colonoscopy in patients presenting with acute lower gastrointestinal bleeding : a systematic review and meta-analysis. *Therap Adv Gastroentero*l., 2018, **11** : 1756283X18757184.
15. KIM JH, CHUN J, LEE C, IM JP, KIM JS. Early versus late bedside endoscopy for gastrointestinal bleeding in critically ill patients. *Korean J Intern Med.,* 2018, **33** (2) : 304-312.
16. ALBELDAWI M, HA D, MEHTA P, et al. Utility of urgent colonoscopy in acute lower gastro-intestinal bleeding : a single-center experience. *Gastroenterol Rep (Oxf),* 2014, **2** (4) : 300-5.
17. CREMONE C, ESCH A, GAGNIERE C, *et al.* Patients' comorbidities reduce the clinical value of emergency colonoscopy : results of a retrospective cohort study. *Endosc Int Open.,* 2017, **5** (11) : E1119-E1127.
18. CHAVALITDHAMRONG D, JENSEN DM, KOVACS TO *et al.* Ischemic colitis as a cause of severe hematochezia : risk factors and outcomes compared with other colon diagnoses. *Gastrointest Endosc.,* 2011, **74** : 852-857.
19. NAGATA N, NIIKURA R, AOKI T, *et al.* Risk factors for adverse in-hospital outcomes in acute colonic diverticular hemorrhage. *World J Gastroenterol*., 2015, **21** (37) : 10697-703.
20. SUGIHARA Y, KUDO SE, MIYACHI H, *et al.* Analysis of Risk Factors for Colonic Diverticular Bleeding : A Matched Case-Control Study. *Gut Liver.,* 2016, **10** (2) : 244-9.
21. NAVANEETHAN U, NJEI B, VENKATESH PG, SANAKA MR. Timing of colonoscopy and outcomes in patients with lower GI bleeding : a nationwide population-based study. *Gastrointest Endosc.,* 2014, **79** (2) : 297-306.e12.
22. LIM DS, KIM HG, JEON SR, *et al.* Comparison of clinical effectiveness of the emergent colonoscopy in patients with hematochezia according to the type of bowel preparation. J *Gastroenterol Hepatol* 2013, **28** : 1733-1737.