ORIGINAL ARTICLE

การตรวจสถานะธาตุเหล็กในร่างกายของผู้ป่วยที่นอนโรงพยาบาลด้วยเลือดออกในทางเดินอาหารส่วนต้น

Iron Status Assessment among Hospitalized Patients with Acute Upper Gastrointestinal Bleeding

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บทคัดย่อ

ที่มาของปัญหา: ในปัจจุบันยังขาดข้อมูลในการตรวจสถานะธาตุเหล็กและความชุกของโรคโลหิตจางจากขาดธาตุเหล็กในผู้ป่วยเลือดออกในทางเดินอาหารส่วนต้น

วัตถุประสงค์: ศึกษาการตรวจสถานะธาตุเหล็กและความชุกของโรคโลหิตจางจากขาดธาตุเหล็ก รวมถึงปัจจัยที่ส่งผลให้ผู้ป่วยเกิดโรคโลหิตจางจากขาดธาตุเหล็กในผู้ป่วยเลือดออกในทางเดินอาหารส่วนต้นเฉียบพลัน

วิธีการศึกษา: ศึกษาข้อมูลย้อนหลังจากเวชระเบียนผู้ป่วยในที่นอนโรงพยาบาลด้วยเลือดออกในทางเดินอาหารส่วนต้นและมีโลหิตจางร่วมด้วย ระหว่าง พ.ศ. 2559-2562

ผลการศึกษา: จากผู้ป่วย 867 คน มี 180 คน (ร้อยละ 20.8) ที่ได้รับการตรวจสถานะธาตุเหล็ก ในกลุ่มผู้ป่วยนี้ 108 คน (ร้อยละ 60.0) มีโรคโลหิตจางจากขาดธาตุเหล็ก โดยปัจจัยที่ทำให้มีการส่งตรวจสถานะธาตุเหล็ก ได้แก่ โรคกล้ามเนื้อหัวใจขาดเลือด (aOR 3.88, p=0.001), การใช้ยาต้านอักเสบชนิดที่ไม่ใช่สเตียรอยด์ (aOR 1.56, p=0.03), การใช้ยาสมุนไพร (aOR 2.84; p=0.01), และเม็ดเลือดแดงขนาดเล็ก (aOR 1.52; p=0.03) ส่วนปัจจัยที่ทำให้ไม่มีการส่งตรวจ ได้แก่ อายุที่มากขึ้น (aOR เพิ่มขึ้น 0.984 สำหรับทุกๆ 1 ปี, p=0.01), เลือดออกจากเส้นเลือดดำโป่งพอง (aOR 0.14, p<0.001) และ AIMS65 score มากกว่า 2 คะแนน (aOR 0.69, p=0.002) นอกจากนี้พบว่า เพศหญิง (aOR 2.69, p=0.05), และเม็ดเลือดแดงขนาดเล็ก (aOR 2.00, p=0.04) เป็นปัจจัยที่มีผลต่อการเป็นโรคโลหิตจางจากขาดธาตุเหล็ก แต่โรคเบาหวานเป็นปัจจัยที่ป้องกันการเกิดโรค (aOR 0.32, p=0.001).

สรุป: การตรวจสถานะธาตุเหล็กในผู้ป่วยเลือดออกในทางเดินอาหารส่วนต้นและมีโลหิตจางยังน้อย ในขณะที่พบโรคโลหิตจากจากขาดธาตุเหล็กมากในผู้ป่วยที่ได้รับการตรวจ งานวิจัยนี้ชี้ให้เห็นถึงความสำคัญในการตรวจสถานะธาตุเหล็กและปัจจัยของการเกิดโรคโลหิตจากการขาดธาตุเหล็กเพื่อเป็นแนวทางในการรักษาโลหิตจางในผู้ป่วยผู้ป่วยเลือดออกในทางเดินอาหารส่วนต้น

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ClinicalTrials.gov Identifier, NCT06299007

ABSTRACT

BACKGROUND: Data on iron status assessment and iron deficiency anemia (IDA) prevalence in acute upper gastrointestinal bleeding (UGIB) are limited.

OBJECTIVES: In this study, we aimed to investigate iron status assessment and prevalence of IDA and its associated factors in patients with anemia hospitalized for acute UGIB.

METHODS: We retrospectively reviewed the medical records of patients with endoscopically confirmed UGIB who were admitted between January 2016 and December 2019 and presented with anemia upon admission. The outcomes were iron status measurement and IDA incidence. A logistic regression model was used to determine the factors affecting outcomes.

RESULTS: Among the 867 patients, 180 (20.8%) were evaluated for iron status. Of these patients, 108 (60.0%) had IDA. Factors of iron status assessment were ischemic heart disease (adjusted odds ratio [aOR] 3.88, *p*=0.001), non-steroidal anti-inflammatory drug use (aOR 1.56, *p*=0.03), traditional medicine use (aOR 2.84; *p*=0.01), and mean corpuscular volume (MCV) <80 fL (aOR 1.52, *p*=0.03), however, older age (aOR increased 0.984 for every 1 year; *p*=0.01), variceal bleeding (aOR 0.14; *p*<0.001) and AIMS65 score >2 (aOR 0.69, *p*=0.002) were intervening factors for iron status assessment. Female sex (aOR 2.69, *p*=0.05) and MCV <80 fL (aOR 2.00, *p*=0.04) were independent risk factors for IDA, but diabetes mellitus was a protective factor for IDA (aOR 0.32, *p*=0.001).

CONCLUSIONS: Iron status assessment among patients with acute UGIB and anemia was low, while the incidence of IDA was high. Our results indicate the importance of evaluating iron status and factors associated with IDA to improve the management of anemia secondary to acute UGIB.

KEYWORDS: iron status, iron deficiency, upper gastrointestinal bleeding, anemia

ClinicalTrials.gov Identifier, NCT06299007

INTRODUCTION

Upper gastrointestinal bleeding (UGIB) is a common disorder worldwide that usually requires hospitalization and urgent management. Anemia is a major consequence of gastrointestinal bleeding, and most patients with acute UGIB require blood transfusion during admission[1]. Iron deficiency anemia (IDA) occurs in up to 60% of the patients with acute UGIB[2]; however, iron status assessments are not routinely performed. Undetected IDA during admission leads to suboptimal treatment and consequently, post-discharge uncorrected anemia.

In general, the symptoms of anemia are non-specific and may include dizziness, fatigue, and reduced cognitive function or quality of life. In severe cases, anemia may result in hospitalization, exacerbate pre-existing disorders (e.g., heart failure), and even mortality[3]. In contrast, post-discharge UGIB-related anemia is associated with a risk for rebleeding and mortality[4]. However, recommendations regarding the assessment and treatment of gastrointestinal bleeding-associated IDA are scarce owing to limited studies[5-8], indicating a gap in knowledge in this area.

To address this gap, we aimed to investigate the evaluation of iron status among patients with anemia who were hospitalized because of acute UGIB to underscore the pinpoint area of concern in the diagnosis of IDA in these cases. We also evaluated the incidence and predictive factors of IDA.

METHODS

Study design

This retrospective observational study was performed at a tertiary care academic center at Hatyai Hospital, Songkhla Province, Thailand. This study was based on the medical records of patients admitted to the inpatient department of Hatyai Hospital between January 2016 and December 2019. The study protocol was reviewed and approved by the Institutional Review Board of Hatyai Hospital (protocol number HYH EC 052-66-01), and the requirement for informed consent was waived. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient population

Patients >18 years of age who were admitted because of acute UGIB and diagnosed with anemia from UGIB during hospitalization were included. UGIB was defined as the presentation of overt signs of UGIB, including hematemesis, coffee-ground vomiting, melena, or hematochezia, with subsequent confirmation of the diagnosis after a diagnostic endoscopic workup by a gastroenterologist. Patients who had previously undergone endoscopy at another institution before admission, had a definite cause of UGIB that was inconclusive, or incomplete data for analysis were excluded. (Figure 1)

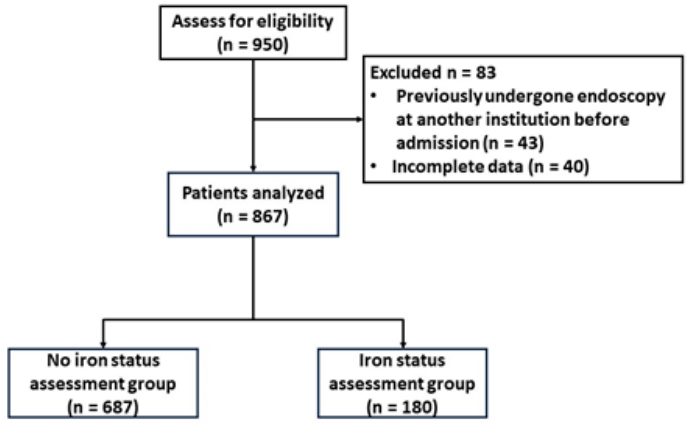

Figure 1 Flowchart of patient's selection in the study

Data collection

We retrospectively documented patient data collected from computerized medical records. Data on the following variables were collected from each patient: age, sex, clinical presentation, comorbidities, current medications, initial vital signs, and laboratory reports throughout admission. The pre-endoscopic severity of UGIB was evaluated using the Glasgow-Blatchford score (GBS) and AIMS65 score[9-11]. The GBS was calculated using sex, blood urea level, hemoglobin level, initial systolic blood pressure, heart rate, presentation of melena, syncope, cardiac failure, and history of hepatic disease. AIMS65 score was based on albumin levels, prothrombin time, international normalized ratio (INR), altered mental status, systolic blood pressure, and age.

Outcomes and definitions

The primary outcome was iron status measurement during admission among patients hospitalized for acute UGIB. The secondary outcome was IDA incidence. We also determined the predictive factors that influenced physicians to evaluate the iron status and IDA occurrence in these patients.

Shock was defined as a heart rate >100 beats/min with a calculated mean arterial pressure <65 mmHg or inotrope use. Anemia was defined in accordance with the World Health Organization definition: hemoglobin levels <12 g/dL in women and <13 g/dL in men[12]. Microcytosis was defined as a mean corpuscular volume (MCV) <80 fL. IDA was diagnosed in patients with anemia who had serum ferritin <30 µg/L and/or transferrin saturation <16%.

Statistical analysis

Categorical variables are presented as frequency statistics and were tested for significant differences using Pearson's chi-squared or Fisher's exact test, as appropriate. Continuous variables are presented as mean with standard deviation (SD) and mean with interquartile range (IQR), and significant differences were determined using Student's t-test and Wilcoxon rank-sum test, as appropriate. Logistic regression models were used to examine the relationships between demographic data and primary and secondary outcomes. After univariate analysis, the variables with $p<0.1$ were included in the multivariate analysis (using backward stepwise selection method). All analyses were performed using Stata Statistical Software (Version 15.1; StataCorp LLC, College Station, TX, USA). Statistical significance was set at $p<0.05$ in all analyses.

RESULTS

Patient population

A total of 867 patients who were admitted for acute UGIB and developed anemia during admission were included in this study (Fig 1). The mean age was 59.7±15.4 years, and most patients were male (78.9%). According to the endoscopic findings, 607 (70.0%) patients had non-variceal bleeding and 260 (30.0%) had variceal bleeding. Moreover, approximately 20% of the patients had prior episodes of acute UGIB.

Iron status assessment and associated factors

Among the patients with anemia, iron status was not assessed in 687 (79%) patients, whereas it was assessed in 180 (21%). Demographic and clinical data and comparisons between patients with and without iron status assessments are summarized in Table 1. Patients without an iron status assessment were older than those with an iron status assessment (60.2±15.1 vs. 57.6±16.4, $p=0.004$), had more incidence of shock at presentation (12.7% vs. 3.3%, $p<0.001$) had more frequent variceal bleeding (36.5% vs. 5%, $p<0.001$) and more frequent underlying cirrhosis (31.3% vs. 12.2%, $p<0.001$). In the

laboratory tests, patients without iron status assessment had more microcytosis (12.7% vs. 3.3%, $p<0.001$) and higher INR (1.4±0.7 vs. 1.3±0.5, $p<0.001$) than those with iron status assessment. Similarly, the AIMS65 score was higher in patients who did not undergo iron status assessment [median (interquartile range, IQR); 1 (1-2) vs. 1 (0-1), $p<0.001$). In contrast, patients who underwent iron status assessment had an underlying ischemic heart disease more frequently (7.2% vs. 2.3%, $p=0.004$). The use of non-steroidal anti-inflammatory drugs (NSAIDs), clopidogrel, and traditional medicines was also higher in patients who underwent iron status assessment than in those who did not, 33.9% vs. 17.5% ($p<0.001$), 4.4% vs. 1.6% ($p=0.04$) and 8.2% vs. 2.8% ($p=0.001$), respectively. In the laboratory tests, platelet count and albumin levels were higher in patients who underwent iron status assessment than in those who did not: median (IQR); 229 (166-304) $\times 10^3/\mu L$ vs. 164 (91-238) $\times 10^3/\mu L$ ($p<0.001$), and 3.3±0.6 vs. 2.9±0.6 ($p<0.001$), respectively.

Logistic regression analysis was performed to identify the factors of iron status assessment (Table 2). On multivariate analysis, ischemic heart disease (adjusted odds ratio [aOR] 3.88; 95% confidence interval [CI] 1.70-8.84, $p=0.001$), NSAIDs use (aOR 1.56; 95% CI 1.04-2.34, $p=0.03$), traditional medicine use (aOR 2.84; 95% CI 1.31-6.14, $p=0.01$), microcytosis (aOR 1.52; 95% CI 1.05-2.22, $p=0.03$) were independent factors of iron status assessment; however, older age (aOR 0.984 for every 1 year increase; 95% CI 0.972-0.996, $p=0.01$), variceal UGIB (aOR 0.14; 95% CI 0.07-0.28, $p<0.001$), and AIMS65 score >2 (aOR 0.69; 95% CI 0.55-0.88, $p=0.002$) were intervening factors for iron status assessment.

IDA and its associated factors

Among 180 of patients who underwent iron status assessment, 108 (60%) were found to have IDA. Based on endoscopy, there were no significant differences in terms of endoscopic findings between the two groups (Table 3). Nonetheless, upper GI malignancy trends to be found in IDA group more than in another group. We additionally performed subgroup analysis stratified by sex, the endoscopic findings were not significantly different between the two groups in neither male nor female participants.

Multivariate analysis identified that female sex (aOR 2.69; 95% CI 1.01-7.03, $p=0.05$), and microcytosis (aOR 2.00; 95% CI 1.03-3.90, $p=0.04$) were independent risk factors for IDA, but diabetes mellitus was a protective factor for IDA (aOR 0.32; 95% CI 0.14-0.77, $p=0.001$) (Table 4).

Table 1 Baseline demographic data.

Variable	Total (n=867)	No iron status assessment group (n=687)	Iron status assessment group (n=180)	*p*-value
Male sex, n (%)	684 (78.9)	538 (78.3)	146 (81.1)	0.47
Age (years), mean±SD	59.7±15.4	60.2±15.1	57.6±16.4	0.004
Body mass index (kg/m^2): mean±SD	23.1±4.6	23.1±4.6	23.2±5.0	0.92
Syncope, n (%)	302 (34.8)	239 (34.8)	63 (35.0)	1.00
Presence of shock, n (%)	93 (10.7)	87 (12.7)	6 (3.3)	<0.001
Variceal bleeding, n (%)	260 (30)	251 (36.5)	9 (5)	<0.001
Previous history of gastrointestinal bleeding, n (%)	176 (20.7)	146 (21.3)	30 (16.7)	0.21
Co-morbidity, n (%)				
Hypertension	270 (31.1)	208 (30.3)	62 (34.4)	0.28
Cirrhosis	237 (27.4)	215 (31.3)	22 (12.2)	<0.001
Diabetic mellitus	168 (19.4)	135 (19.7)	33 (18.3)	0.75
Dyslipidemia	96 (11.1)	72 (10.5)	24 (13.3)	0.29
Chronic kidney disease	76 (8.8)	64 (9.3)	12 (6.7)	0.30
Cerebrovascular disease	47 (5.4)	35 (5.1)	12 (6.7)	0.46
Ischemic heart disease	29 (3.3)	16 (2.3)	13 (7.2)	0.004
COPD	22 (2.5)	17 (2.5)	5 (2.8)	0.79
CHF	8 (0.9)	8 (1.2)	0 (0)	0.27
Medication, n (%)				
Non-steroidal anti-inflammatory drug	181 (20.9)	120 (17.5)	61 (33.9)	<0.001
Aspirin and/or clopidogrel	72 (8.3)	53 (7.7)	19 (10.6)	0.23
Aspirin	64 (7.4)	48 (7.0)	16 (8.9)	0.42
Clopidogrel	19 (2.2)	11 (1.6)	8 (4.4)	0.04
Proton pump inhibitor	67 (7.7)	55 (8.0)	12 (6.7)	0.64
Traditional medicine	35 (4.0)	19 (2.8)	16 (8.2)	0.001
Warfarin	23 (2.7)	18 (2.6)	5 (2.8)	0.80
Corticosteroid	11 (1.3)	8 (1.2)	3 (1.7)	0.71
Laboratory				
Hemoglobin (g/dL): mean±SD	7.8±2.4	7.8±2.3	7.1±2.6	0.58
MCV: mean±SD	83.7±10.5	84.4±10.3	80.8±10.7	<0.001
Microcytosis (MCV<80 fL), n (%)	93 (10.7)	87 (12.7)	6 (3.3)	<0.001
Platelet count (×103/μL): median [IQR]	177 [101-254]	164 [91-238]	229 [166-304]	<0.001
Albumin (mg/dL): mean±SD	3.0±0.6	2.9±0.6	3.3±0.6	<0.001
International normalized ratio: median: mean±SD	1.4±0.7	1.4±0.7	1.3±0.5	<0.001
Serum creatinine (mg/dL): median [IQR]	1.0 [0.8-1.4]	1.0 [0.8-1.4]	1.0[0.8-1.3]	0.83
Scoring system				
Glasgow-Blatchford score: mean±SD	10.6±3.6	10.7±3.6	10.3±3.4	0.23
AIMS65: median [IQR]	1 [1-2]	1 [1-2]	1 [0-1]	<0.001

CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; MCV, mean corpuscular volume; SD, standard deviation

Table 2 Factors of iron status assessment.

Variable	Univariate analysis			Multivariate analysis*		
	COR	95% CI	*p*-value	aOR	95% CI	*p*-value
Female sex	0.84	0.56-1.27	0.41	-	-	-
Age added every 1 year	0.989	0.979-0.999	0.045	0.984	0.972-0.996	0.01
Presence of shock	0.24	0.10-0.55	0.001	0.41	0.16-1.06	0.07
Variceal bleeding	0.09	0.05-0.18	<0.001	0.14	0.07-0.28	<0.001
Cirrhosis	0.31	0.19-0.49	<0.001	-	-	-
Ischemic heart disease	3.27	1.50-6.92	0.002	3.88	1.70-8.84	0.001
NSAIDs	2.42	1.68-3.49	<0.001	1.56	1.04-2.34	0.03
Clopidogrel	2.86	1.13-7.22	0.03	-	-	-
Traditional medicine	3.43	1.73-6.82	<0.001	2.84	1.31-6.14	0.01
Microcytosis	1.77	1.26-2.47	0.001	1.52	1.05-2.22	0.03
Thrombocytopenia	0.31	0.20-0.46	<0.001	0.65	0.40-1.04	0.07
Albumin level elevated every 1 g/dL	2.54	1.90-3.39	<0.001	-	-	-
INR elevated every 1 unit	0.31	0.17-0.55	<0.001	-	-	-
AIMS65 >2	0.25	0.12-0.53	<0.001	0.69	0.55-0.88	0.002

*using backward stepwise selection method

COR, Crude odds ratio; aOR, Adjusted odds ratio; CI, Confidence interval

NSAIDs, non-steroidal anti-inflammatory drugs; INR, international normalized ratio; OR, odds ratio; Microcytosis: mean corpuscular volume <80 fL; Thrombocytopenia: platelet counts < 140,000 /μL

Table 3 Endoscopic findings in patients with iron status assessment

Variable	IDA group (n=108)	No IDA group (n=72)	*p*-value
Variceal bleeding, n (%)	4 (3.7)	5(6.9)	0.49
Ulcer, n (%)			
Esophageal ulcer	6 (5.6)	4 (5.6)	1.00
Gastric ulcer	60 (55.6)	33 (45.8)	0.23
Duodenal ulcer	32 (29.6)	27 (37.5)	0.33
Ulcer with high-risk stigmata, n (%)	19 (17.6)	14 (19.4)	0.85
Helicobacter pylori infection, n (%)	31 (33.3)	27 (43.5)	0.24
Mallory-Weiss tear, n (%)	4 (3.7)	5 (6.9)	0.90
Gastritis, n (%)	19 (17.6)	9 (12.5)	0.41
Duodenitis, n (%)	3 (2.8)	2 (2.8)	1.00
Malignancy, n (%)	6 (5.6)	0 (0.0)	0.08
Dieulafoy's lesion, n (%)	0 (0.0)	2 (2.8)	0.16

IDA, iron deficiency anemia

Table 4 Factors associated with iron deficiency anemia.

Variable	Univariate analysis			Multivariate analysis*		
	COR	95% CI	*p*-value	aOR	95% CI	*p*-value
Female sex	3.10	1.27-7.56	0.01	2.69	1.01-7.03	0.05
Age added every 1 year	1.01	0.99-1.03	0.35	1.00	0.98-1.03	0.80
Syncope	2.40	1.24-4.66	0.01	1.50	0.63-3.60	0.36
Diabetes mellitus	0.42	0.19-0.90	0.03	0.32	0.14-0.77	0.001
NSAIDs	1.78	0.93-3.41	0.08	1.33	0.65-2.73	0.44
Traditional medicine	3.15	0.86-11.47	0.08	3.07	0.74-12.69	0.12
Severe anemia	2.08	1.13-3.81	0.02	1.40	0.62-3.15	0.42
Microcytosis	2.08	1.12-3.85	0.02	2.00	1.03-3.90	0.04

*using backward stepwise selection method

COR, Crude odds ratio; aOR, Adjusted odds ratio; CI, Confidence interval

NSAIDs, non-steroidal anti-inflammatory drugs; Severe anemia, Hb <8 g/dL; Microcytosis, mean corpuscular volume <80 fL.

DISCUSSION

The issue of IDA in patients with acute gastrointestinal bleeding has been attracting increasing attention; however, data on its prevalence are lacking. Previous studies have claimed that this problem is underdiagnosed, necessitating the resolution of this unmet need[13]. The key findings of our study were as follows: first, a small number of patients hospitalized with acute UGIB were further investigated for iron status; second, although there have not been many investigations, we found that these patients frequently had IDA; and third, microcytosis played an important role in both investigating the iron status and predicting IDA.

In our retrospective study, we found that only 21% of the patients hospitalized for acute UGIB with anemia were further investigated for iron status and 60% of the patients had IDA. Thus, IDA is prevalent in patients with gastrointestinal bleeding; however, IDA assessment among these patients is low. Our study results correspond with those of El-Halabi et al.'s study in the United States, in which only 30% of the patients were evaluated for iron status, and nearly all of these patients were found to have IDA[13]. We postulated that, unlike patients with other acute bleeding conditions, those with UGIB usually experience occult bleeding from pre-existing mucosal lesions (especially peptic ulcer cases) prior to the acute episode of gastrointestinal bleeding leading to hospital admission, resulting in a high incidence of IDA in these populations. Without ferrous supplementation, approximately 70% of the patients with acute UGIB continued to exhibit anemia after admission, and more than half of those who received standard medical treatment without iron supplementation showed persistent iron depletion at 6 weeks after discharge.[14,15]

According to our data, the underlying disease of ischemic heart disease is more likely to be investigated for iron status assessment. This correlation may be due to the antiplatelet therapy prescribed for these patients. The association of antiplatelet therapy, especially aspirin administration, with UGIB has been well established in gastric damage resulting in IDA[16,17]. Similarly, the use of NSAIDs and traditional medications (widely used in Thailand without medical indications) that have a steroid component are common risk factors of gastrointestinal bleeding[18,19]. These factors can explain why physicians evaluate the presence of IDA

in patients who use this medicine. Nonetheless, clopidogrel was not a factor of iron status assessment in multivariate analysis, which may be explained by an extremely small population.

Notably, microcytosis, a red blood cell index in the complete blood count (CBC), is used for the inspection of iron status. Low hemoglobin with low MCV, as categorized in the group of microcytic anemia, is the initial finding in routine CBC that is considered for further investigation of IDA; however, low hemoglobin with normal MCV cannot exclude IDA because of the possibility of combined etiologies of anemia such as anemia of inflammation and megaloblastic anemia[20]. According to Johnson-Wimbley et al., approximately 40% of patients with IDA exhibit normocytosis[21]. Further, a study by Joosten et al. showed that the average MCV in patients with IDA was 82 fL[22].

Gastrointestinal bleeding-related death is usually associated with host-specific factors (particularly coexisting medical illnesses) and bleeding severity. Patients experiencing acute variceal gastrointestinal bleeding present with severe exsanguinating bleeding or hemorrhagic shock, and those identified to be at high-risk for poor outcomes[11] (including older patients and those with higher pre-endoscopic score [AIMS65>2]) have a higher probability of intensive care unit admission[23]. During this admission, the physicians strive for prompt resuscitation and close monitoring of these patients, including a higher blood transfusion rate, resulting in an assumption of iron status assessment or considering it as a less important test. Thus, post-discharge iron status assessment is necessary in this patient population. Despite the lack of significant differences in endoscopic findings between the IDA group and the non-IDA group, the prevalence of malignancy was notably higher within the IDA group. This observation may be attributed to the fact that individuals with upper gastrointestinal malignancies often experience occult or unrecognized blood loss prior to hospital admission, coupled with suboptimal nutrition, leading to iron depletion

In terms of factors associated with iron depletion, women had higher levels of IDA than men. These populations could have included a number of women of reproductive age who may have had coexisting conditions that increase the risk for iron deficiency in view of menstrual blood loss. Furthermore, the fact that the total amount of body iron stores in women is lower than that in men[24], it could be a possible determinant for women being more prone to iron deficiency than men in cases of acute UGIB. Microcytosis was an important factor associated with iron depletion in this study. Thus, IDA is a potential causative agent of microcytosis. Morphological abnormalities (microcytosis and hypochromia) due to a lower amount of hemoglobin are seen in the peripheral blood in patients with increasing severity of IDA. Diabetes mellitus seems to be a protective factor for iron depletion in acute UGIB conditions. It is difficult to explain this finding because of the lack of evidence on this issue. Diabetes can contribute to IDA by interfering with the intestinal absorption of iron and causing diabetic complications[25,26]. To address this quest, future trials with more detailed design and large sample size are needed.

Our study has some limitations. First, the patients were retrospectively reviewed, and the data collection via medical records may have had missing data, resulting in bias. Second, this was a single-center study, and the results may not be generalizable to other populations.

In conclusion, iron status assessment in patients with acute UGIB is low; however, the incidence of IDA among these patients is high.

In particular, with the wide adoption of a restrictive transfusion strategy in general practice, we believe that IDA tends to be a more important concern in patient management because of its probability for increasing prevalence, especially in female individuals and those with microcytosis, which are independent factors of IDA according to our study. We hope that this result will aid physicians in developing treatment strategies for post-discharge acute UGIB-associated anemia.

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