ANATOLIAN
CURRENT MEDICAL

Are the blood urea nitrogen/creatinine ratio and the mean platelet volume able to act as predictors of mortality and morbidity in patients with upper gastrointestinal bleeding?

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ABSTRACT

Background: Upper gastrointestinal (GI) bleeding originates above the Treitz ligament and blood urea nitrogen (BUN)/Creatinine (Cr) ratio ≥30 was shown to indicate the presence of upper GI bleeding and it might be an independent risk factor for mortality. The mean platelet volume (MPV) was reported as an indicator of platelet function and activation and was shown to be useful in the diagnosis and follow-up of vascular-origin disorders. In the present study, we aimed to investigate whether BUN/Cr ratio and MPV were predictors of mortality and morbidity in patients with upper GI bleeding.

Material and Method: This retrospective study enrolled a total of 141 patients admitted to the Emergency Department with symptoms of upper GI bleeding and had undergone endoscopy between January 2013-January 2015. Demographics, hemoglobin, hematocrit, MPV, BUN/Cr, the hospitalization unit, the duration of stay, outcome, and the endoscopy reports of the patients were recorded. Statistical analysis was performed using SPSS 17.0.

Results: It was found that the MPV level did not predict mortality and morbidity in our patients with upper GI bleeding. The likelihood of active bleeding was higher in patients with a BUN/Cr ratio of above 30 when compared to those with a ratio of below 30.

Conclusion: In patients presenting to the emergency department with symptoms of GI bleeding but without signs of renal failure, calculation of admission BUN/Cr ratio may be beneficial for making treatment and follow-up plans.

Keywords: Upper gastrointestinal bleeding, blood urea nitrogen/creatinine ratio, mean platelet volume, morbidity, mortality

INTRODUCTION

Upper gastrointestinal (GI) bleeding originates from proximal sites of the Treitz ligament, and mostly occurs due to gastric or duodenal ulcers. GI bleeding is a significant cause of mortality and morbidity that should be ruled out in patients presenting with hematemesis, hypotension, blood in stool, and darkening of stool color. Despite all advances in diagnosis and management, 8-10% of patients presenting to emergency departments (EDs) with upper GI bleeding are currently lost (1).

The annual incidence of acute massive upper GI bleeding in the population is 40-150 per 100,000 (2). Its incidence is lower in the young population, and it has started to be seen even more commonly in elderly due to several factors such as the increased prevalence of comorbidities, and more frequent use of non-steroidal anti-inflammatory agents (3).

The findings on physical examination include orthostatic symptoms, postural changes, pallor, palpitations, fatigue, chest pain, dyspnea, tachypnea, and abdominal pain. The digital anorectal examination should be performed both to investigate the presence of anorectal disease, and to confirm stool color described by the patient. The findings on physical examination, decreased hemoglobin level, abnormal coagulation parameters, and occult blood in stool do not necessarily indicate the presence or the severity of GI bleeding. It is essential to diagnose upper GI bleeding by esophagogastroduodenoscopy (4,5).

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In upper GI bleeding, the level of blood urea nitrogen (BUN) rises due to volume contraction and absorption of blood proteins, resulting in an increased BUN/Creatinine (Cr) ratio (6). The BUN/Cr ratio ≥30 was shown to indicate the presence of GI bleeding, and has been suggested in various reports that it might have been an independent risk factor for mortality (7).

The mean platelet volume (MPV) is an easy-to-measure parameter, indicating the platelet function and activation. The platelets are indispensable for hemostasis, and their dysfunction leads to bleeding and coagulation disorders (8). It has been suggested that MPV might be useful in the diagnosis and follow-up of many disorders, mainly those with vascular origin (9).

In this study, we aimed to investigate whether the BUN/Cr ratio calculated at admission of the patient and the MPV level were predictors of mortality and morbidity in patients who had presented to the ED with symptoms of upper GI bleeding and had undergone endoscopic examination.

MATERIAL AND METHOD

Approval of the Ethics Committee
Our study was approved by the Adnan Menderes University Faculty of Medicine Non-invasive Clinical Research Ethics Committee (Date: 12.02.2015, Decision No: 2015/546-9). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Properties of the Patient Group
This retrospective study enrolled the patients aged 18 years and over, who had presented to the ED with symptoms of GI bleeding and had undergone an endoscopic examination between January 1st, 2013 and January 1st, 2015. The data on their medical charts were recorded and reviewed. Patients admitted to ED with chronic renal failure, known high urea levels or ongoing hemodialysis program and under age of 18 were excluded from the study.

Data Collection
A data sheet was prepared to record patient information. This data sheet included information about the patient characteristics including name, gender, age, and medical chart number, the hemoglobin (Hgb), hematocrit (Htc), MPV, BUN, and Cr values at the time of admission, the unit that the patient had been hospitalized (intensive care unit (ICU)/regular ward), the duration of stay in the hospital, the patient outcome (discharged/deceased), and the endoscopy reports. After recording all relevant data on the data sheet, the BUN/Cr ratio at the time of admission to the ED was calculated and recorded.

Statistical Analysis
All results were reported as mean± standard deviation. All study data were analyzed with the Statistical Package for Social Sciences (SPSS) 17.0 software package. The T-test, the Chi-square and the Mann-Whitney U test methods were used in the analysis and comparison of the data and the groups. p<0.05 was considered statistically significant.

RESULTS

Of 141 patients, 49 (35%) were female, and 92 (65%) were male. The male-to-female ratio was 1.87. The mean patient age of all patients was 67 years. Approximately 50% of our patients were aged between 60-80 years and particularly 75-80 years (25%).

The mean ages of the patients admitted to the ICU and the regular ward were 68 years and 65 years, respectively. The mean Hgb value of all patients at the time of admission was 9.5±2.5 g/dL. The mean Hgb level was 8.7±2.4 g/dL among patients admitted to ICU, and 10.5±2.33 g/dL among others. The mean Htc levels of the entire study population, the patients in ICU, and those in the ward were 29.5±7.1%, 26.9%, and 32.6%, respectively. The mean BUN/Cr ratios of the entire study population, the patients hospitalized in ICU and the regular ward were 34.1±15.0, 36.4, and 31.0, respectively. The analysis of MPV levels revealed an overall mean MPV level of 9.8±1.1 fL. The mean MPV level was 9.8 fL in both the patients admitted to ICU and the regular ward. **Table 1** shows the values and the comparison of age, gender, Hgb, Htc, and MPV, the BUN/Cr ratio, the rates of active bleeding and mortality according to the units in which the patients were hospitalized. Statistically significant differences were found to be present between the patients hospitalized in ICU and the regular ward regarding Hgb and Htc values, the BUN/Cr ratio, and the mortality rate. The patient group in ICU had significantly lower levels of Hgb and Htc, and significantly higher BUN/Cr ratio and mortality rate compared to the patient group hospitalized in the regular ward (p<0.05).

Table 1. The distribution of the study population according to the unit that the patients were hospitalized

		ICU group	Regular ward group	P
Sex	Male	48	44	
	Female	29	20	
Mean age (years)		68	65	0.104
Hemoglobin (g/dL)		8.7	10.5	0.000
Hematocrit (%)		26.9	32.6	0.000
MPV (fL)		9.8	9.8	0.805
BUN/Creatinine		36.4	31.0	0.027
Active bleeding		11%	3%	0.111
Mortality rate		8%	0.00	0.031

ICU: Intensive care unit; MPV: Mean platelet volume; BUN: Blood urea nitrogen

The analysis of the study group based on patient age under vs. over 60 years showed that there were 42 patients (35 males, 7 females) under the age of 60 years, and 99 patients (57 males, 42 females) aged over 60 years. The mean Hgb levels were 9.1 g/dL and 10.3 g/dL in the patients aged over and under 60 years, respectively. The mean Htc level was 31.5% in patients aged under 60 years and 28.7% in those aged over 60 years. The age-based analysis of the MPV levels revealed that the mean MPV level was 9.8 fL in both the patients under and over the age of 60 years. The active bleeding rate was 4.0% in the patients aged over 60 years whereas it was 17.1% in those aged under 60 years. **Table 2** depicts the age-based comparison of sex, ICU admission rate, Hgb, Htc, MPV, BUN/Cr ratio, active bleeding, and mortality rates. There were statistically significant differences between the patients aged over and under 60 years regarding Hgb and Htc values and the active bleeding rates ($p<0.05$). The patient group aged over 60 years had significantly lower Hgb and Htc values than those aged under 60 years; however, the active bleeding rate was significantly higher in the patient group aged under 60 years when compared to the patient group with age over 60 years.

Table 2. The distribution and comparison of the study population according to age being under and over 60 years

		Age >60	Age <60	P
Sex	Male	57	35	
	Female	42	7	
ICU admission rate		58%	47%	0.255
Hemoglobin (g/dL)		9.1	10.3	0.009
Hematocrit (%)		28.7	31.5	0.034
MPV (fL)		9.8	9.8	0.992
BUN/Creatinine		33.8	34.7	0.561
Active bleeding		4.0%	17.1%	0.015
Mortality rate		5%	2%	0.670
ICU: Intensive care unit; MPV: Mean platelet volume; BUN: Blood urea nitrogen				

A total of 61 (43%) patients (44 males, 17 females) had a BUN/Cr ratio below 30. BUN/Cr ratio was above 30 in a total of 79(56%) patients (47 males, 32 females).

The analysis of the laboratory results of patients with a BUN/Cr ratio below 30 revealed that Hgb, Htc, and MPV levels were 10.0 gr/dL, 31.4%, and 9.7 fL, respectively; the corresponding figures for those with a ratio greater than 30 were 9.0 gr/dL, 27.8%, and 9.9 fL, respectively. The mean age of patients with a BUN/Cr ratio lower than 30 was 73 years whereas the mean age was 67 years in those with a BUN/Cr ratio greater than 30. The rate of active bleeding in endoscopy was 18% in the patients with a BUN/Cr ratio below 30 whereas it was 82% among those with a ratio above 30. The rate of ICU admission was 32% in patients with a BUN/Cr ratio below 30 and 67% for those with a ratio over 30. **Table 3** shows BUN/Cr ratio-based comparison of sex, ICU admission rate, age, Hgb, Htc and MPV values, together with the active bleeding and mortality rates. There were significant differences between the patient groups having a BUN/Cr ratio over and under 30 regarding ICU admission rate, and Hgb and Htc values. The ICU admission rate was significantly higher and Hgb and Htc levels were significantly lower in the patient group with a BUN/Cr ratio over 30 when compared to those with a ratio under 30 ($p<0.05$).

Table 3. The distribution and comparison of the study population according to the BUN/Creatinine ratio

		BUN/Creatinine >30	BUN/ Creatinine <30	P
Sex	Male	47	44	
	Female	32	17	
ICU admission rate		67%	32%	0.003
Hemoglobin (g/dL)		9.0	10.0	0.012
Hematocrit (%)		27.8	31.4	0.003
MPV (fL)		9.9	9.7	0.429
Mean Age (years)		67	73	0.377
Active bleeding		82%	18%	0.113
Mortality rate		67%	33%	0.699
ICU: Intensive care unit; MPV: Mean platelet volume; BUN: Blood urea nitrogen				

DISCUSSION

Upper GI bleeding constitutes a significant portion of the disorders in patients admitted to EDs. Ten to thirty percent of cases with upper GI bleeding results in rebleeding and two to fifteen percent result in death (10). While the etiology of upper GI bleeding is considerably variable, peptic ulcer, erosive gastritis, and esophageal varices have been reported as the most common causes, constituting 90% of all incidents with GI bleeding (11).

The epidemiology of upper GI bleeding is characterized by a lesser rate of peptic ulcer bleeding among the young population and an increased incidence of peptic ulcer bleeding in the elderly population due to increased use of aspirin and non-steroidal anti-inflammatory drugs. Factors increasing mortality and morbidity in GI bleeding include being over 50 years of age, comorbidities such as cardiovascular, hepatic, and renal disorders, encephalopathy, malignancy, major surgery, physiological stress due to sepsis or trauma, a low Htc level, and prolonged prothrombin time. Performing a risk classification especially in the triage setting would be useful for making correct medical decisions, treatment planning, prediction of disease course, and use of available resources, even though it is difficult to prove that patients benefit from such a classification regarding mortality.

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The gender distribution in our study was consistent with the reports published in the medical literature. Okutur et al. (12), in their study conducted on 230 patients with upper GI bleeding, reported that 71% of patients were male and 29% were female. In their study involving 336 patients, Sezgin et al. (13) reported that 71% of patients were male and 29% were female, with the mean age of 57.7 years (13).

The age distribution found in our study was also compliant with the literature. Seventy percent of all acute upper GI bleedings occur in patients older than 60 years. Advanced age is an independent risk factor for mortality in upper GI bleeding. The review of the literature revealed that affected patients were predominantly over 50 years of age. Uyanıkoğlu et al. (14) reported that 19% of patients had an age between 51 and 60 years, and Yenigün et al. (15) reported that 26% of their patients were aged between 70 and 79 years.

Hemoglobin level is essential for follow-up, prognosis, and treatment planning in patients with upper GI bleeding. The mean Hgb level in our study was consistent with previously conducted studies. In patients with upper GI bleeding, Di Fiore et al. (15) reported a mean admission Hgb level of 9.5 g/dL, Chassaignon et al. (16) 9.8 g/dL, Yenigün et al. (17) 8.8 g/dL, Göksu et al. (18) 9.9 g/dL, and Kaltar et al. (19) 9.30 g/dL.

The mean Htc value determined in our study was also in accordance with the reports published in the literature. Okutur et al. (12) found an admission Htc level of 28.5±8.1%. They reported the values of 26.97±6.85% in patients admitted to ICU, and 32.61±6.33% for others.

The analysis of the MPV levels of our patients with upper GI bleeding showed that there was no significant correlation between age, hospitalization in ICU, and MPV level. Our results were in accordance with the reports in the literature. Altun et al. (20) showed that the MPV level during admission to ICU was not predictive of mortality. Yavuzcan et al. (21), on the other hand, showed that MPV level, which is a peripheral marker of the systemic inflammatory response, was not changed when the hematological parameters of patients with abnormal vaginal bleeding who were diagnosed either with endometrium cancer or benign endometrial pathology were compared.

GI bleeding involving the upper tract increases serum BUN level due to the absorption and digestion of Hgb. A BUN/Cr ratio of ≥30 was reported by Witting et al. (22) to indicate that the bleeding was more likely of upper GI origin. Other reports have also shown that patients with a BUN/Cr ratio above 30 had higher rates of active bleeding, ICU admission, and mortality when compared to the patients with a ratio below 30 (7). Our study produced similar results as in the literature.

Limitations

The limitations of the study are the retrospective design of the study, the advanced mean age of the patients, and the inclusion criteria being only those with renal dysfunction and patients under 18 years of age.

CONCLUSION

Our results suggest that the MPV level is not a significant predictor of mortality and morbidity in patients presenting to the ED with signs of upper GI bleeding and, the MPV level during admission is not useful for prediction of mortality and morbidity in patients with upper GI bleeding in whom an endoscopic examination is performed. However, in patients presenting with symptoms of GI bleeding, the BUN/Cr ratio is a significant predictor of the location of bleeding in the upper or lower tract, the likelihood of active bleeding, and mortality and morbidity rates. In addition to indicating the upper gastrointestinal tract as the origin of a hemorrhagic incident, a BUN/Cr ratio greater than 30 also increases the likelihood of active bleeding. The mortality rate is higher in patients with a BUN/Cr ratio above 30 when compared to those with a ratio below 30.

In clinical practice, the BUN/Cr ratio may give clues about the location of bleeding, the presence of active bleeding, and mortality. This study suggests that the BUN/Cr ratio may prove beneficial for treatment planning and follow-up.

ETHICAL DECLARATIONS

Ethics Committee Approval: Our study was approved by the Adnan Menderes University Faculty of Medicine Non-invasive Clinical Research Ethics Committee (Date: 12.02.2015, Decision No: 2015/546-9).

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. Feldman M, Friedman LS, Sleisenger MH. Gastrointestinal bleeding. Fordtran's Gastrointestinal and Liver Disease; 2002. page: 211-3.

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2. Longstreth GF. Epidemiology of hospitalization for acute upper gastrointestinal hemorrhage: a population-based study. Am J Gastroenterol 1995; 90: 206-10.

3. Tırnaksız B. Gastrointestinal kanamanın cerrahi yönetimi. Yoğun Bakım Derg 2005; 5: 174-81.

4. Osman D, Djibre M, Da Silva D, Goulenok C. Management by the intensivist of gastrointestinal bleeding in adults and children. Ann Intensive Care 2012; 2: 46.

5. Colle I, Wilmer A, Le Moine O, et al. Upper gastrointestinal tract bleeding management: Belgian guidelines for adults and children. Acta Gastroenterol Belg 2011; 74: 45-66.

6. Uzunismail H. Akut üst gastrointestinal kanama. İstanbul Üniversitesi Cerrahpaşa Tıp Fakültesi Sürekli Tıp Eğitimi Etkinlikleri Acil Hekimlik Sempozyumu Oct, 16-17th, 1997; İstanbul. page: 233-45.

7. Wu KH, Shih HA, Hung MS, Hsiao CT, Chen YC. The association between blood urea nitrogen to creatinine ratio and mortality in patients with upper gastrointestinal bleeding. Arab J Gastroenterol 2018; 19: 143-7.

8. Akpolat T, Utaş C. Günlük nefroloji ve böbrek yetmezliğinde ilaç kullanımı. 2006.

9. O'Malley T, Langhorne P, Elton RA, Stewart C. Platelet size in stroke patients. Stroke 1995; 26: 995-9.

10. Wang CH, Chen YW, Young YR, Yang CJ, Chen IC. A prospective comparison of 3 scoring systems in upper gastrointestinal bleeding. Am J Emerg Med 2013; 31: 775-8.

11. Krupp MA, Chatton MJ. Current Medical Diagnosis and Treatment. 1984.

12. Okutur SK, Alkım C, Bes C, Gürbüz D, Kınık Ö. Akut üst gastrointestinal kanamaları. Akademik Gastroenteroloji Derg 2007; 6: 30-6.

13. Sezgin O, Altıntaş E, Tombak A. Effect of seasonal variations on acute upper gastrointestinal bleeding and its etiology. Turk J Gastroenterol 18: 172-6.

14. Uyanıkoğlu A, Danalıoğlu A, Davutoğlu C, Alimoğlu O, Baş G. Akut üst gastrointestinal sistem kanaması: endoskopi sonuçlarının retrospektif değerlendirilmesi. İstanbul Üniversitesi Tıp Fakültesi Derg 2008; 71: 120-3.

15. Yenigün EC, Pirpir A, Aytan P, Ulusal G, Yıldırım İS. Üst gastrointestinal sistem kanamalı hastaların özelliklerinin değerlendirilmesi. Akademik Gastroenteroloji Derg 2006; 5: 116-22.

16. Di Fiore F, Lecleire S, Merle V, et al. Changes in characteristics and outcome of acute upper gastrointestinal haemorrhage: a comparison of epidemiology and practices between 1996 and 2000 in a multicentre French study. Eur J Gastroenterol Hepatol 2005; 17: 641-7.

17. Chassaignon C, Letoumelin P, Pateron D, Group HD. Upper gastrointestinal haemorrhage in Emergency Departments in France: causes and management. Eur J Emerg Med 2003; 10: 290-5.

18. Göksu E, Erken Ö, Erçetin Y. Akdeniz Üniversitesi Hastanesi Acil Servisine üst gastrointestinal sistem kanaması ile başvuran hastalarda mortaliteyi belirleyen faktörler ve demografik özellikleri. Türkiye Acil Tıp Derg 2004; 4: 121-6.

19. Katlar T. Üst gastrointestinal sistem kanamalı hastalarda steroid olmayan antiinflamatuar ilaç kullanımı ve bu hastalarda hemostaz parametrelerine etkilerinin incelenmesi. 2007.

20. Altun Y, Demircan F, Mengeloğlu FZ, Namuslu M. Yoğun bakım hastalarında ortalama trombosit hacminin mortalite ile ilişkisi. J Clin Exp Invest 2011; 2: 408-11.

21. Yavuzcan A, Çağlar M, Erdem H, et al. Anormal uterin kanamalı hastalarda endometrium kanseri ve benign endometrial patoloji tanısı alanların hematolojik parametrelerinin karşılaştırılması. Van Tıp Derg 2014; 21: 148-53.

22. Witting MD, Magder L, Heins AE, Mattu A, Granja CA, Baumgarten M. ED predictors of upper gastrointestinal tract bleeding in patients without hematemesis. Am J Emerg Med 2006; 24: 280-5.