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Using the Charlson comorbidity index as a prognostic factor of lower gastrointestinal system bleeding: the experience of a tertiary center

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ABSTRACT

Introduction: Lesions in the gastroinestinal (GI) tract that are distal to the Treitz ligament are what cause the lower gastrointestinal bleeding (LGB) system. The purpose of this study was to investigate and compare the Charlson Comorbidity Index (CCI), mortality rates, length of hospital stays, need for intensive care, need for blood products, and surgical rates in patients with acute LGB.

Material and Method: Retrospective research was done on patients who had lower GI bleeding and had been seen in our gastroenterology clinic between 2015 and 2021. We looked into the impact of CCI on patients' follow-up after LGB.

Results: The mean age of the 210 patients who had lower GI bleeding was 67.70±13.67 years. For all of the patients, the median CCI value was 4.00. (2.00-5.00). While 16 study participants (group 1) passed away, 194 participants (group 2) were released from the hospital. The variance in the median CCI values between the two groups was statistically significant (p>0.001). The results of a multivariate logistic regression analysis revealed that CCI was a reliable predictor of mortality (p>0.001).

Conclusion: It was found that CCI was an accurate predictor of mortality. CCI ought to be regarded as a crucial factor in the treatment of patients who are bleeding from their lower gastrointestinal tract.

Keywords: Charlson comorbidity index, colonoscopy, lower gastrointestinal bleeding

INTRODUCTION

Although the definition of lower gastrointestinal bleeding (LGB) includes bleeding distal to the ligament of Treitz, it is generally used for bleeding from the anorectal region or colon. Most of patients presenting with LGI bleeding are over 70 years of age (1). Hospitalization rates are lower than those for upper GI bleeding. Patients may present with 'occult bleeding' characterized by the presence of occult blood in the stool, or with cherry-bruised or bright red stools (hematochezia) or black stools (melena). On the other hand, it should not be forgotten that hematochezia may develop in massive upper GI bleedings (2).

Diverticulosis, angiodysplasia, ischemic colitis, infectious or inflammatory bowel disease, or cancer are all possible causes of acute LGI bleeding. Additionally, it might appear following a procedure like polypectomy. Diverticulosis and angiodysplasia hemorrhages are typically massive and painless, whereas bleeding from an inflammatory source is typically accompanied by diarrhea and abdominal pain. Diverticulosis is found in the etiology of 15% to 55% of patients (3,4). Angiodysplasia has been reported as the other most cause of LGI bleeding in patients over 65 years of age (5,6). The hemorrhoids are the most cause of rectal bleeding and usually causes minor bleeding (7). Patients with acute LGI bleeding may have their prognosis affected by clinical findings, age, anticoagulant/antiaggregant use, and the presence of comorbid conditions. Therefore, it must be recognized which patients have a high risk of complications or which patients are suitable for discharge. Charlson Comorbidity Index (CCI) is one of the prediction models to determine high and low-risk patient groups (7).

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CCI was first used to predict prognosis due to comorbid disease in 1887. The following studies also showed that CCI is an important and effective prognostic marker for mortality. CCI is a method that consists of 19 parameters and is applied by categorizing the comorbidities of the patients and scoring them between 1-6 points, providing predictivity in terms of mortality. The higher the CCI score, the higher the mortality observed (8-11).

In this study, we aimed to investigate and compare patients presenting with acute LGI bleeding in terms of the Charlson Comorbidity Index and mortality rates, hospitalization rates and durations, need for intensive care, need for blood products, and rate of going to surgery. Accordingly, it was evaluated whether a prognostic prediction could be made according to the CCI scores at the time of admission to the hospital.

MATERIAL AND METHOD

The study was carried out with the permission of the Ankara City Hospital Scientific Research Evaluation and Ethics Committee (Date:16.09.2019, Decision No: E1-22-2327). We obtained an informed consent form from all patients for colonoscopy. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Retrospective analysis was performed on patients who were hospitalized after being admitted to the emergency room with LGI bleeding between January 2015 and August 2021. The patient files and hospital automation system were used to gather information about the patients' demographics, comorbid disease histories, and drug use histories. The length of the patients' hospital stays and, if any, their time in the intensive care unit (ICU) were assessed. It was noted whether the patients received fresh frozen plasma (FFP) or erythrocyte suspension (ES).

All patients underwent colonoscopies using colonoscopes with the models CF-Q150L and CF-H170L made by Olympus. All patients had their anal examinations and rectal touches evaluated prior to the procedure. Before the procedure, each patient was prepared for colonoscopy with oral colonoscopy solution and 2 intermittent enemas.

The patients' colonoscopy results were documented. Patients who underwent colonoscopic intervention but still experienced bleeding who were referred for surgery were noted. CCI of all patients were calculated by analyzing the medical information of the patients (**Figure 1**). Total scores were calculated and recorded for patients.

Charlson comorbidity indexes (CCI) Scoring	
Comorbidity	**Score**
Myocardial ınfarction (MI)	1
Congestive heart failure (CHF)	1
Peripheral vascular disease	1
Cerebrovascular disease or transient ıschemic attack	1
Hemiplegia	2
Renal disease	2
Mild liver disease	1
Severe liver disease	3
Diabetes mellitus (DM)	1
Complicated diabetes	2
Peptic ulcer	1
Leukemia	2
Lymphoma	2
Solid tumor	2
Metastatic solid tumor	6
Dementia	1
Chronic pulmonary disease	1
Hıv/aıds	6
Rheumatological disease	1

Figure 1. Charlson Comorbidity Index

As the primary outcomes of the study, it has been aimed to determine the relationship between the CCI scores calculated at the time of admission to the hospital and the rates of hospitalization, hospitalization in the intensive care unit, and mortality. The variables of the study are the comorbidities of the patients used when calculating the CCI scores. According to the CCI scoring system, each comorbidity has a specific score and these scores were calculated.

All patients who were hospitalized with lower GI bleeding within the predetermined time frame and were admitted to the emergency room were included in the study without using any particular sampling methodology.

All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Statistical Analysis

We reviewed the patients' demographic and clinical details, colonoscopy results, duration of hospital and intensive care stay, and CCI. The distribution patterns of the continuous variables were investigated using the Kolmogorov-Smirnov test. Gender, antiaggregant and anticoagulant use, surgery, colonoscopy results, and ICU hospitalization were analyzed between the two groups using the $\chi 2$ -test or Fisher's exact test. Continuous variables were analyzed with the Mann-Whitney U test if they had an abnormal distribution pattern or with the Student's t-test if they had a normal distribution pattern. The correlation between CCI and duration of hospital and intensive care stay was evaluated using Spearman's test. To determine the independent predictors of mortality, univariate and

multivariate logistic regression analyses were performed. The capacity of CCI value in predicting the presence of mortality was analyzed using receiver operating characteristic (ROC) curve analysis. Kaplan-Meier curves were constructed to compare survival between groups and the log-rank test was used to determine significance. A value of p <0.05 was considered statistically significant. The IBM Statistical Package for the Social Sciences for Windows, version 25.0, IBM.Corp., Armonk, NY, 2012 was used for the statistical analysis.

RESULTS

One hundred two (49%) of the 210 patients included were male in the study. The patients mean age was 67.70±13.67. Colonoscopy was performed in all patients. In **Table 1**, the results of colonoscopy are listed. The median length of hospital stay was 9.00 (5.00-15.00) days. While 49% of all patients were admitted to the ICU, the median length of ICU stay was 0 (0-5.00) days. In addition, the median CCI value of all patients was 4.00 (2.00-5.00). While 16 of the patients (group 1, 8%) included in the study died, the others (group 2, n=194, 94%) were discharged from the hospital. While the mean age of the patients in group 1 was 72.25±14.09 years, it was 67.33±13.61 years in group 2. There was no statistical significance between the two groups in terms of gender (male; group 1, n=5 (31%) vs. group 2, n=97 (50%); p=0.15), antiaggregant and anticoagulant use. Length of hospital stay (21.00 (9.75-34.25) vs. 8.00 (4.00-15.00); p= 0.001), intensive care hospitalization rates (12 (75%) vs. 90 (46%); p= 0.03) and length of ICU stay (14.00 (1.25-21.50) vs. 0 (0-4.00); p= <0.001) were higher in group 1. The median CCI values between the two groups (group 1 vs. group 2; 8.00 (7.00-9.75) vs. 2, 3.00 (2.00-4.00), p=<0.001; respectively) were statistically significantly different (**Table 1**).

We performed logistic regression analyses to determine the independent predictors of mortality. In multivariate logistic regression analysis, CCI (OR:4.511, 95% CI: 2.128-9.564, P<0.001) was identified as an independent predictor of mortality (**Table 2**). **Figure 2** presents Kaplan-Meier survival curves when patients were divided according to CCI value. Patients with CCI <7 had significantly better survival when compared with patients with CCI≥7 (Log rank P<0.001). In the ROC analysis (**Figure 3**) of mortality prediction, the AUC value of CCI was determined as 0.931 (95% CI: 0.853-0.999, p<0.001). At the cut-off value of 6.5, CCI had sensitivity, specificity, positive predictive and negative predictive values of 87.5%, 93.8 %, 53.8%, 98.9% respectively.

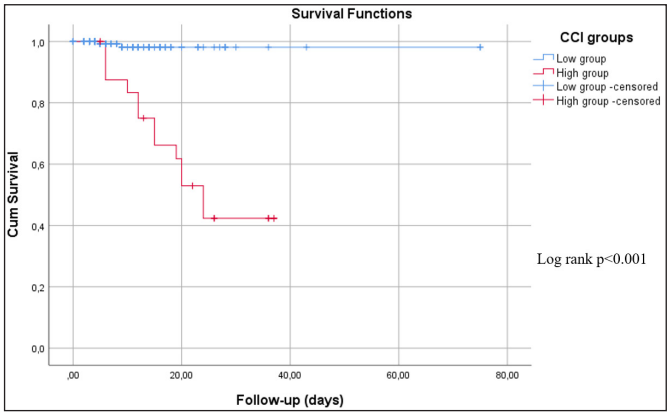

Figure 2. Kaplan-Meier survival curves of CCI subgroups.
CCI: Charlson Comorbidity Index

Table 1. Baseline demographic and clinical features of the study population

	Total (n=210)	Group 1 (n=16)	Group 2 (n=194)	P
Age, years	67.70±13.67	72.25±14.09	67.33±13.61	0.17
Gender, male, n (%)	102 (49)	5 (31)	97 (50)	0.15
Antiaggregant, n (%)	78 (37)	6 (38)	72 (37)	0.98
Anticoagulant, n (%)	58 (27)	3 (19)	55 (28)	0.41
Surgery, n (%)	20 (10)	5 (31)	15 (8)	0.01
Colonoscopy				
Angiodysplasia, n (%)	52 (25)	0 (0)	52 (27)	0.017
Malignancy, n (%)	17 (8)	3 (19)	14 (7)	0.13
Polyp, n (%)	21 (10)	0 (0)	21 (11)	0.38
Diverticulum, n (%)	64 (31)	4 (25)	60 (31)	0.62
Hemorrhoids, n (%)	12 (6)	0 (0)	12 (6)	0.61
Ischemic colitis, n (%)	38 (18)	7 (44)	31 (16)	0.006
Inflammatory bowel disease, n (%)	4 (2)	0 (0)	4 (2)	1.0
Dieulafoy, n (%)	2 (1)	2 (13)	0 (0)	0.005
Length of hospital stay, day	9.00 (5.00-15.00)	21.00 (9.75-34.25)	8.00 (4.00-15.00)	0.001
Intensive care hospitalization, n (%)	102 (49)	12 (75)	90 (46)	0.03
Length of ICU stay, day	0 (0-5.00)	14.00 (1.25-21.50)	0 (0-4.00)	<0.001
ES replacement, units	3.00 (1.00-6.00)	7.00 (6.00-10.25)	3.00 (1.00-6.00)	<0.001
FFP replacement, units	0 (0-0)	0 (0-0)	0 (0-0)	0.06
CCI	4.00 (2.00-5.00)	8.00 (7.00-9.75)	3.00 (2.00-4.00)	<0.001

ICU: Intensive care unit, ES: Erythrocyte suspension, FFP: Fresh frozen plasma, CCI: Charlson Comorbidity Index. Statistically significant results (p<0.05) were shown in bold type.

Table 2. Univariate and multivariate logistic regression analysis shows the independent predictors of mortality

	Univariate				Multivariate			
	OR	95% CI		P	OR	95% CI		P
		Lower	Upper			Lower	Upper	
Age, years	1.028	0.988	1.070	0.170				
Gender, male	0.455	0.152	1.357	0.158				
Surgery	5.424	1.665	17.673	0.005	1.036	0.113	9.458	0.975
Angiodysplasia	0.000	0.000	-	0.997				
Ulcer	4.090	1.417	11.801	0.009	20.208	1.816	224.830	0.014
Dieulafoy	0.000	0.000	-	0.999				
Duration of hospital stay	1.054	1.017	1.093	0.004	0.917	0.816	1.030	0.145
Intensive care	3.467	1.080	11.128	0.037	0.182	0.019	1.739	0.139
ES replacement	1.187	1.065	1.322	0.002	1.292	1.008	1.657	0.043
CCI	2.973	1.956	4.518	<0.001	4.511	2.128	9.564	<0.001

ES: Erythrocyte suspension, CCI: Charlson Comorbidity Index.

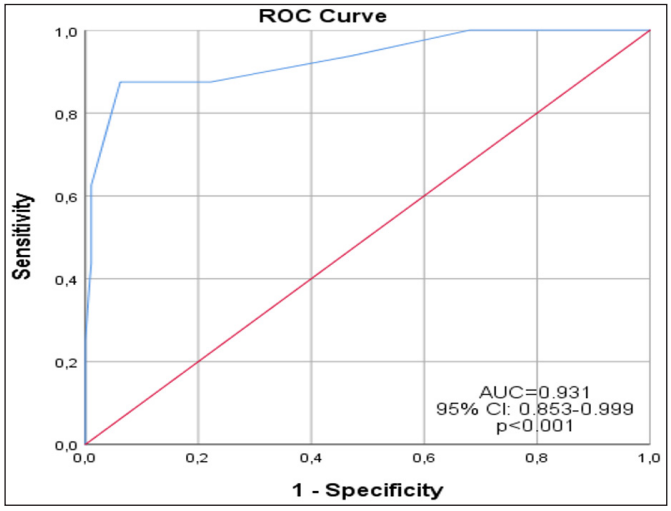

Figure 3. Receiver operating characteristic (ROC) curve for Charlson Comorbidity Index as a predictor of mortality.

The scatter plot in **Figure 4** and **Figure 5** shows the correlation between CCI and length of hospital and ICU stay in the study population. There was a weak correlation between them (Rho=0.252, p<0.001 for hospital stay, Rho=0.273, p<0.001 for ICU stay) (**Table 3**).

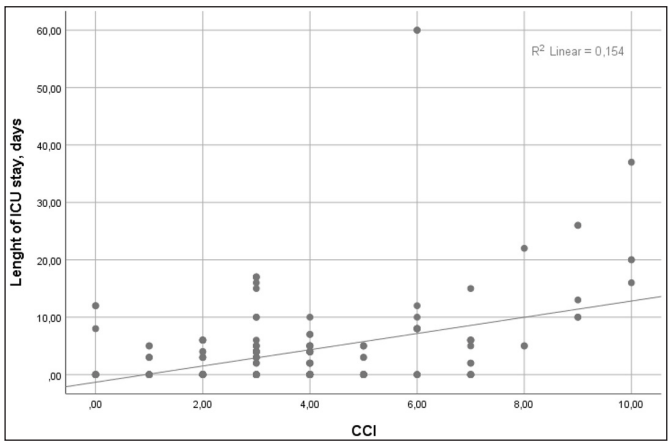

Figure 4. Scatter plot showing a positive linear correlation between length of ICU stay and CCI.
CCI: Charlson Comorbidity Index

Table 3. Correlation Between CCI and length of hospital and ICU stay

	Spearman's Rho	P
Length of hospital stay	0.252	<0.001
Length of ICU stay	0.273	<0.001

ICU: Intensive care unit, CCI: Charlson Comorbidity Index.

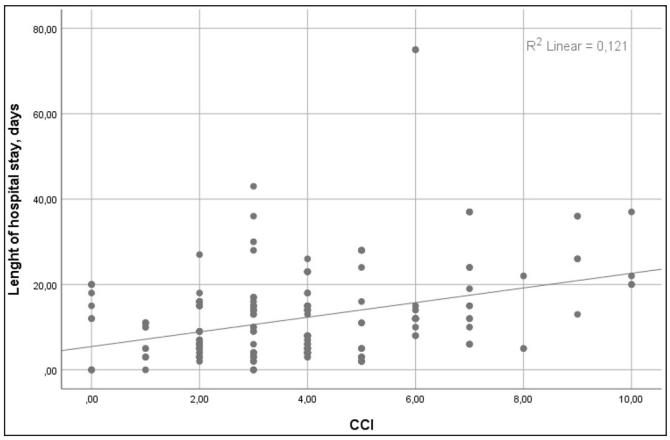

Figure 5. Scatter plot showing a positive linear correlation between length of hospital stay and CCI.
CCI: Charlson Comorbidity Index

DISCUSSION

Hospitalization rates for LGI bleeding range from 33 to 87 per 100,000 people (12). Hospital mortality rates range from 2.5 to 3.9%, and the annual rebleeding rate ranges from 13 to 20% Aoki et al. (13). In our study, 210 patients with LGI bleeding were assessed. While conducting the statistical analysis, the patients were split into two groups. Patients in Group 1 were those who passed away, while those who were released from the hospital were in Group 2. While the median CCI in Group 1 was 8, Group 2 had a median CCI of 3, and the difference between the two was statistically significant. Additionally, the length of hospitalization, the amount of time spent in the intensive care unit, and the requirement for erythrocyte suspension replacement were discovered to be statistically higher

in Group 1 than in Group 2 in the comparative analysis between the two groups. The meta-analysis of Aoki et al.(13) showed that the patients whose CCI score>2 have a higher mortality rate and serious rebleeding risk. Radelli et al. (14) determined that patients with CCI scores ≥3 have a higher mortality rate concerning the results of the study that included 1198 patients from 15 centers (OR 1.20; 95%CI, 1.04-1.38). Strate et al. (15) established in the study that included 252 patients, that the percentage of CCI>2 rates were 49% and 33% in patients with serious bleeding or not, respectively (OR 1.91; 95%CI, 1.15-3.17). They determined that having a CCI>2 is an independent risk factor for LGI bleeding.

The first step in the management of patients with LGI bleeding is to determine the severity of bleeding and risk factors. The most effective treatment is lower gastrointestinal endoscopy (LGE), but there is no consensus on who should is performed emergency LGE (16,18). Gopalswamy et al. (19) looked at 66 patients with GI bleeding who were admitted to the ICU in 2004 and found that patients with high CCI scores had a significantly higher mortality rate. In our study, the group with higher CCI had significantly higher mortality and morbidity, and CCI was also found to be an independent predictor of mortality in multivariate regression analysis. The management of patients who have high CCI must be closely monitored during ICU hospitalization because of high mortality rates. We believed that CCI is an appropriate prognostic indicator to determine whether an urgent colonoscopy is necessary. However, prospective and randomized controlled studies with higher populations are needed.

Camus et al. (20) compared CURE hemostasis prognosis score, ASA score and CCI scores in LGI bleeding, and although ASA score was found to be useful in predicting 30-day mortality, CURE and CCI were not found to be useful. In our study, CCI was found to be significant in predicting mortality, and a CCI cut-off value was determined accordingly. In the present study, a CCI cut-off value of 6.5 was found to be useful in predicting mortality with a sensitivity of 87.5% and specificity of 93.8%.

The most significant limitation of our study is that it was conducted retrospectively, with no comparisons to other scoring systems. One of the most impressive aspects of our research is the in-depth statistical analysis. In this way, data was presented to support the use of CCI as a predictive scoring system for patients with LGI bleeding, including a cut-off value, specificity, sensitivity, positive and negative predictive values. Furthermore, all patients were actively and individually followed up with throughout the process, and data was collected that was completely reliable.

CONCLUSION

In this study, hospitalized patients with LGI had their Charlson Comorbidity Index and mortality rates, hospitalization rates and lengths of stay, needs for intensive care, and needs for blood products compared. As a result, it was assessed to see if a prognostic prediction could be made based on the CCI scores at the time of hospital admission. CCI was also discovered to be a standalone predictor of mortality. Our research yielded specificity, sensitivity, positive and negative predictive values, as well as the cut-off value for CCI.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of the Ankara City Hospital Scientific Research Evaluation and Ethics Committee (Date:16.09.2019, Decision No: E1-22-2327).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Kim BS, Li M, Engel BT, et al. Diagnosis of gastrointestinal bleeding: a practical guide for clinicians. World J Gastrointest Pathophysiol 2014; 5: 467-78
2. Zuccaro G. Management of the adult patient with acute lower gastrointestinal bleeding. American College of Gastroenterology. Practice Parameters Committee. Am J Gastroenterol 1998; 93: 1202-08.
3. Zuckerman GR, Prakash C. Acute lower intestinal bleeding. Part II: etiology, therapy, and outcomes. Gastrointest Endosc 1999; 49: 228-38.
4. Strate LL. Lower GI bleeding: epidemiology and diagnosis. Gastroenterol Clin North Am 2005; 34: 643-64.
5. Boley SJ, Sammartano R, Adams A, DiBiase A, Kleinhaus S, Sprayregen S. On the nature and etiology of vascular ectasias of the colon. Degenerative lesions of aging. Gastroenterology 1977; 72: 650-60.
6. Boley SJ, DiBiase A, Brandt LJ, Sammartano RJ. Lower intestinal bleeding in the elderly. Am J Surg 1979; 137-57.
7. Korkis AM, McDougall CJ. Rectal bleeding in patients less than 50 years of age. Dig Dis Sci 1995; 40: 1520-3.
8. Moons KG, Altman DG, Reitsma JB, et al. Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis (TRIPOD): explanation and elaboration. Ann Intern Med 2015; 162: W1-73.

9. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987; 40: 373-83.
10. Gabriel SE, Crowson CS, O'Fallon WM. A comparison of two comorbidity instruments in arthritis. J Clin Epidemiol 1999; 52: 1137-42.
11. Zhang JX, Iwashyna TJ, Christakis NA. The performance of different lookback periods and sources of information for Charlson comorbidity adjustment in Medicare claims. Med Care 1999; 37: 1128-39.
12. Hussain H, Lapin S, Cappell MS. Clinical scoring systems for determining the prognosis of gastrointestinal bleeding. Gastroenterol Clin North Am 2000; 29: 445-64.
13. Aoki T, Hirata Y, Yamada A, Koike K. Initial management for acute lower gastrointestinal bleeding. World J Gastroenterol 2019; 25: 69-84.
14. Radaelli F, Frazzoni L, Repici A, et al. Clinical management and patient outcomes of acute lower gastrointestinal bleeding. A multicenter, prospective, cohort study. Digestive and Liver Disease 2021; 53: 1141-7.
15. Strate LL, Orav EJ, Syngal S. Early predictors of severity in acute lower intestinal tract bleeding. Archives of Internal Medicine 2003; 838-43.
16. Manning-Dimmitt LL, Dimmitt SG, Wilson GR. Diagnosis of gastrointestinal bleeding in adults. Am Fam Physician 2005; 71: 1339-46.
17. Lhewa DY, Strate LL. Pros and cons of colonoscopy in management of acute lower gastrointestinal bleeding. World J Gastroenterol 2012; 18: 1185-90.
18. Jensen DM, Machicado GA, Jutabha R, Kovacs TO. Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. N Engl J Med 2000; 342: 78-82.
19. Gopalswamy N, Malhotra V, Reddy N, et al. Long-term mortality of patients admitted to the intensive care unit for gastrointestinal bleeding. South Med J 2004; 97: 955-8.
20. Camus M, Jensen DM, Ohning GV, et al. Comparison of three risk scores to predict outcomes of severe lower gastrointestinal bleeding. J Clin Gastroenterol 2016; 50: 52-8.