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Diagnostic yield of esophagogastroduodenoscopy in upper gastrointestinal bleeding in pediatrics: a cross-sectional study at a tertiary center

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Abstract

Background Esophagogastroduodenoscopy (EGD) is currently considered the first-line diagnostic procedure of choice for upper gastrointestinal bleeding (UGIB); however, the etiology of bleeding remains unknown in a subset of patients. This study aimed to evaluate the diagnostic yield of EGD in UGIB in pediatrics and determine the clinical predictors for positive endoscopic diagnosis.

Methods A cross-sectional study was conducted at the pediatrics endoscopy unit, Ain Shams University, Cairo, Egypt, where 100 children were included. They were referred for EGD due to overt UGIB in the form of hematemesis and/or melena. Full medical history, thorough physical examination, laboratory investigations, and endoscopic and histopathologic findings were documented.

Results Forty-seven males and 54 females were included. Their ages ranged from 3 months to 15 years, with a median age of 4 years. Sixty-five percent presented with hematemesis only, 7% presented with melena only, and 28% presented with hematemesis and melena. An endoscopic diagnosis could be reached in 62% of cases, with *Helicobacter pylori* (*H. pylori*) gastritis (23%) and reflux esophagitis (11%) as the most common endoscopic diagnoses, with the former being the most common in children above 4 years and the latter for younger ones. Other diagnoses included non-specific gastritis (8%) and esophageal varices (4%). Presentation with melena only was a negative predictor to reach a diagnosis by EGD, while splenomegaly and thrombocytopenia were independent predictors of variceal bleeding.

Conclusion EGD is the investigation of choice in children suffering from hematemesis especially in older age groups. Clinical and laboratory parameters might help in the prediction of the underlying etiology.

Keywords Pediatrics, Child, Hematemesis, Melena, Esophageal and gastric varices, Endoscopy, Gastrointestinal hemorrhage

What is already known?

- The etiology of upper gastrointestinal bleeding is variable based on geographic distribution.
- Appropriately trained pediatric therapeutic endoscopists and well-equipped units are scarce, so clinical prediction of etiology may help triaging of patients.

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- The Sheffield score is the only available pediatric scoring system to predict the need for interventional endoscopy and is not validated properly.

What does this study add?

- In Egypt, esophagitis is the most common cause of upper gastrointestinal bleeding in children younger than 4 years, while gastritis is the most common cause for older children.
- Splenomegaly and thrombocytopenia are independent predictors of varices.
- The Sheffield score has good sensitivity and specificity; however, the positive predictive value was low.

Background

Upper gastrointestinal bleeding (UGIB) is defined as bleeding within the intraluminal gastrointestinal tract from any location between the upper esophagus to the duodenum at the ligament of Treitz [1].

Gastrointestinal bleeding (GIB) during infancy and childhood is common and accounts for up to 20% of referrals to pediatric gastroenterologists [2].

In patients who present with UGIB, a broad differential diagnosis must be considered based on the patient age and symptomatology [3]. Esophagogastroduodenoscopy (EGD) is currently considered the first-line diagnostic procedure for UGIB [4]. Despite the routine use of EGD in pediatric GIB, there are no large series in children [2].

Experience in different countries indicates the variation in the frequency of different causes of GIB in children, and this can be attributed to many factors including lifestyle, quality of health, nutritional habits, and geographical conditions [5].

The application of life-saving endoscopic therapy is further complicated by the wide variability in the availability of appropriately trained pediatric therapeutic endoscopists and the availability of units with the adequate and appropriate equipment, and thus, the Sheffield scoring system to predict the need for interventional endoscopy was suggested [6].

Triaging patients with UGIB and predicting their etiology is of outmost importance for proper liaison with smaller centers for referral. This study aimed to evaluate the diagnostic yield of EGD in UGIB in pediatrics and determine the clinical predictors for positive endoscopic diagnosis as a primary objective to help in selecting children suitable for endoscopy as an initial step in diagnostic workup. The secondary objective is to evaluate the accuracy of the Sheffield score in predicting the need for interventional endoscopy.

Methods

Type of study: a cross-sectional study which included

- Patients referred for EGD due to overt UGIB in the form of hematemesis (vomiting of blood) and/or melena (black tarry stool) and
- Aged between 1 month and 18 years

Exclusion criteria consisted of those

- Patients with a known systemic cause of bleeding,
- Patients receiving anticoagulants, and
- Patients already diagnosed with a cause of UGIB (for example, peptic ulcer, portal hypertension, Crohn's disease)

Sample size

Using the PASS 11 program for sample size calculation and according to Cleveland et al. [7], the expected yield of endoscopy for diagnosis of etiology of upper GI bleeding=57%, setting margin of error at 10%, and confidence level at 95%, the sample size of at least 95 patients was needed. The sample size was calculated to be 100 patients. Each patient included in this study was subjected to:

1. Detailed medical history taking with special emphasis on sociodemographic characteristics including age, sex, order of birth, residence, and consanguinity of parents; medical history for known extra-gastrointestinal medical conditions, analysis of UGIB including the form of bleeding (hematemesis and/or melena), onset, course, duration, amount as described by patients, and color (coffee ground or fresh red in case of hematemesis); need for blood transfusion; associated symptoms (abdominal pain, vomiting, weight loss, arthritis, arthralgia, or fever); other sites of bleeding; history of recent febrile illness; drug history including non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and anti-epileptic medications; and family history of bleeding disorders or GI diseases
2. Thorough clinical examination included the following: vital data on presentation including heart rate and blood pressure, and their values were compared with the normal range according to age based on Pediatric advanced life support guidelines, 2015 [8]; capillary refill time was also recorded; anthropometric measurements included body weight, length or height, and body mass index; and skin examination for the presence of ecchymosis or purpura and

abdominal examination searching for epigastric tenderness or organomegaly
3. Laboratory investigations: complete blood count (CBC) and Hgb level in grams per deciliter where anemia was diagnosed and classified into mild, moderate, and severe according to Chaparro et al. [9]
4. Applying the Sheffield scoring system which includes a combination of clinical and laboratory parameters: amount of bleeding, vital data, level of hemoglobin drop, and need for resuscitation and/or blood transfusion. If the total score exceeds 8 points, it predicts the need for therapeutic intervention [6]
5. Radiology: pelvi-abdominal ultrasound with portal vein Doppler in patients suspected to have portal hypertension (organomegaly, history of liver disease)
6. EGD (using Pentax EPK-*i*5000) which was performed by expert pediatric endoscopists under general anesthesia, with a comment on the esophagus, stomach, and duodenum. Esophagitis was graded according to the Los Angeles classification [10] and gastritis and duodenitis were graded according to the Lanza Scoring system [11]. During endoscopy, multiple biopsies were taken from the esophagus, stomach, and duodenum, even in the absence of gross abnormalities, because the risks of sedation and performing repeat endoscopy in pediatric populations are considered to outweigh the risks of obtaining biopsy specimens [12]
7. Histopathology: for diagnosis and grading of esophagitis, gastritis, duodenitis, or a combination of any of these.

Statistical analysis

Data were collected, revised, coded, and entered into the Statistical Package for Social Science version 23. The quantitative data were presented as mean, standard deviation, and range in case of parametric data and median and inter-quartile range (IQR) when data was found to be non-parametric. Also, qualitative variables were presented as numbers and percentages.

The comparison between groups regarding qualitative data was done by using the chi-square test and/or Fisher exact test while the comparison between two groups was done by using an independent *t*-test or Mann-Whitney test. The comparison between more than two groups was done by using the one-way ANOVA test or the Kruskal-Wallis test. Univariate and multivariate logistic regression analysis was used to assess factors associated with the diagnosis. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *P* value was considered significant as the following: *P* value < 0.05 is considered significant (S).

Results

The study included 100 children, 47 males and 53 females. Their ages ranged between 3 months and 15 years with a median age of 4 years. Hematemesis was present in 65%, melena in 7%, and both in 28%. Duration of bleeding had a median range of 4 weeks. The median frequency was 3 times ranging from 1 to 10 times. The amount of bleeding was considered large by parents in 37%, 21 patients required blood transfusion, and 5 patients needed more than one transfusion. The Sheffield score exceeded 8 points in 24%.

Abdominal pain was the most common associated symptom which was epigastric in 25% of cases and generalized in 32% of cases. Vomiting and fever were the next common associated symptoms, with a percentage of 41% and 33%, respectively. Nasal bleeding was found in 1% and fresh bleeding per rectum was described in 12%. Comorbidities were present in 13% of the patients (cerebral palsy, beta thalassemia, congenital heart disease, and others). History of drug intake was positive in 11 patients (6% non-steroidal anti-inflammatory drugs (NSAIDs), 4% antiepileptics, and 1% steroids). One patient had a family history of peptic ulcer disease, and another had a family history of gastric cancer.

On examination, nine patients were hemodynamically unstable. Epigastric tenderness was felt in 38 patients and hepatosplenomegaly was felt in 4 patients and one patient had splenomegaly alone. Most of patients had normal growth parameters, with 9% being underweight and 3% having stunting.

Anemia was present in 60% of patients and was moderate in 31% and severe in 9%. Mean hemoglobin was 10.51 $\pm$ 2.21 g/dL, ranging from 3.9 to 15 g/dL. Thrombocytosis was present in 14% and thrombocytopenia in 2%.

The EGD showed a source of bleeding in 62%. The source of bleeding was localized to the esophagus in 18%, stomach in 25%, duodenum in 7%, and gastroduodenal in 12%. The most common diagnoses were gastritis in 31% (*H. pylori*-related in 23 and non-specific in 8%) and gastro-esophageal reflux disease (GERD) in 13% (with significant hiatus hernia in 2%). Variceal bleeding was found in 4% and other causes are shown in Fig. 1. Table 1 shows the distribution of endoscopic diagnoses according to age groups.

During endoscopy, therapeutic interventions were performed in 7 patients (7%) including esophageal band ligation (4), removal of foreign body (1), argon laser photocoagulation (1), and endoclip insertion for duodenal ulcer (1). Histopathologic examination of endoscopic biopsies confirmed the endoscopic diagnosis in 79% and added a diagnosis in 21%.

Patients who had a positive endoscopic diagnosis had a significantly higher median age (7 years) than

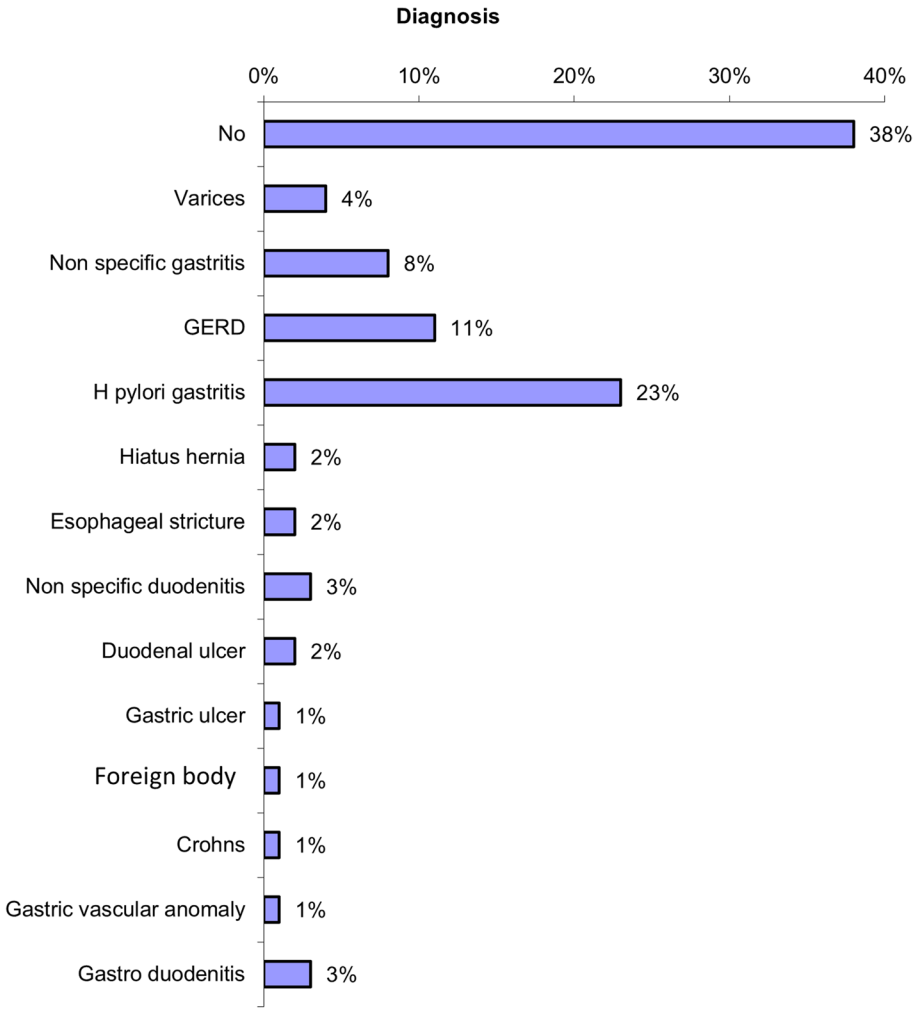

Fig. 1 Bar chart indicating the different diagnoses reached by endoscopy

Table 1 Endoscopic diagnoses according to age groups

Endoscopic diagnosis	1 month–4 years ($n = 35$) Freq (%)	Older than 4 years ($n = 65$) Freq (%)
Diagnostic yield	17 (48.6%)	47 (72.3%)
Reflux esophagitis	8 (22.8%)	8 (12.3%)
Varices	2 (5.7%)	2 (3.1%)
Gastritis	5 (14.3%)	27 (41.5%)
H. pylori gastritis	1 (2.9%)	21 (32.3%)
Non-specific gastritis	4 (11.4%)	6 (9.2%)
Duodenitis	2 (5.7%)	3 (4.6%)
Other causes		Gastro-duodenitis (6.1%), accidentally discovered foreign body (1.5%), gastric vascular malformation (1.5%), Chron's disease (1.5%)
No identifiable cause	18 (51.4%)	18 (27.7%)

children with a negative endoscopic diagnosis (2.75 years). Among all patients presenting with melena without hematemesis, no endoscopic diagnosis could be reached. Both findings were confirmed by univariate regression analysis. Comparisons between patients who reached a final diagnosis via EGD to those who had a negative diagnostic yield during EGD are presented in Table 2.

Among the above tested variables, univariate regression analysis for a positive endoscopic diagnosis showed that only age >4 years was associated with positive endoscopic findings (odds ratio 3.886, 95% confidence interval (1.632–9.254), *P* value=0.002); on the other hand, presenting with melena alone was a negative predictor to reach a diagnosis via EGD (odds ratio 0.073, 95% confidence interval (0.009–0.617), *P* value=0.016).

Comparisons were done between the most common causes of bleeding in our studied population, aiming to find predictors of such a diagnosis, and this is shown in Table 3. Patients with varices presented with both hematemesis and melena in all cases, and the amount of bleeding and rate of hemodynamic instability was much higher among them. On the other hand, age was much higher among those diagnosed with gastritis in comparison to varices or GERD.

Moreover, anemia was present in 100% of varices patients, 65% of GERD, 52% of *H. pylori* gastritis, and 12% of non-specific gastritis. Logistic regression analysis for factors associated with varices is shown in Table 4.

Finally, the use of the Sheffield score in determining the need for endoscopic intervention was validated, where it showed a sensitivity of 85.7%, a specificity of 80.6%, a positive predictive value of 25%, and a negative predictive value of 98.68%.

Discussion

Rates of endoscopic and histologic abnormalities from EGD vary based on age and indication for endoscopy, and this should be factored into the decision to proceed with initial endoscopy along with consideration of adverse event rates and effects of anesthesia [13].

The patients who reached a final diagnosis by EGD were only 62%. This diagnostic yield is much variable between studies ranging from 51% [14] to 90% [15], while in Gimiga et al. [16] and Cleveland et al. [7] a certain bleeding source was found in 34.95% and 57% of cases,

Table 2 Comparisons of clinical manifestations between patients with positive endoscopic diagnosis and negative diagnosis

		Diagnostic yield		Test value	*P* value
		Negative	Positive		
		No.= 38	No.= 62		
Age in years	Median (IQR)	2.75 (1–8)	7 (2.5–11)	−2.717[a]	0.007
	Range	0.5–14	0.25–15		
Gender	Male	18 (47.4%)	29 (46.8%)	0.003[b]	0.954
	Female	20 (52.6%)	33 (53.2%)		
Upper GI bleeding	Hematemesis	21 (55.3%)	44 (71.0%)	2.554[b]	0.110
	Melena	7 (18.4%)	0 (0.0%)	9.044[b]	0.003
	Both	10 (26.3%)	18 (29.0%)	0.086[b]	0.769
Drug intake (NSAIDS, antiepileptics, steroids)		3 (7.8%)	8 (12.9%)	0.6	0.43
Heart rate	Mean ± SD	107.21±19.55	101.97±21.70	1.217[c]	0.227
	Range	70—160	70—190		
Low blood pressure		3 (7.9%)	3 (4.8%)	0.390[b]	0.532
Prolonged capillary refill time (CRT)		3 (7.9%)	6 (9.7%)	0.091[b]	0.762
Blood transfusion related to bleeding	No	30 (78.9%)	49 (79.0%)	1.478[b]	0.831
	Once	7 (18.4%)	9 (14.5%)		
	Twice	1 (2.6%)	2 (3.2%)		
	3 or more times	0 (0.0%)	2 (3.2%)		
Abdominal pain	No	19 (50.0%)	24 (38.7%)	1.763[b]	0.414
	Epigastric	7 (18.4%)	18 (29.0%)		
	Generalized	12 (31.6%)	20 (32.3%)		
Epigastric tenderness		11 (28.9%)	27 (43.5%)	2.132[b]	0.144
Sheffield score	≤8 points	28 (73.7%)	48 (77.4%)	0.180[b]	0.671
	>8 points	10 (26.3%)	14 (22.6%)		

[a] Mann-Whitney test, [b]chi-square test, [c]independent *t*-test

Table 3 Comparisons between the 4 most common etiologies of UGI bleeding

Variables		Varices No. = 4	GERD No. = 11	Non-specific gastritis No. = 8	*H. pylori* gastritis No. = 23	Test value	*P* value
Age in years	Median (IQR)	3 (1.38–7.5)	9 (4.5–11.5)	9 (4.5–11.5)	12 (9–14)	18.920[a]	<0.001
	Range	0.75–11	1–13	1–13	2.5–15		
Upper GI bleeding	Hematemesis	0 (0%)	5 (62.5%)	5 (62.5%)	20 (87.0%)	14.260[b]	0.003
	Melena	0 (0%)	0 (0.0%)	0 (0.0%)	0 (0%)		
	Both	4 (100%)	3 (37.5%)	3 (37.5%)	3 (13.0%)		
Large amount		4 (100.0%)	1 (9.1%)	3 (37.5%)	5 (21.7%)	12.967[b]	0.005
Drug intake		1 (25%)	1 (9.1%)	2 (25%)	3 (12.9%)	5.591[b]	0.780
HR	Tachycardia	2 (50.0%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	15.244[b]	0.002
BP	Hypotension	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	10.733[b]	0.013
CRT	Prolonged	2 (50.0%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	15.244[b]	0.002
Pallor		2 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	21.955[b]	<0.001
Abdominal pain	No	2 (50.0%)	3 (37.5%)	3 (37.5%)	7 (30.4%)	12.085[b]	0.060
	Epigastric	1 (25.0%)	1 (12.5%)	1 (12.5%)	14 (60.9%)		
	Generalized	1 (25.0%)	4 (50.0%)	4 (50.0%)	2 (8.7%)		
Epigastric tenderness		1 (25.0%)	3 (27.3%)	2 (25.0%)	15 (65.2%)	7.109[b]	0.069
Hepatomegaly		0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (8.7%)	2.091[b]	0.554
Splenomegaly		2 (50.0%)	0 (0.0%)	0 (0.0%)	2 (8.7%)	10.405[b]	0.015
Hgb in g/dL	Mean ± SD	8.05 ± 1.82	12.64 ± 1.53	10.35 ± 1.86	11.55 ± 1.42	8.896[c]	<0.001
	Range	5.5–9.8	10.2–15	6.6–13.2	8.3–13.5		
Platelets	Thrombocytopenia	2 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	28.476[b]	<0.001
INR	Mean ± SD	1.22 ± 0.19	1.19 ± 0.08	1.07 ± 0.10	1.09 ± 0.09	3.792[c]	0.017
	Range	1–1.4	1.1–1.28	0.93–1.2	0.95–1.36		
Sheffield score	>8 points	4 (100.0%)	2 (25.0%)	2 (25.0%)	0 (0.0%)	27.327[b]	<0.001
PAUS	Not done	0 (0.0%)	2 (25.0%)	2 (25.0%)	11 (47.8%)	48.055[b]	<0.001
	Unremarkable	1 (25.0%)	6 (75.0%)	6 (75.0%)	10 (43.5%)		
	Splenomegaly	2 (50.0%)	0 (0.0%)	0 (0.0%)	1 (4.3%)		
	Hepatomegaly	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (4.3%)		
	Chronic portal vein thrombosis	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		

[a] Kruskal-Wallis test, [b]chi-square test, [c]one-way ANOVA test

a possible one in 39.81% and 29.7% of the patients, and no source was found in 25.24% and 11.4% and of cases, respectively. Meanwhile, a study by Dehghani et al. [17] and Hassoon et al. [18] stated that the causes of bleeding could not be ascertained in 20.5% and 30% of cases, respectively. In a Chinese multicenter study, the diagnostic yield was 71.9% [19]. Another study also was done in Saudi Arabia and showed that the overall yield of endoscopy was 75%; however, the yield was higher (91%) in children below 12 years of age [20].

This relatively low diagnostic yield of endoscopy in our results and variability among studies may be related to non-standardization of the time between the attack of hematemesis and the performance of endoscopy. Since we are a tertiary referral center for pediatric endoscopy, and we serve distant areas, so we do not have the luxury to perform the endoscopy in less than 48 h of the attack of UGIB in a subset of patients. It has been stated by

Table 4 Regression analysis for factors associated with varices

	P value	Odds ratio (OR)	95% C.I. for OR	
			Lower	Upper
Platelets (thrombocytopenia)				
Univariate	0.005	9.89	1.986	49.257
Multivariate	0.030	7.465	1.218	45.738
INR >1.12				
Univariate	0.035	12.158	1.197	123.491
HR (tachycardia)				
Univariate	0.018	12.714	1.548	104.406
Splenomegaly				
Univariate	0.003	31	3.195	300.746
Multivariate	0.031	20.233	1.314	311.540

some studies that bleeding source was more likely to be determined in children having EGDs within 48 h [7, 19].

In our study, the positive endoscopic diagnoses were gastritis (31%), esophagitis (15%), varices (4%), duodenitis (3%), gastro-duodenitis (3%), and duodenal ulcer (2%), while gastric ulcer, gastric vascular ectasia, accidentally discovered foreign body, and Crohn's disease represented 1% each.

In Western countries, the most common causes of UGIB are gastric and duodenal ulcers, esophagitis, gastritis, and varices, whereas in India, variceal bleeding is reported to be the most important cause of UGIB (reaching 31.7%) [4, 15]. In China, erosive gastritis and duodenal ulcers represented the first and second important causes of bleeding, respectively [19]. The most common causes of upper GI bleeding among patients from Iran were gastric erosions (28%), followed by esophageal varices (16%) in one study [17], while another study showed that erosive esophagitis was the most common diagnosis (40%) [21]. In Sudan, diagnoses included esophageal varices (16%), gastritis (7%), and hiatus hernia (6%) [14]. In Iraq, the most common causes of upper GI bleeding among all patients were esophageal varices (39%), followed by gastric erosions (19.6%) [18]. In Saudi, gastritis was the commonest cause of hematemesis (44%), followed by esophagitis (36%) [20].

The differences in the frequency of endoscopic diagnoses could be attributed to global geographical variations in the etiologies, where systematic reviews and meta-analysis involving the epidemiology of *H. pylori* infection show much variability between regions [22], as well as variations in the type of chronic liver disease [23], which may lead to the acquisition of esophageal and gastric varices and certain changes in the dietary patterns. The epidemiology of diseases also has changing trends necessitating reevaluation from time to time.

Age-related analysis for our patients placed reflux esophagitis at the first place in children less than 4 years (22.2%) and gastritis for those more than 4 years (41.5%).

Similarly, age-related analysis shows that esophagitis was a more common cause of hematemesis in the younger age group (45%) than gastritis in adolescents (30%) [20]. In another study, in infants, the most common reasons were esophagitis and Mallory-Weiss syndrome, and in older children, esophagitis, esophageal varices, Mallory-Weiss, gastric ulcers, and gastritis were common [24].

Predictors of positive yield and etiology

Age more than 4 years was a positive predictor to reach a diagnosis via endoscopy while the presence of melena alone without hematemesis was a negative predictor. Similarly, Bose and associates [25] found that endoscopy in infants with gastrointestinal bleeding had limited diagnostic benefit, while Yu and colleagues [19] stated that the diagnostic yield was higher among children suffering from hematemesis and melena than in those suffering from any of them separately.

Comparing the 4 main diagnoses reached by EGD, variceal bleeding has distinct features from other causes which can be potential predictors as younger age, anemia, thrombocytopenia, splenomegaly, presentation with combined hematemesis and melena with large amount of bleeding and indication for blood transfusion, and high Sheffield scores.

Pelvi-abdominal ultrasound was performed on 69% of our patients, and it was unremarkable in 81% of them, splenomegaly in 5 patients, hepatomegaly in 3 patients, and portal vein thrombosis in 1 patient only, while in Sabir and colleagues [26] ultrasound abdomen was performed in 70% of children who presented with hematemesis or abdominal pain, and 38% of those who had ultrasonographic abnormalities were found to have a cavernous transformation of the portal vein, whereas 19% had features of liver cirrhosis.

Searching for predictors to esophageal varices is important in low-facility settings, since the initial medical management may differ from non-variceal bleeding, in which vasoactive agents as octreotide infusion or even Sengstaken-Blakemore tube may be used for variceal bleeding in emergency department until the patient is transferred to a specialized center for endoscopy [27]. Our study showed that splenomegaly and thrombocytopenia were independent predictors of the presence of varices.

Thrombocytopenia as an independent predictor for variceal bleeding was shown in many studies [27–31], while other factors were also documented by other authors such as hypoalbuminemia [28], elevated INR and elevated bilirubin levels [27], Child-Pugh class B/C [29], spleen diameter [28–30], portal vein diameter [29], previous diagnosis of cirrhosis [27, 32], and signs of chronic liver disease [32]. They can assist in triaging children for endoscopy to identify esophageal varices [30]. If considering surveillance endoscopy, these variables help to determine the likelihood of varices and to triage for endoscopy [28].

In our study, the Sheffield scoring system was 100% sensitive to variceal bleeding. Sari and associates found that 90.0% of children with variceal bleeding had a Sheffield severity score of > 8. He also deduced that the Sheffield scoring as a predictor of endoscopy requirement had 90.0% sensitivity, 90.0% specificity, 81.8% positive predictive value, and 94.7% negative predictive value [33]; however, he had a much smaller sample size than our study.

Strengths and limitations

Our study was not retrospective, unlike most of the studies documenting the diagnostic yield.

Limitations include non-standardization of the time between the attack of bleeding and endoscopy; another point is that patients on NSAIDs were not referred to us in many situations so we could not get proper data about its relation to bleeding, because general practitioners usually advise parents to avoid NSAIDs in cases of minimal bleeding without further interventions.

Conclusions

Causes of UGIB vary depending on age, with esophagitis being the most common for younger children and gastritis being the most prevalent among older ones, and the diagnostic yield increases in older age groups. Splenomegaly and thrombocytopenia are independent predictors of varices. Clinical and laboratory parameters are therefore useful in triaging patients especially that pediatric interventional endoscopies are usually available only at tertiary centers.

Abbreviations

EGD	Esophagogastroduodenoscopy
UGIB	Upper gastrointestinal bleeding
H. pylori	*Helicobacter pylori*
GIB	Gastrointestinal bleeding
CBC	Complete blood count
Hgb	Hemoglobin
IQR	Inter-quartile range
S	Significant
NSAIDs	Non-steroidal anti-inflammatory drugs
GERD	Gastro-esophageal reflux disease
CRT	Capillary refill time

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Authors' contributions

MH: constructing the research idea and revision of the paper for its intellectual content. HA: planning methodology, revision of the statistics, and the data. PO: collection of consents and patients' data, tabulating results, and shared in writing the manuscript. AY: supervision of data collection and statistics and writing the manuscript. All authors revised and approved the final version of the manuscript.

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Availability of data and materials

The data used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the University Research Ethics committee and complied with the regulations of the Helsinki Declaration. Informed consent was taken from the parents or guardians of the children before enrollment in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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