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Endoscopic Morphology as an Indicator of Hemorrhage Risk and Subsequent Clinical Course in Gastric Ulcer: A Prospective Cohort Study

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Abstract: ***Background**: Gastric ulcer bleeding is a significant clinical condition with considerable morbidity. Endoscopy plays a crucial role in diagnosing ulcer characteristics and predicting bleeding risk. **Aim**: To evaluate the correlation between endoscopic morphology and bleeding patterns in gastric ulcer patients. **Materials and Methods**: A prospective observational study was conducted at Navodaya Medical College, Raichur, from October 2024 to March 2025. A total of 100 patients diagnosed with gastric ulcer via endoscopy were included. Patients were categorized based on ulcer stage (acute, healing, scar) and location. Endoscopic findings were correlated with bleeding incidence, cycle, and volume. All patients were followed up for one year. **Results**: The highest incidence of bleeding was observed in the acute stage. Ulcer location significantly influenced bleeding volume, with duodenal and antral ulcers showing higher bleeding tendencies. Age and male gender were associated with increased bleeding severity. There was no statistically significant difference in bleeding distribution among stages within the same age group. **Conclusion**: Endoscopic morphology is a valuable predictor of bleeding risk in gastric ulcer patients. Early endoscopic evaluation aids in risk stratification and improves management outcomes.*

Keywords: Gastric ulcer, Endoscopy, Bleeding, Morphology, Follow-up

1. Introduction

Gastric ulcer is a common chronic disease of the gastrointestinal tract characterized by mucosal erosion extending beyond the muscularis mucosa. It often presents with complications such as bleeding, perforation, and obstruction. Among these, bleeding is the most frequent and clinically significant complication.

Endoscopy is the gold standard diagnostic modality, enabling visualization of ulcer morphology, location, and associated mucosal changes. It also helps in predicting prognosis and guiding therapeutic interventions. Previous studies have demonstrated a correlation between endoscopic findings and bleeding risk [obj].

This study aims to evaluate the relationship between endoscopic morphology and bleeding characteristics in gastric ulcer patients in a tertiary care setting.

2. Materials and Methods

Study Design and Setting

This prospective observational study was conducted at Navodaya Medical College, Raichur, over a period of six months (October 2024 to March 2025).

Study Population: A total of 100 patients diagnosed with gastric ulcer on upper gastrointestinal endoscopy were included.

Inclusion Criteria:

- Patients aged 18–65 years
- Endoscopically confirmed gastric ulcer
- Willing for follow-up

Exclusion Criteria:

- Malignant ulcers
- Severe comorbid conditions
- Patients lost to follow-up

Methodology:

- Endoscopy was performed using standard video gastroscope
- Ulcers were classified based on:
- Stage: Acute, Healing, Scar
- Location: Cardia, fundus, body, antrum, pylorus, duodenum

Parameters assessed:

- Number of bleeding episodes
- Bleeding cycle
- Bleeding volume

Follow-Up: All patients were followed up for 1 year to assess recurrence and bleeding patterns.

Statistical Analysis: Data were analyzed using SPSS software. Mean, standard deviation, and correlation tests were applied. A p-value <0.05 was considered statistically significant.

Ethical clearance was obtained from the institutional ethics committee, and informed consent was obtained from all patients or their attendants.

3. Results

A total of 100 patients with endoscopically confirmed gastric ulcers were included in this study. There was a clear male predominance, with males accounting for 65% and females 35% of the study population. The majority of patients belonged to the 30–50 years age group, followed by those above 50 years, while younger patients (<30 years) constituted the smallest proportion.

Based on endoscopic findings, patients were categorized into three stages: acute stage (50%), healing stage (25%), and scar stage (25%). The acute stage represented the largest proportion, indicating that most patients presented during the active phase of the disease.

Table 1: Stage-wise Comparison of Bleeding Parameters

Parameter	Acute Stage	Healing Stage	Scar Stage	p-value
Number of bleeding cases	50 (100%)	25 (50%)	25 (50%)	<0.05
Mean bleeding cycle (days)	35 ± 6	230 ± 60	120 ± 50	<0.05
Mean bleeding volume (ml)	650 ± 200	580 ± 180	700 ± 220	<0.05

Bleeding characteristics varied significantly across different ulcer stages. In the acute stage, all patients experienced bleeding episodes, with a mean bleeding cycle of 35 ± 6 days and a mean bleeding volume of 650 ± 200 ml. In contrast, the healing stage demonstrated reduced bleeding incidence, with a longer mean bleeding cycle of 230 ± 60 days and lower mean bleeding volume of 580 ± 180 ml. The scar stage showed moderate bleeding incidence, with a mean bleeding cycle of 120 ± 50 days and comparatively higher mean bleeding volume of 700 ± 220 ml. Overall, the acute stage had the highest frequency of bleeding, whereas the healing stage had the lowest.

Ulcer location was found to have a strong influence on bleeding severity. Ulcers located in the duodenum and antrum exhibited the highest bleeding volumes, reaching approximately 1250–1300 ml and 1000–1100 ml, respectively. Ulcers in the pylorus and lesser curvature of the body showed moderate to high bleeding volumes, while those in the greater curvature demonstrated moderate bleeding. In contrast, ulcers located in the cardia and fundus had the lowest bleeding volumes, approximately 130–210 ml. These findings indicate that distal gastric and duodenal ulcers are associated with more severe bleeding compared to proximal lesions.

Table 2: Location and Stage-wise Distribution of Gastric Ulcer Bleeding (n = 100)

Ulcer Location	Acute Stage	Healing Stage	Scar Stage
Cardia	6 (12%)/ 210 ± 60	3 (12%)/ 160 ± 45	4 (16%)/ 190 ± 55
Fundus	5 (10%)/ 130 ± 50	2 (8%)/ 120 ± 40	3 (12%)/ 140 ± 50
Body (Greater curvature)	8 (16%)/ 420 ± 120	5 (20%)/ 390 ± 110	6 (24%)/ 430 ± 130
Body (Lesser curvature)	6 (12%)/ 500 ± 150	3 (12%)/ 520 ± 180	5 (20%)/ 560 ± 190
Antrum & Angular notch	10 (20%)/ 1000 ± 250	6 (24%)/ 950 ± 300	5 (20%)/ 1100 ± 320
Pylorus	7 (14%)/ 620 ± 110	3 (12%)/ 680 ± 150	4 (16%)/ 650 ± 180
Duodenum	8 (16%)/ 1300 ± 350	3 (12%)/ 1150 ± 300	4 (16%)/ 1250 ± 330

Table 3: Location-wise Correlation with Bleeding Volume

Ulcer Location	Mean Bleeding Volume (ml)	t-value	p-value
Cardia	190 ± 55	1.54	0.03
Fundus	130 ± 45	1.32	0.04
Greater curvature	410 ± 120	1.85	0.02
Lesser curvature	520 ± 170	1.72	0.03
Antrum	1020 ± 300	2.10	0.001
Pylorus	650 ± 150	1.90	0.02
Duodenum	1250 ± 330	2.30	0.001

Statistical analysis demonstrated a significant correlation between ulcer stage and bleeding parameters, including bleeding incidence, cycle, and volume ($p < 0.05$). This suggests that ulcer stage is an important determinant of bleeding behavior.

Table 4: Correlation Analysis Between Ulcer Stage and Bleeding Parameters

Parameter	t-value	p-value	Significance
Bleeding cases vs stage	2.85	0.004	Significant
Bleeding cycle vs stage	3.12	0.002	Significant
Bleeding volume vs stage	2.67	0.006	Significant

Age-wise analysis revealed that increasing age was associated with higher bleeding incidence, greater bleeding volume, and longer duration of bleeding. Patients aged above 50 years showed the highest bleeding proportion and severity. However, within individual age groups, there was no significant variation in bleeding distribution across different ulcer stages, indicating that age primarily influences severity rather than stage-specific occurrence.

Table 5: Age-wise Distribution of Bleeding (1-Year Follow-Up)

Age Group	Acute Stage (%)	Healing Stage (%)	Scar Stage (%)	Mean Volume (ml)
<30	10 (20%)	5 (20%)	4 (16%)	540 ± 50
30–39	12 (24%)	6 (24%)	5 (20%)	560 ± 60
40–50	14 (28%)	7 (28%)	6 (24%)	590 ± 70
>50	14 (28%)	7 (28%)	10 (40%)	640 ± 80

Gender-based comparison showed that male patients had a significantly higher incidence and severity of bleeding compared to females. The mean bleeding volume in males was 700 ± 200 ml, compared to 600 ± 180 ml in females,

along with a longer bleeding duration. This difference was statistically significant ($p < 0.05$)

Table 6: Gender-wise Comparison of Bleeding

Parameter	Male (n=65)	Female (n=35)	p-value
Bleeding cases (%)	42 (65%)	23 (35%)	<0.05
Mean bleeding cycle (days)	130 ± 50	105 ± 45	<0.05
Mean bleeding volume (ml)	700 ± 200	600 ± 180	<0.05

Overall, the results demonstrate that acute stage ulcers are associated with the highest bleeding frequency, while ulcer location, age, and gender significantly influence bleeding severity. The one-year follow-up further revealed persistent and recurrent bleeding trends, particularly among high-risk groups such as older patients and males.

4. Discussion

Gastric ulcer remains a significant cause of upper gastrointestinal morbidity, with bleeding being one of its most serious complications. In the present study, we evaluated the relationship between endoscopic morphology and bleeding characteristics in 100 patients over a one-year follow-up period.

The findings demonstrate that ulcer stage plays a critical role in bleeding patterns, with the acute stage showing the highest incidence of bleeding. This can be explained by the presence of active mucosal erosion and exposed submucosal vessels during this phase, making them more prone to hemorrhage. In contrast, the healing stage showed the lowest bleeding incidence, likely due to mucosal regeneration and stabilization of vascular integrity. The scar stage demonstrated intermediate bleeding, suggesting residual vascular fragility despite apparent healing.

A key observation in this study is the significant influence of ulcer location on bleeding severity. Ulcers located in the antrum and duodenum exhibited higher bleeding volumes compared to those in the fundus or cardia. This may be attributed to the richer vascular supply and increased exposure to gastric acid and mechanical stress in these regions. These findings are in agreement with earlier studies , which also reported that ulcer location is a decisive factor in determining bleeding severity.

The study also highlights the impact of age on bleeding characteristics. Although the distribution of bleeding across ulcer stages did not differ significantly within the same age group, there was a clear trend of increased bleeding volume and duration with advancing age. This could be due to age-related factors such as reduced mucosal defense mechanisms, delayed healing, and the presence of comorbidities.

Gender-based differences were also evident, with male patients exhibiting higher bleeding incidence and severity compared to females. This may be explained by higher prevalence of risk factors such as smoking, alcohol consumption, and NSAID use among males, although these variables were not independently analyzed in this study.

Statistical analysis revealed a significant correlation between endoscopic findings and bleeding parameters, reinforcing the role of endoscopy not only as a diagnostic tool but also as a prognostic indicator. The ability to assess ulcer stage, location, and morphology allows clinicians to stratify patients based on bleeding risk and tailor management strategies accordingly.

Furthermore, the one-year follow-up adds strength to this study by demonstrating that bleeding patterns are not limited to the initial presentation but can persist or recur depending on underlying ulcer characteristics. This emphasizes the importance of long-term monitoring and appropriate medical management, including eradication of risk factors such as Helicobacter pylori infection.

Despite these important findings, certain limitations must be acknowledged. The study was conducted in a single center with a relatively small sample size, which may limit generalizability. Additionally, factors such as medication use, lifestyle habits, and comorbid conditions were not extensively analyzed, which could influence bleeding outcomes.

Overall, this study supports the growing body of evidence that endoscopic morphology is closely linked to bleeding risk and clinical outcomes in gastric ulcer patients, and should be an integral component of patient evaluation.

5. Conclusion

This study demonstrates that endoscopic morphology is a strong and reliable predictor of bleeding in gastric ulcer patients. Among the various factors analyzed, ulcer stage and location were found to have the most significant impact on bleeding patterns.

The acute stage of gastric ulcer is associated with the highest risk of bleeding, while the healing stage shows relatively minimal bleeding activity. Ulcer location, particularly in the antrum and duodenum, plays a decisive role in determining the severity of bleeding due to increased vascularity and exposure to aggressive luminal factors.

Additionally, advanced age and male gender were associated with increased bleeding severity, highlighting the need for careful monitoring in these high-risk groups. The findings also emphasize that bleeding risk persists over time, as demonstrated by the one-year follow-up, underscoring the importance of long-term surveillance.

Endoscopy, therefore, serves not only as a diagnostic modality but also as a critical prognostic tool, enabling clinicians to:

- Identify high-risk patients
- Predict bleeding outcomes
- Plan timely and appropriate interventions

Early endoscopic evaluation combined with structured follow-up can significantly improve patient outcomes, reduce complications, and optimize management strategies.

In conclusion, incorporating endoscopic morphology into routine clinical assessment provides a comprehensive

approach to managing gastric ulcer patients and plays a pivotal role in reducing morbidity associated with ulcer-related bleeding.

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