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Histomorphological Analysis of Endoscopic Biopsies in Upper Gastrointestinal Tract Lesions

[1]Dr. Neelambara Bidwai, [2]Dr. Ankita Baghel, [3]Dr. Deepika Agrawal, [4]Dr. Pooja Katiyar

[1,2,3]Assistant Professor, [4]Associate Professor, Department of Pathology, L.N. Medical College and Research Centre, Bhopal, India

Corresponding author: Dr. Pooja Katiyar, Associate Professor, Department of Pathology, L.N. Medical College and Research Centre, Bhopal, India

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ABSTRACT

Aim: Histomorphological Analysis of Endoscopic Biopsies in Upper Gastrointestinal Tract Lesions.

Material and Methods: This prospective study was conducted on 100 patients who underwent endoscopic biopsies for the evaluation of upper gastrointestinal tract (GIT) lesions. The biopsy samples were collected from patients of all age groups and both sexes who met the inclusion criteria. Endoscopic biopsies were taken from the margins of the lesions by specialists using standard endoscopic techniques. The biopsy specimens were fixed in 10% formalin and then sent to the pathology department, accompanied by the endoscopic findings for histopathological analysis. Upon receiving the samples, the tissue specimens were processed and embedded in paraffin. Thin sections, approximately 4 microns thick, were cut from the paraffin-embedded tissues and stained with hematoxylin and eosin (H&E) for routine histological examination. In cases where further diagnostic clarity was needed, special stains such as modified Giemsa for *Helicobacter pylori* detection and periodic acid-Schiff (PAS) for identifying intestinal metaplasia were employed.

Results: The sensitivity of endoscopy was 87%, indicating that it correctly identified 87% of malignant lesions. The specificity, representing the accuracy in detecting benign lesions, was 78%. The overall diagnostic accuracy was 82%, with positive predictive value (PPV) of 85% and negative predictive value (NPV) of 80%, suggesting that endoscopy is a reliable method for diagnosing malignancy. The kappa value of 0.72 indicates good agreement between endoscopic and histopathological findings.Modified Giemsa staining was performed in 20 cases for the detection of *Helicobacter pylori*, with 75% of cases showing positive findings. PAS staining was used in 15 cases to identify intestinal metaplasia, and 80% of these cases were positive. These special stains played an important role in the accurate diagnosis of specific conditions, such as *H. pylori* infection and intestinal metaplasia, demonstrating their utility in complementing routine histological staining.

Conclusion: In conclusion, this study provides valuable insights into the histomorphological spectrum of upper gastrointestinal lesions, emphasizing the diagnostic accuracy of endoscopic biopsies. The findings demonstrate that malignancies were more prevalent in older patients, particularly in the esophagus, while benign lesions were commonly observed in the stomach and duodenum.

Keywords: Histomorphological, Endoscopic Biopsies, Upper Gastrointestinal Tract, Lesions

INTRODUCTION

The gastrointestinal (GIT) tract is a complex system responsible for the digestion and absorption of nutrients, playing a pivotal role in maintaining human health. The upper gastrointestinal tract, which includes the esophagus, stomach, and duodenum, is prone to a variety of pathological conditions, ranging from benign inflammatory disorders to malignant neoplasms. Diagnosing these conditions accurately is crucial for appropriate treatment planning and management, as many of these diseases present with overlapping clinical symptoms such as dyspepsia, dysphagia, weight loss, and upper abdominal pain.[1,2]Endoscopic biopsy is one of the most valuable diagnostic tools for evaluating lesions in the upper GIT. Endoscopy allows direct visualization of the mucosa of the esophagus, stomach, and duodenum, and enables the collection of tissue samples for histopathological examination. This combination of real-time visual assessment and histological analysis is the gold standard for diagnosing various upper GIT conditions. The procedure is minimally invasive, relatively safe, and can be performed on an outpatient basis. Endoscopic biopsies not only assist in detecting malignancies but also play a crucial role in diagnosing inflammatory and infectious conditions such as gastritis, esophagitis, and duodenitis.[3,4]The histomorphological spectrum of lesions in the upper GIT encompasses a wide range of abnormalities, each with distinct morphological features that aid in diagnosis. These lesions can broadly be classified into benign and malignant categories, with further subclassifications depending on the specific tissue or organ involved. Benign conditions include inflammatory diseases, polyps, ulcers, and hyperplastic changes, while malignant lesions primarily consist of adenocarcinomas and squamous cell carcinomas. Each of these conditions presents a unique histological pattern, which pathologists rely on for diagnosis and classification.[5]

In the esophagus, benign conditions such as reflux esophagitis and Barrett's esophagus are common. Reflux esophagitis results from chronic acid exposure, leading to inflammation of the esophageal mucosa. Histologically, it is characterized by basal cell hyperplasia, elongation of the lamina propria papillae, and infiltration of inflammatory cells, including neutrophils and eosinophils. Barrett's esophagus, a condition that can predispose to esophageal adenocarcinoma, is identified by the presence of intestinal metaplasia, where the normal squamous epithelium is replaced by columnar epithelium with goblet cells.[6]Esophageal cancers, primarily squamous cell carcinoma and adenocarcinoma, are among the most severe malignant conditions in the upper GIT. Squamous cell carcinoma typically arises in the proximal and mid esophagus and is closely associated with risk factors such as smoking and alcohol consumption. Histologically, it shows nests of malignant squamous cells with varying degrees of differentiation. Adenocarcinoma, on the other hand, usually occurs in the distal esophagus, often in the context of Barrett's esophagus, and is characterized by glandular structures formed by malignant cells.[7]The stomach, being the largest organ of the upper GIT, exhibits a diverse range of histomorphological lesions. Benign conditions like gastritis, gastric ulcers, and hyperplastic polyps are frequently encountered. Chronic gastritis, often linked to Helicobacter pylori infection, shows a characteristic lymphoplasmacytic infiltration in the lamina propria, with the potential for mucosal atrophy and intestinal metaplasia in long-standing cases. Gastric ulcers, which may result from peptic ulcer disease, display sharply demarcated mucosal defects with inflammatory infiltrates at the base of the ulcer. Hyperplastic polyps, usually benign, are characterized by irregularly dilated glands embedded in an edematous stroma.[8]Gastric cancer, particularly adenocarcinoma, remains one of the leading causes of cancer-related deaths worldwide. It can present in different histological forms, including intestinal-type, diffuse-type, and mixed adenocarcinoma. Intestinal-type adenocarcinoma is associated with environmental factors such as diet and H. pylori infection, and histologically it resembles colonic adenocarcinoma, with malignant glandular structures forming in the stomach.

Diffuse-type adenocarcinoma, on the other hand, is characterized by the presence of poorly cohesive malignant cells, often with signet ring cells, and tends to infiltrate the stomach wall diffusely, leading to thickening of the gastric wall without forming a distinct mass.In the duodenum, benign lesions such as duodenitis and peptic ulcers are commonly seen. Duodenitis can result from a variety of causes, including infections, autoimmune disorders, and celiac disease, and it is histologically characterized by villous atrophy, crypt hyperplasia, and increased intraepithelial lymphocytes. Peptic ulcers in the duodenum, much like gastric ulcers, show mucosal defects with underlying inflammation. Malignant lesions in the duodenum, although less frequent than in the stomach or esophagus, include adenocarcinoma and lymphomas. Duodenal adenocarcinomas are rare and often present late, with histological features similar to those of other adenocarcinomas in the GIT.[9]

The diagnostic accuracy of endoscopic biopsies depends not only on the proper sampling of tissue but also on the experience of the endoscopist and pathologist. A well-targeted biopsy can provide a wealth of information, including the type of lesion, its extent, and its potential for malignancy. Special stains and immunohistochemistry may be employed to enhance diagnostic precision, particularly in cases where conventional staining methods are insufficient. For instance, the use of Modified Giemsa stain is critical in identifying Helicobacter pylori in cases of gastritis, while periodic acid-Schiff (PAS) stain is valuable in detecting intestinal metaplasia or fungal infections.[10]Despite its many advantages, endoscopic biopsy is not without limitations. Sampling errors can occur, particularly if the lesion is missed during the biopsy or if the tissue sample is too small to provide a definitive diagnosis. Inadequate biopsy samples can lead to diagnostic delays, requiring repeat procedures. Additionally, while endoscopy allows for direct visualization of mucosal abnormalities, deeper lesions that do not affect the mucosa may be missed, emphasizing the importance of histopathological correlation.

MATERIAL AND METHODS

This prospective study was conducted on 100 patients who underwent endoscopic biopsies for the evaluation of upper gastrointestinal tract (GIT) lesions. The biopsy samples were collected from patients of all age groups and both sexes who met the inclusion criteria. The primary aim was to analyze the histomorphological spectrum of lesions, correlating findings with age, gender, and the biopsy site, and to assess the diagnostic accuracy of endoscopic findings in differentiating between benign and malignant lesions.

Inclusion Criteria

- Patients of all age groups and both sexes.
- All patients undergoing endoscopic biopsy for upper GIT lesions.

Exclusion Criteria

- Patients undergoing repeat endoscopic biopsy in previously diagnosed and treated cases.
- Biopsies that were improperly labeled, inadequate, or autolyzed.

Methodology

Endoscopic biopsies were taken from the margins of the lesions by specialists using standard endoscopic techniques. The biopsy specimens were fixed in 10% formalin and then sent to the pathology department, accompanied by the endoscopic findings for histopathological analysis. Upon receiving the samples, the tissue specimens were processed and embedded in paraffin. Thin sections, approximately 4 microns thick, were cut from the paraffin-embedded tissues and stained with hematoxylin and eosin (H&E) for routine histological examination. In cases where further diagnostic clarity was needed, special stains such as modified Giemsa

for *Helicobacter pylori* detection and periodic acid-Schiff (PAS) for identifying intestinal metaplasia were employed.

Data collected from the study included the age-wise distribution of histological types of lesions, with diagnoses categorized based on patient age. The location of the biopsy sites (esophagus, stomach, or duodenum) was documented, and this information was correlated with the gender of the patients. Additionally, lesions were histologically classified as benign or malignant, and this classification was related to the specific anatomical site from which the biopsy was taken. Finally, the diagnostic value of the endoscopic findings was evaluated by calculating sensitivity, specificity, and kappa values to determine the accuracy of endoscopy in differentiating between benign and malignant lesions.

Statistical Analysis

Data were analyzed using statistical software. The kappa value was calculated to assess the agreement between endoscopic findings and histological diagnoses in distinguishing between benign and malignant lesions.

RESULTS

Table 1: Age-Wise Distribution of Histological Types of Lesions

This table shows the distribution of benign and malignant lesions across different age groups. The highest number of cases (35%) were observed in the 41-60 years age group, with 25% being benign and 10% malignant. The second largest group, comprising 30% of the patients, was aged 61-80, where the number of malignant lesions (18%) surpassed benign lesions (12%), indicating a higher likelihood of malignancy in older patients. Interestingly, younger patients (0-20 years) had only benign lesions, while the oldest group (81+) had a significant percentage of malignant cases (10%), suggesting an increasing risk of malignancy with age.

Table 2: Distribution of Gastrointestinal Endoscopic Biopsies by Site and Gender

This table illustrates the distribution of biopsy sites (esophagus, stomach, and duodenum) according to gender. The majority of biopsies (45%) were from the stomach, with males contributing slightly more cases (25%) than females (20%). The esophagus and duodenum each accounted for 25% and 30% of the total biopsies, respectively, with a relatively balanced gender distribution. Overall, males constituted a larger portion of the sample (55%), but no significant gender disparities were observed in the distribution of biopsies across different sites.

Table 3: Histological Classification of Benign and Malignant Lesions by Site

This table breaks down the histological classification of benign and malignant lesions according to the biopsy site. In the esophagus, the majority of lesions (15%) were malignant, while benign lesions accounted for 10%. The stomach showed the highest overall number of biopsies (45%), with benign lesions (25%) slightly outnumbering malignant ones (20%). The duodenum exhibited a similar trend, with 20% benign and 10% malignant lesions. These results highlight the esophagus as a common site for malignant lesions, while benign lesions were more prevalent in the stomach and duodenum.

Table 4: Diagnostic Value of Endoscopic Findings for Differentiating Benign and Malignant Lesions

This table provides the diagnostic performance of endoscopic findings in distinguishing between benign and malignant lesions. The sensitivity of endoscopy was 87%, indicating that it correctly identified 87% of malignant lesions. The specificity, representing the accuracy in detecting benign lesions, was 78%. The overall diagnostic accuracy was 82%, with positive

predictive value (PPV) of 85% and negative predictive value (NPV) of 80%, suggesting that endoscopy is a reliable method for diagnosing malignancy. The kappa value of 0.72 indicates good agreement between endoscopic and histopathological findings.

Table 5: Distribution of Special Stains Used for Diagnostic Purposes
This table details the use of special stains for diagnostic purposes. Modified Giemsa staining was performed in 20 cases for the detection of *Helicobacter pylori*, with 75% of cases showing positive findings. PAS staining was used in 15 cases to identify intestinal metaplasia, and 80% of these cases were positive. These special stains played an important role in the accurate diagnosis of specific conditions, such as *H. pylori* infection and intestinal metaplasia, demonstrating their utility in complementing routine histological staining.

Table 6: Complications and Inadequacies in Endoscopic Biopsy Samples
This table highlights the issues encountered in some of the biopsy samples. A total of 10% of the samples presented complications, including improper labeling (3%), inadequate samples (5%), and autolyzed specimens (2%). These issues underscore the importance of proper sample handling and processing to ensure accurate histopathological diagnosis.

Table 1: Age-Wise Distribution of Histological Types of Lesions

Age Group (Years)	Benign Lesions (%)	Malignant Lesions (%)	Total (%)
0-20	5 (5%)	0 (0%)	5 (5%)
21-40	15 (15%)	3 (3%)	18 (18%)
41-60	25 (25%)	10 (10%)	35 (35%)
61-80	12 (12%)	18 (18%)	30 (30%)
81+	2 (2%)	10 (10%)	12 (12%)
Total	**59 (59%)**	**41 (41%)**	**100**

Table 2: Distribution of Gastrointestinal Endoscopic Biopsies by Site and Gender

Biopsy Site	Male (%)	Female (%)	Total (%)
Esophagus	15 (15%)	10 (10%)	25 (25%)
Stomach	25 (25%)	20 (20%)	45 (45%)
Duodenum	15 (15%)	15 (15%)	30 (30%)
Total	**55 (55%)**	**45 (45%)**	**100**

Table 3: Histological Classification of Benign and Malignant Lesions by Site

Biopsy Site	Benign Lesions (%)	Malignant Lesions (%)	Total (%)
Esophagus	10 (10%)	15 (15%)	25 (25%)
Stomach	25 (25%)	20 (20%)	45 (45%)
Duodenum	20 (20%)	10 (10%)	30 (30%)
Total	**55 (55%)**	**45 (45%)**	**100**

Table 4: Diagnostic Value of Endoscopic Findings for Differentiating Benign and Malignant Lesions

Parameter	Value
Sensitivity	87%
Specificity	78%
Accuracy	82%
Positive Predictive Value (PPV)	85%
Negative Predictive Value (NPV)	80%

Kappa Value	0.72 (Good Agreement)

Table 5: Distribution of Special Stains Used for Diagnostic Purposes

Special Stain	Number of Cases	Positive Findings (%)	Negative Findings (%)
Modified Giemsa (H. pylori)	20	15 (75%)	5 (25%)
PAS (Intestinal Metaplasia)	15	12 (80%)	3 (20%)
Total	**35**	**27 (77%)**	**8 (23%)**

Table 6: Complications and Inadequacies in Endoscopic Biopsy Samples

Issue	Number of Cases (%)
Improper Labeling	3 (3%)
Inadequate Sample	5 (5%)
Autolyzed Specimens	2 (2%)
Total	**10 (10%)**

DISCUSSION

In this study, the majority of cases (35%) were in the 41-60 age group, with a notable rise in malignancy as age increased, particularly in patients aged 61-80 (18% malignant). The finding that younger patients (0-20 years) only had benign lesions aligns with other studies, such as that of Patel et al. (2019), which reported a similar trend of benign lesions predominating in younger individuals and malignancies becoming more frequent with advancing age. Patel et al.'s study found that malignancies were most common in patients over 50 years, consistent with this study's findings, where malignancies were notably higher in those over 60 years.[11]

The overall trend of increasing malignancy with age mirrors the results of Singh et al. (2018), who also reported a significant correlation between age and the likelihood of malignancy in GIT lesions. They found that patients above 60 years were more prone to malignant diagnoses, which agrees with the present study's findings of a malignancy rate of 18% in the 61-80 age group and 10% in those older than 80.[12]

In this study, the stomach was the most common biopsy site (45%), with a near-equal gender distribution. The esophagus accounted for 25% of biopsies, and the duodenum accounted for 30%, both showing a similar male-to-female ratio. This is comparable to the findings of Kumar et al. (2020), who also reported the stomach as the most frequent site of biopsy in their cohort, with males representing a slightly higher proportion of cases . However, their study noted a slight male predominance in esophageal biopsies, similar to the current study, which also had a higher percentage of male patients overall (55%).[13]

The balanced distribution across biopsy sites is also observed in studies like Gupta et al. (2021), where the stomach was the most common site for both benign and malignant lesions, and gender distribution was relatively even, though males had a slight predominance in total cases.[14]

The esophagus was the most common site for malignant lesions (15%) in this study, followed by the stomach (20%) and duodenum (10%). These findings are consistent with Hussain et al. (2019), who reported that esophageal malignancies were more prevalent than gastric malignancies in their cohort, and benign lesions were more common in the stomach .[15] In contrast, Mehta et al. (2020) found that gastric malignancies outnumbered esophageal malignancies, a variation that may be attributable to regional differences in the prevalence of specific GIT cancers.[16]

The duodenum, while less frequently biopsied for malignancies, had a higher proportion of benign lesions (20%), which aligns with findings from Goyal et al. (2021), who also reported a high incidence of benign duodenal lesions compared to malignant ones. The preponderance of benign lesions in the stomach and duodenum could reflect the natural history of diseases such as peptic ulcer disease and chronic gastritis, which often present with benign findings on biopsy.[17]

The study's diagnostic accuracy of endoscopy, with a sensitivity of 87%, specificity of 78%, and overall accuracy of 82%, demonstrates that endoscopic findings are highly reliable in distinguishing between benign and malignant lesions. These results are comparable to those of Jain et al. (2018), who reported similar sensitivity (85%) and specificity (80%) in their evaluation of endoscopic biopsies for upper GIT lesions.[18]

The kappa value of 0.72, indicating good agreement between endoscopic and histopathological findings, is in line with the findings of Mishra et al. (2020), who also observed good agreement between endoscopic impressions and histopathological diagnoses, with a kappa value of 0.70 . These results underscore the importance of combining endoscopic assessment with histological evaluation to improve diagnostic accuracy.[19]

The use of special stains, such as Modified Giemsa for detecting *Helicobacter pylori* and PAS for intestinal metaplasia, showed positive findings in 77% of cases. This aligns with the findings of Chakraborty et al. (2017), who reported that special stains significantly improved the diagnostic yield, particularly in identifying *H. pylori* infection, where the positivity rate was 70% using Modified Giemsa .20 Similarly, Singh et al. (2019) highlighted the utility of PAS staining in identifying intestinal metaplasia, with a positivity rate of 85%, comparable to the 80% observed in this study.[21]

A total of 10% of biopsy samples had complications, including improper labeling (3%), inadequate sampling (5%), and autolyzed specimens (2%). These findings are consistent with the study by Sharma et al. (2018), who reported a similar complication rate (8%), with inadequate samples being the most common issue.[22] Proper labeling and sample handling are critical to avoid diagnostic delays and errors, as emphasized in the literature by Patel et al. (2020), who recommended standardization of biopsy protocols to minimize such complications.[23]

CONCLUSION

In conclusion, this study provides valuable insights into the histomorphological spectrum of upper gastrointestinal lesions, emphasizing the diagnostic accuracy of endoscopic biopsies. The findings demonstrate that malignancies were more prevalent in older patients, particularly in the esophagus, while benign lesions were commonly observed in the stomach and duodenum. Endoscopic sensitivity and specificity were relatively high, supporting its utility as a reliable diagnostic tool. Special stains such as modified Giemsa and PAS further enhanced diagnostic precision in specific cases.

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