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Original Article

# The Diagnostic Value of Barium Swallow in the Esophageal Disorders: A Retrospective Study

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## ABSTRACT

**Introduction:** Esophageal disorders are a common cause of dysphagia and encompass a wide range of structural and functional abnormalities. Although endoscopy and advanced imaging modalities are widely used, the barium swallow examination continues to play an important role owing to its ability to provide dynamic assessment of esophageal anatomy and motility. This study evaluated the diagnostic value of barium swallow in detecting esophageal disorders in patients presenting with upper gastrointestinal symptoms.

**Materials and Methods:** A retrospective observational study was conducted in the Department of Radiology, BLDE (DU) Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura. Medical records and archived barium swallow examinations performed between April 2025 and March 2026 were reviewed. Adult patients with dysphagia, odynophagia, chronic gastroesophageal reflux, or suspected esophageal pathology were included. Demographic details, radiological findings, and available endoscopic and histopathological diagnoses were analyzed using descriptive statistics.

**Results**: A total of 42 patients were included, comprising 26 (61.9%) females and 16 (38.1%) males. The most common age group was 31–40 years (33.3%). Abnormal barium swallow findings were identified in 27 (64.3%) patients, while 15 (35.7%) had normal examinations. Achalasia cardia was the most frequent abnormality (11.9%), followed by esophageal web (9.5%) and neoplastic lesions (9.5%). Structural benign lesions constituted the largest diagnostic category (23.8%), followed by motility disorders (14.3%). The examination effectively demonstrated both structural and functional abnormalities of the esophagus.

**Conclusion**: Barium swallow remains a valuable, safe, and cost-effective diagnostic modality for evaluating esophageal disorders. It provides comprehensive assessment of esophageal morphology and motility and continues to serve as an effective first-line investigation, particularly in patients presenting with dysphagia and suspected esophageal pathology.

***Keywords***: *Barium swallow; Dysphagia; Esophageal disorders; Fluoroscopy; Achalasia cardia; Esophageal motility; Contrast radiography.*

## INTRODUCTION

Esophageal disorders comprise a broad spectrum of structural and functional abnormalities, including gastroesophageal reflux disease (GERD), inflammatory conditions, benign strictures, diverticula, motility disorders, and malignant neoplasms. These disorders commonly present with dysphagia, odynophagia, regurgitation, chest pain, heartburn, and weight loss, leading to considerable morbidity and reduced quality of life[1]. Dysphagia, defined as difficulty in the passage

of food or liquids from the mouth to the stomach, is one of the most frequent presenting symptoms. Swallowing is a complex neuromuscular process involving the oral, pharyngeal, and esophageal phases, and disruption at any stage may result in swallowing dysfunction. Esophageal dysphagia may arise from motility disorders such as achalasia and diffuse esophageal spasm or from structural abnormalities including strictures, rings, webs, diverticula, and malignancies. Secondary esophageal dysmotility may also occur in systemic diseases such as scleroderma and inflammatory myopathies.[2]

Accurate diagnosis of esophageal disorders is essential for timely management and prevention of complications. Diagnostic modalities include upper gastrointestinal endoscopy, high-resolution esophageal manometry, computed tomography (CT), magnetic resonance imaging (MRI), endoscopic ultrasound, and contrast radiographic studies.[2] Among these, the barium swallow examination remains a widely available, inexpensive, and non-invasive investigation. Using barium sulfate contrast under fluoroscopic guidance, it provides dynamic assessment of esophageal morphology, luminal patency, and swallowing physiology, allowing simultaneous evaluation of structural lesions and functional abnormalities.[3]

Barium swallow continues to play an important role in patients presenting with dysphagia and other esophageal symptoms. It is particularly useful for detecting benign and malignant strictures, esophageal rings and webs, diverticula, hiatal hernia, fistulas, extrinsic compression, postoperative complications, and recurrent disease. In addition, real-time fluoroscopic imaging enables assessment of esophageal peristalsis and lower esophageal sphincter function, facilitating the diagnosis of motility disorders such as achalasia.[3,4] Unlike endoscopy, which primarily evaluates mucosal abnormalities, barium swallow provides valuable information on esophageal transit and functional dynamics, making it especially useful when endoscopy is contraindicated or technically difficult.[3]Studies have shown that abnormalities of the oropharyngeal and esophageal phases of swallowing frequently coexist. Oropharyngeal dysfunction has been reported in patients with GERD, achalasia, and esophageal carcinoma, while localization of dysphagia by patients is often inaccurate, emphasizing the importance of imaging-based evaluation.[5-8] Videofluoroscopic swallowing studies incorporating barium swallow also provide useful information regarding esophageal emptying, aspiration, and esophageal clearance, with persistent barium retention suggesting motility disorders or mechanical obstruction.[4,9]Despite advances in endoscopy and cross-sectional imaging, barium swallow remains clinically relevant because of its ability to assess both anatomy and function in a single examination. However, its diagnostic performance varies with the underlying pathology and clinical setting. Therefore, the present retrospective study was undertaken to evaluate the diagnostic value of barium swallow in patients with suspected esophageal disorders.

## MATERIALS AND METHODS

This retrospective observational study was conducted in the Department of Radiology, BLDE (Deemed to be University) Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura, Karnataka. Medical records and archived radiological images of patients who underwent barium swallow examination between April 2025 and March 2026 were retrospectively reviewed.

### Study Population

The study included adult patients who underwent barium swallow examination for evaluation of suspected esophageal disorders during the study period.

### Inclusion Criteria

- Patients aged ≥18 years.
- Patients presenting with dysphagia, odynophagia, chronic gastroesophageal reflux symptoms, or suspected upper gastrointestinal pathology.
- Patients with complete clinical records and diagnostic-quality barium swallow images.

### Exclusion Criteria

- Patients with suspected esophageal or gastrointestinal perforation in whom barium examination was contraindicated.
- Pregnant women.
- Patients with incomplete imaging studies or poor-quality radiographs that precluded adequate interpretation.

### Data Collection

Clinical records, radiological findings, endoscopic reports, and histopathological reports (where available) were retrieved from the hospital information system and departmental archives. Demographic details, presenting symptoms, radiographic findings, and final diagnoses were recorded using a structured data collection proforma.

**Patient Preparation**
All patients had been instructed to fast for 6–8 hours before the examination to ensure adequate visualization of the upper gastrointestinal tract and to minimize the risk of aspiration. Metallic objects from the chest and abdominal region were removed before imaging to prevent radiographic artifacts.

**Barium Swallow Examination Technique**
The examination was performed using a high-density barium sulphate suspension (200% w/v) prepared by diluting commercially available high-density barium sulphate powder (Microbar-HD, Eskay Chemicals, Mumbai) with 70 mL of water. Whenever indicated, a double-contrast examination was performed after administration of effervescent granules followed by ingestion of the barium suspension.

During the examination, patients orally ingested the barium suspension while real-time fluoroscopic imaging was performed to evaluate the passage of contrast through the pharynx, esophagus, and gastroesophageal junction into the stomach. Multiple fluoroscopic images were obtained in upright and supine positions, including anteroposterior, lateral, and oblique projections, to comprehensively assess esophageal anatomy and function. The total duration of the examination was approximately 20–30 minutes.

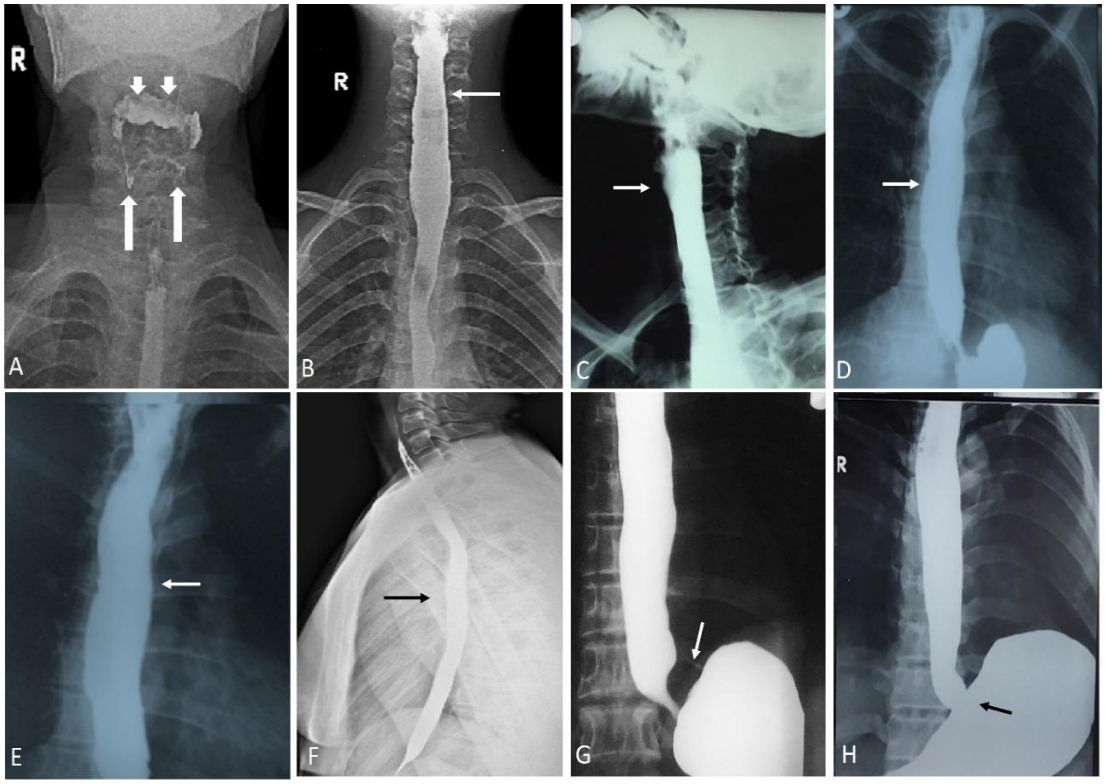


**Image 1:** Barium swallow of different patients shown **normal anatomy** and views to be taken for routine barium swallow studies. **A**. anteroposterior (AP) view of oropharynx, valleculae (small white arrows) and pyriform sinuses (large white arrows), **B**. AP view of cervical and upper thoracic esophagus (white arrow), **C**. lateral view of cervical esophagus (white arrow), **D&E**. AP view of thoracic esophagus (white arrow), **F**. lateral view of thoracic esophagus (black arrow), **G**. AP view of gastroesophageal (GE) junction and fundus of stomach (white arrow), **H**. oblique view of GE junction (black arrow) and fundus of stomach. Note: reflux in GE junction has to be demonstrated in supine position by asking patient to rise lower limb above the table (image not shown).

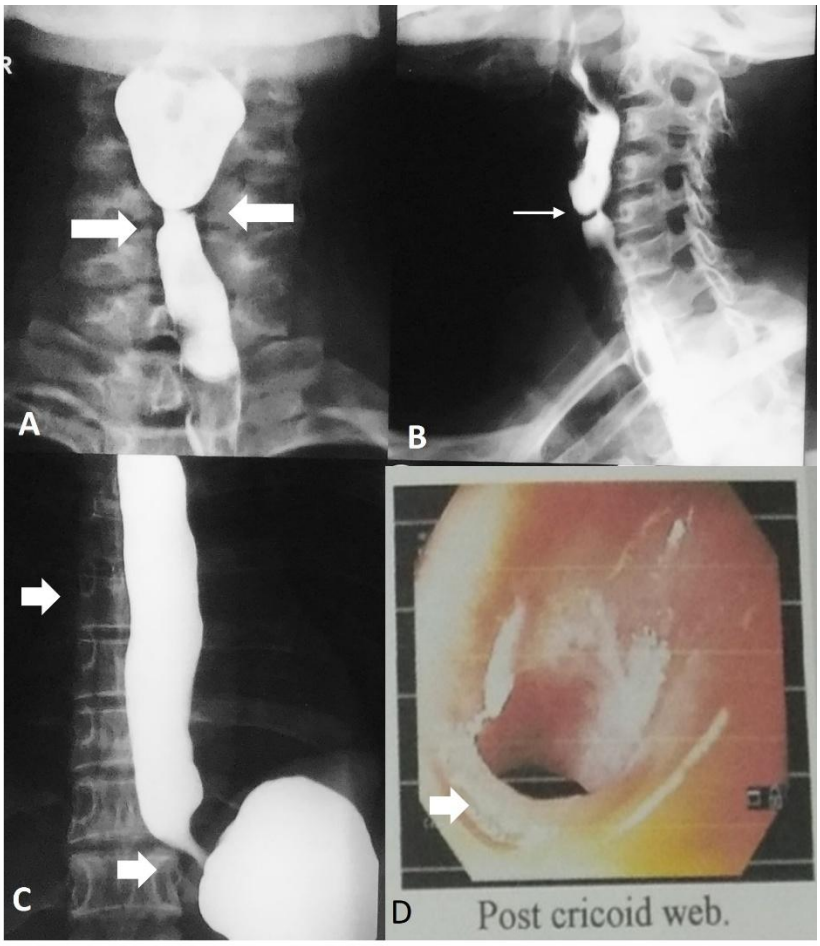


**Image 2:** A 43 years old female patient came with complaint of dysphagia. **A.** Anteroposterior (AP) view & **B**. lateral view of cervical esophagus shows a hypodense band like filling defect [white arrows] noted in the cervical esophagus at post cricoid region. **C**. AP view of lower thoracic esophagus, gastroesophageal (GE) junction [white arrow] and fundus of stomach show no significant abnormality with normal contrast opacification. **D**. Upper gastrointestinal endoscopy (UGIE) confirms **Post Cricoid Esophageal Web** [white arrow]**.**

**Imaging Protocol**

The fluoroscopic examination was performed according to a standardized departmental protocol. Initially, upright left posterior oblique (LPO) views were obtained, followed by mucosal relief images to evaluate the thickness and integrity of the esophageal mucosal folds. Patients were then instructed to rotate through 360° to facilitate uniform coating of the gastric fundus with barium.

Subsequently, recumbent right lateral views were acquired to assess the cardiac rosette and gastric fundus. Prone right anterior oblique (RAO) views were obtained to evaluate esophageal motility and peristalsis. Finally, patients were rotated from the supine position to right posterior oblique and right lateral positions under fluoroscopic guidance to assess for gastroesophageal reflux. Additional swallowing maneuvers, positional changes, or breath-holding techniques were performed whenever required to better demonstrate suspected functional or structural abnormalities.

**Image Interpretation**

All examinations were interpreted by experienced consultant radiologists. The following parameters were systematically evaluated:

- Esophageal contour, caliber, and mucosal pattern.
- Presence of strictures, rings, webs, diverticula, polyps, masses, or carcinoma.
- Esophageal motility and peristaltic activity, including features suggestive of achalasia or diffuse esophageal spasm.
- Upper and lower esophageal sphincter function.

- Presence of gastroesophageal reflux, hiatal hernia, aspiration, fistula, or other associated abnormalities.

Whenever available, barium swallow findings were correlated with upper gastrointestinal endoscopy, histopathological examination, and relevant clinical diagnoses to assess the diagnostic performance of the investigation.

**Outcome Measures**

The primary outcome was the diagnostic value of barium swallow in detecting esophageal disorders. Secondary outcomes included the distribution of various esophageal pathologies identified on barium swallow and the correlation of radiological findings with endoscopic and histopathological diagnoses.

**Statistical Analysis**

The collected data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as mean ± standard deviation. Agreement between barium swallow findings and reference diagnostic modalities, wherever available, was evaluated. A p-value of $<0.05$ was considered statistically significant.

**RESULTS**

A total of 42 patients who underwent barium swallow examination during the study period were included in the analysis. Females constituted the majority of the study population, accounting for 26 (61.9%) patients, while 16 (38.1%) were males. The most frequently represented age group was 31–40 years, comprising 14 (33.3%) patients, followed by the 20–30 years and 41–50 years age groups, each contributing 8 (19.0%) patients. The detailed demographic characteristics of the study population are presented in (Table 1 and Figure 1)Barium swallow examination demonstrated abnormal radiological findings in 27 (64.3%) patients, whereas 15 (35.7%) patients had no significant abnormality on imaging. The overall clinical profile of the study population is summarized in (Table 2 and Figure 2)

Among the abnormal findings, achalasia cardia was the most common diagnosis, observed in 5 (11.9%) patients. Esophageal web and neoplastic lesions were the next most frequent abnormalities, each identified in 4 (9.5%) patients. Hiatus hernia was detected in 3 (7.1%) patients. Other abnormalities included esophageal stricture, tracheoesophageal fistula, and right-sided aortic arch compression, each occurring in 2 (4.8%) patients. Less common findings comprised patulous gastroesophageal junction with reflux, esophageal diverticulum, displaced esophageal stent, presbyesophagus, and left atrial enlargement causing esophageal compression, each observed in 1 (2.4%) patient. The detailed distribution of individual radiological findings is shown in Table 3.When radiological abnormalities were categorized according to the underlying pathology, structural benign lesions represented the largest group, accounting for 10 (23.8%) cases, followed by motility disorders in 6 (14.3%) patients. Malignant lesions and miscellaneous abnormalities each constituted 4 (9.5%) cases, while extrinsic compressions accounted for 3 (7.1%) cases. No significant abnormality was identified in 15 (35.7%) patients. The diagnostic categorization of radiological findings is presented in Table 4.

**Table 1. Demographic characteristics of the study population (n = 42)**

| Variable | Number of cases | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 16 | 38.1 |
| Female | 26 | 61.9 |
| **Age Group (years)** | | |
| 20–30 | 8 | 19.0 |
| 31–40 | 14 | 33.3 |
| 41–50 | 8 | 19.0 |
| 51–60 | 7 | 16.7 |
| 61–70 | 2 | 4.8 |
| 71–80 | 2 | 4.8 |
| 81–90 | 1 | 2.4 |
| **Total** | **42** | **100.0** |

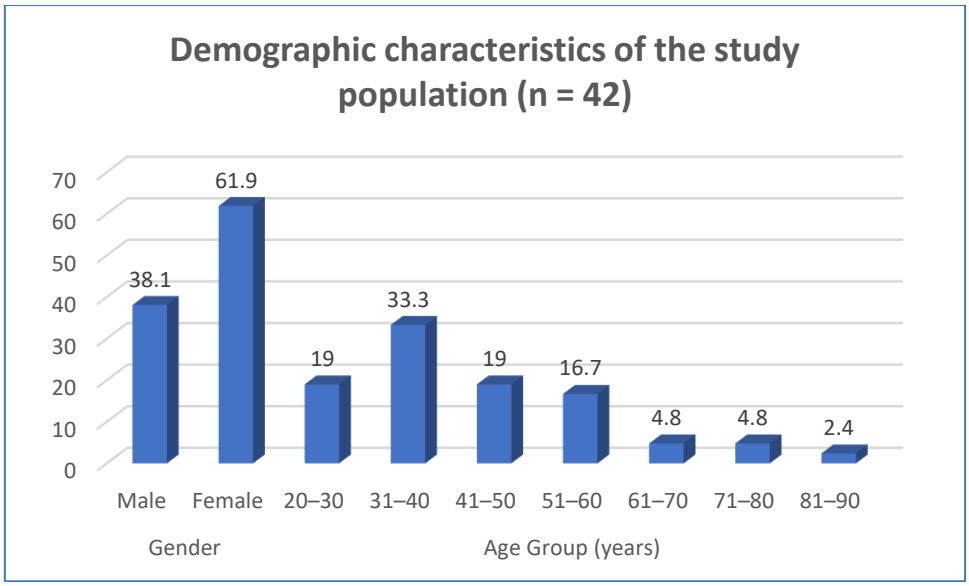


**Figure 1 Demographic characteristics of the study population (n = 42)**

**Table 2. Clinical profile of patients undergoing barium swallow examination (n = 42)**

| Parameter | Number (%) |
|---|---|
| Total patients evaluated | 42 (100.0) |
| Male | 16 (38.1) |
| Female | 26 (61.9) |
| Most common age group | 31–40 years (33.3%) |
| Patients with abnormal barium swallow findings | 27 (64.3) |
| Patients with normal examination | 15 (35.7) |

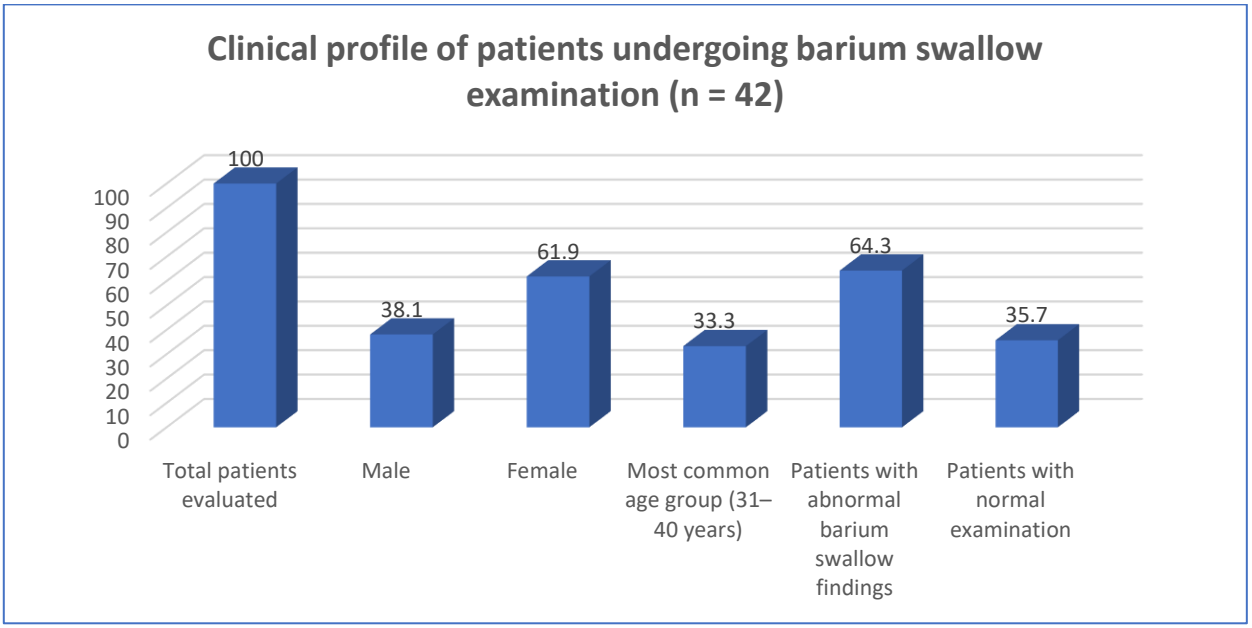


**Figure 2 Clinical profile of patients undergoing barium swallow examination (n = 42)**

**Table 3. Spectrum of esophageal abnormalities detected on barium swallow (n = 42)**

| Radiological finding | Number | Percentage (%) |
|---|---|---|
| Achalasia cardia | 5 | 11.9 |
| Esophageal web | 4 | 9.5 |
| Neoplastic lesions | 4 | 9.5 |
| Hiatus hernia | 3 | 7.1 |
| Esophageal stricture | 2 | 4.8 |
| Tracheoesophageal fistula | 2 | 4.8 |
| Right-sided aortic arch compression | 2 | 4.8 |

| | | |
|---|---|---|
| Patulous gastroesophageal junction / gastroesophageal reflux | 1 | 2.4 |
| Esophageal diverticulum | 1 | 2.4 |
| Displaced esophageal stent | 1 | 2.4 |
| Presbyesophagus | 1 | 2.4 |
| Left atrial enlargement causing esophageal compression | 1 | 2.4 |
| Normal study | 15 | 35.7 |
| **Total** | **42** | **100.0** |

**Table 4. Distribution of radiological findings according to diagnostic category (n = 42)**

| Diagnostic category | Findings included | Number | Percentage (%) |
|---|---|---|---|
| Motility disorders | Achalasia cardia, Presbyesophagus | 6 | 14.3 |
| Structural benign lesions | Esophageal web, Hiatus hernia, Esophageal stricture, Esophageal diverticulum | 10 | 23.8 |
| Malignant lesions | Neoplastic lesions | 4 | 9.5 |
| Extrinsic compression | Right-sided aortic arch compression, Left atrial enlargement | 3 | 7.1 |
| Miscellaneous | Tracheoesophageal fistula, Displaced esophageal stent, Patulous GE junction/Reflux | 4 | 9.5 |
| No significant abnormality | Normal study | 15 | 35.7 |
| **Total** | | **42** | **100.0** |

## DISCUSSION

The present retrospective study evaluated the diagnostic spectrum of barium swallow examination in 42 patients with suspected esophageal disorders. Females constituted the majority of the study population (61.9%), and the most common age group was 31–40 years (33.3%). Abnormal barium swallow findings were observed in 64.3% of patients, while 35.7% had normal examinations, highlighting the continued value of barium swallow as an initial imaging modality for patients presenting with dysphagia and related esophageal symptoms.In our study, the predominance of middle-aged adults is consistent with previous reports indicating that esophageal disorders are more frequently encountered in this age group. Sanagapalli et al. (2023) [10] reported that barium swallow examinations are commonly performed in middle-aged and elderly patients with dysphagia, reflecting the increasing prevalence of both benign and malignant esophageal diseases with advancing age.Abnormal findings were detected in nearly two-thirds of patients (64.3%), demonstrating a satisfactory diagnostic yield. These findings support the continued role of barium swallow as a valuable first-line investigation capable of detecting both structural and functional abnormalities. Austin et al. [11] emphasized that barium swallow remains particularly useful in identifying structural lesions and major motility disorders before further evaluation with endoscopy or high-resolution manometry.Motility disorders accounted for 14.3% of cases, with achalasia cardia representing the most frequent individual diagnosis (11.9%). These findings are comparable to those of Sanagapalli et al. (2023) [10], who described the characteristic "bird-beak" appearance on barium swallow as highly suggestive of achalasia and useful for establishing the diagnosis before manometric confirmation. Similarly, Austin et al. [11] reported that barium swallow demonstrates high diagnostic accuracy for achalasia and advanced esophageal dysmotility, although its sensitivity is lower in mild motility disorders.Benign structural abnormalities were identified in 23.8% of patients and included esophageal webs, hiatus hernia, esophageal strictures, and diverticula. These findings are consistent with published evidence indicating that contrast esophagography remains highly effective in defining the location, length, and morphology of benign esophageal lesions. Radiological studies have demonstrated excellent sensitivity for detecting strictures, webs, diverticula, and hiatal hernias, particularly when endoscopic passage is difficult.

Esophageal malignancy was detected in 9.5% of patients, with barium swallow demonstrating characteristic irregular narrowing and shouldering that prompted further endoscopic biopsy. Although endoscopy with histopathological examination remains the diagnostic gold standard, published literature supports the complementary role of barium swallow in defining the extent, location, and functional impact of malignant lesions before definitive evaluation.Extrinsic compression was observed in 7.1% of patients, including right-sided aortic arch compression and left atrial enlargement. These findings illustrate the ability of barium swallow to identify vascular and mediastinal causes of dysphagia, which can subsequently be confirmed by cross-sectional imaging. Miscellaneous abnormalities, including tracheoesophageal fistula, displaced esophageal stent, and gastroesophageal reflux, further demonstrate the versatility of contrast esophagography in evaluating congenital, postoperative, and functional esophageal disorders.The present study confirms that barium swallow remains an inexpensive, readily available, and effective diagnostic investigation, detecting abnormalities in 64.3% of patients across a wide spectrum of esophageal diseases. Our findings are in agreement with Sanagapalli et al. (2023) [10] and Austin et al. [11], who concluded that although high-resolution manometry and endoscopy are essential for definitive diagnosis in selected cases, barium swallow continues to provide excellent diagnostic information for achalasia, benign structural lesions, malignancy, and other clinically significant esophageal abnormalities, particularly in resource-limited settings.

## CONCLUSION

The present retrospective study demonstrated that barium swallow remains a valuable, safe, and cost-effective imaging modality for the evaluation of esophageal disorders. It effectively identified a wide spectrum of structural and motility abnormalities, with achalasia cardia being the most frequently detected pathology. Despite advances in endoscopic and cross-sectional imaging, barium swallow continues to provide important functional and anatomical information that complements other diagnostic investigations. Therefore, it should remain an integral first-line imaging tool in the assessment of patients presenting with dysphagia and other suspected esophageal disorders.

### Limitations

This study was limited by its retrospective design and relatively small sample size from a single tertiary care center, which may restrict the generalizability of the findings. Correlation with endoscopic and histopathological diagnoses was not available for all patients, limiting comprehensive assessment of diagnostic accuracy. In addition, the study relied on archived imaging records, and variability in image quality and clinical documentation may have influenced interpretation.

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