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ROLE OF BARIUM CONTRAST IN DETECTING ESOPHAGEAL DISORDERS

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ABSTRACT

This study assessed the role of barium contrast in detecting esophageal disorders through barium swallow investigations in 30 patients aged 20 to 80. Using descriptive statistics, the findings revealed that dysphagia was the main complaint in 19 patients (63.33%), with the most common abnormalities being narrowing in the distal esophagus and esophageal cancer. The results indicated that barium examinations are effective for identifying esophageal abnormalities, supporting accurate diagnosis and treatment planning. Overall, barium contrast proves to be a vital imaging technique for diagnosing various esophageal disorders.

Keywords: Fluoroscopy, X-Rays, Barium Sulfate, Gastrointestinal Diseases, Esophageal Diseases, Dysphagia, Esophageal Cancer, Achalasia, Strictures, Hiatal Hernia

INTRODUCTION

Fluoroscopy is an imaging framework that uses a fluoroscope to produce moving, real-time images of a patient's interior anatomy; Thomas A Edison invents the first fluoroscope in 1896. Basically, fluoroscopy is flourishing imaging; in which radiologists continuously supervise images of moving organs while the X-ray beam is in the ON position. Direct vision fluoroscopy uses X-rays transmitted through a patient to a scintillation phosphor screen, producing faint scintillations. Radiologists view the image with red goggles in a darkroom. Conventional fluoroscopy, used until 1950, was discontinued due to radiation concerns.

Digital fluoroscopy offers faster picture acquisition, storage, and processing by displaying high-resolution digital images. Storage, processing, geometrical inversion, dosage reduction, black and white reversal, wide dynamic range, dynamic imaging, and filmless imaging are some of its advantageous features. With PACS, it is compatible. Detectors that are flat panel or charge coupled device are utilised in digital fluoroscopy **[1]**.

When Thomas Edison started looking into materials potential to glow under X-rays in the late 1890s, he created a fluoroscope that could be commercialised by the new year. Brighter images were created by calcium tungstate screens, as Edison had swiftly discovered. However, Edison gave up on his studies in 1903 due to health risks associated with using these antiquated gadgets. Clarence Dally, a glass blower of lab apparatus and tubes in Edison's laboratory, was exposed to radiation on multiple occasions, eventually contracting radiation sickness and passing away from a malignant malignancy. Edison suffered an eye injury while evaluating these early fluoroscopes. Wilhelm Trendelenburg fabricated red adaptation goggles in 1916 to help with the challenge of the eyes inability to adjust to darkness **[2]**.

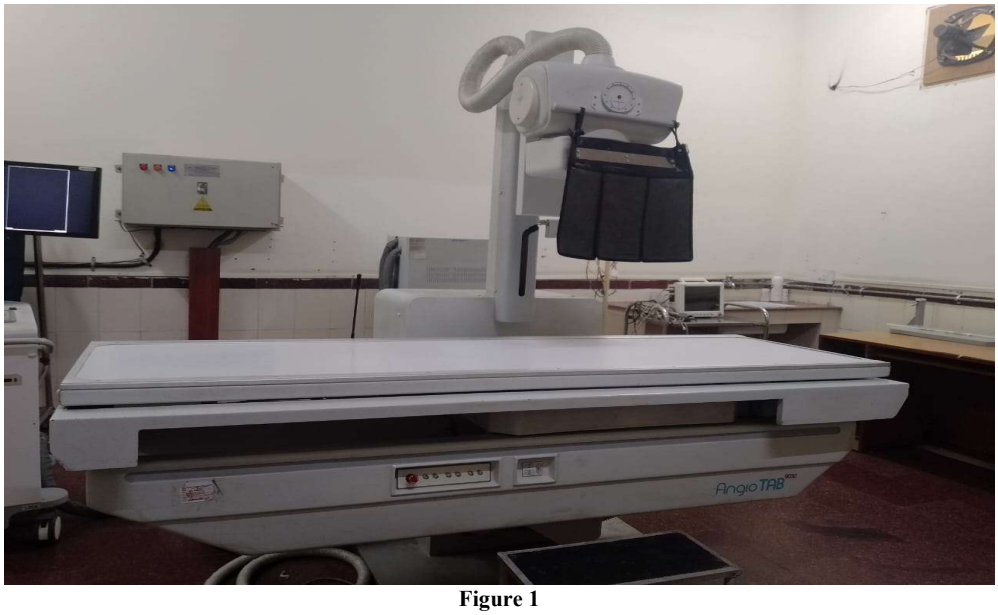


Figure 1

Modern systems use closed-circuit television systems and image intensifiers to transfer X rays onto phosphors. The human body absorbs X-rays differently, causing radiation transfer. An automated collimator controls beam size, resulting in visible images on a fluorescent screen. By adjusting kVp and mA, fluoroscopy can achieve

maximum picture detail and increased brightness. The adoption of a high gain detector system is required to lower patient dose because fluoroscopic images are statistically inferior to radiographic images due to their high radiation dose and low current (1-5mA) output **[1]**.

In order to gather functional information, fluoroscopy is an imaging technique that displays anatomical structures, organ motion, and the movement of contrast media in blood arteries and organs. Modern digital fluoroscopy (DF), which obtains and stores digital dynamic images in a computer, is an evolution from traditional fluoroscopy, which recorded images on film **[3]**.

The chemical element barium has the atomic number 56 and the symbol Ba. It is a delicate, silvery alkaline earth metal that ranks fifth in group 2. Barite, barium sulphate, $BaSO_4$, witherite, barium carbonate, $BaCO_3$, are the two most prevalent forms of barium **[4]**.

BARIUM SULPHATE: It is an inorganic compound; its scientific name is barium sulphate. A barium cation and a sulphate anion are the two parts of barium sulphate. Four oxygen atoms are joined to the sulphur. $BaSO_4$ is the sulphate salt of barium that is present in 9 the mineral barite. This solid white crystal is soluble in strong acids but insoluble in water and alcohol. It has no aroma **[5]**.

The gastrointestinal system (GIS) is a complex network of mucosal membranes and compartments that manages the breakdown, digestion, nutritional absorption, and waste elimination of food. It provides the highest bioavailability and absorption capacity among all bodily systems due to its size. The gastrointestinal (GI) tract, which extends from the mouth to the anus, acts as a barrier against harmful chemicals while facilitating food digestion and absorption. The liver plays a crucial role in metabolizing foreign substances and is often affected by toxic or metabolically activated xenobiotics. Additionally, the GI tract has the second-largest surface area for direct interaction with xenobiotics, following the lungs. It frequently becomes the focus during poisoning incidents, including both intentional ingestion by children and deliberate suicide attempts **[6]**.

UPPER GI TRACT INCLUDES:

- Mouth
- pharynx
- oesophagus
- stomach

LOWER GASTROINTESTINAL TRACT INCLUDES:

- Small intestine
- Large intestine accessory

ORGANS:

- Teeth
- Tongue

- Salivary glands
- Liver
- Gall bladder
- Pancreas **[7]**

VARIATIONS IN ESOPHAGUS PATHOLOGIES:

A group of illnesses known as esophageal diseases impact the function of the oesophagus. The portion of the digestive system that facilitates food movement from your mouth to your stomach is called the oesophagus, sometimes known as the food pipe **[8]**.

Esophageal disorders that need medical attention may be indicated by these symptoms. Oesophagus abnormalities include:

Dysphagia is a medical condition characterized by difficulty swallowing, affecting the coordination of muscles and nerves in transferring food or liquids from the mouth to the stomach. It can cause discomfort, choke, or cough. Dysphagia is classified into three types: oral dysphagia, oropharyngeal dysphagia, and esophageal dysphagia, based on the location of the problem **[9]**.

Gastro-esophageal Reflux Disease. Gastro-esophageal reflux disease (GERD) is a condition where stomach acid backs into the oesophagus, causing irritation and inflammation. Common symptoms include chest burning, backwash, abdominal discomfort, dysphagia, and a lumpy throat. Causes include reflux of gastric acid, esophagitis, Barrett esophageal stricture, and scar tissue growth. GERD can result from persistent reflux over time **[10]**.

Esophageal Carcinoma

Esophageal cancer, primarily caused by changes in DNA, is a significant global health issue that mainly affects men. It typically develops in the mucus-secreting glands of the lower esophagus. The most common type of esophageal cancer is squamous cell carcinoma, but there are also rare variants, including sarcoma, lymphoma, melanoma, small cell carcinoma, and choriocarcinoma **[11]**.

METHODS AND MATERIALS

This study was conducted in the Radiology Department of Maharashtra Medical University, focusing on 30 patients presenting with fluroscan requirements. Data was collected through DR fluoroscopy and analyzed using descriptive statistical tools. The study included 30 patients and medical professionals, with a sample size of 30. The study included demographic variables such as age group, sex, use of radiation protection devices, and medical staff's knowledge about radiation. The barium swallow procedure was performed on a digital fluoroscopy machine to detect esophageal abnormalities. The procedure involves preparing the patient, administering barium sulfate solution, and

capturing images using fluoroscopy or X-ray imaging. Post-procedure care and a detailed report were provided. The study emphasizes the importance of following specific protocols and guidelines when performing a barium swallow procedure.

RESULTS

A barium swallow test was performed on 30 patients at Maharishi Markandeshwar Super-speciality Hospital in Mullana, Ambala, as part of this study. Imaging results, patient records, and medical investigations were the sources of the data. An expert radiologist validated the interpretation of the results by the responsible party. Excel sheets and descriptive statistical tools were used for the data analysis.

The study analyzed 30 patients, revealing that 30% were aged 50-60, 20% aged 60-70, and 10% aged 70-80, with 13.33% in both the 30-40 and 40-50 age groups. Among the patients, 19 (63.34%) were female and 11 (36.66%) male **(Graph 1)**.

In our study, we grouped 30 patients into two categories: 50% male and 50% female **(Table1)**.

Complaints included dysphagia (63.33%), odynophagia and postprandial hiccups (13.33% each), vomiting and weight loss (10% each), and a small number reported loss of appetite, trismus, acid reflux, regurgitation, globus sensation, and throat irritation. **(Graph 2)**.

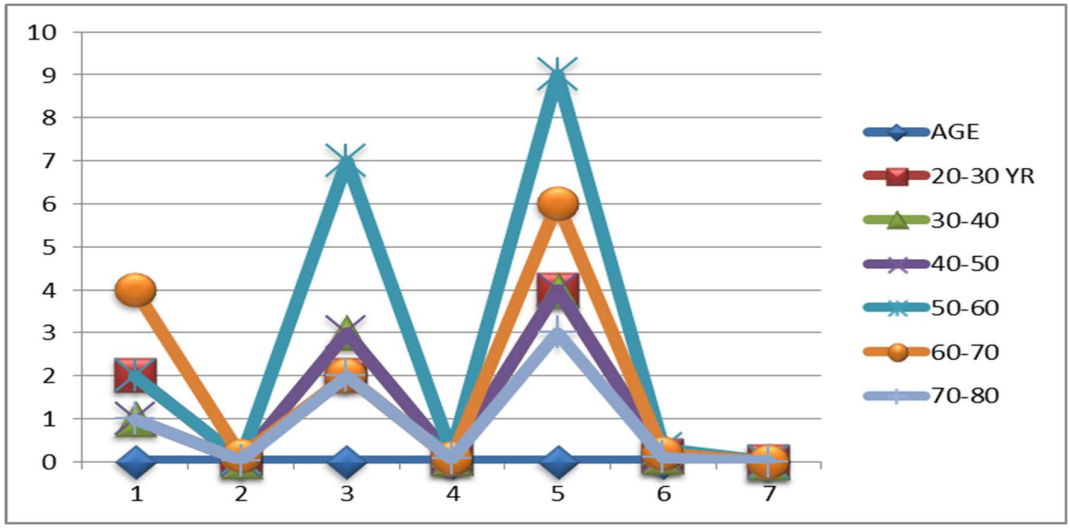
In terms of ward distribution, the radiotherapy ward had the highest count at 30%, followed by ENT (23%) and general wards (17%) **(Table 2)**.

Out of 30 cases examined, 21 (70%) were found to be abnormal, while 9 (30%) were normal **(Graph 3)**.

In a study of 30 patients, 11 (37%) had narrowing, 2 (7%) had abnormal growths, and 1 (3%) each had obstruction, hiatus hernia, achalasia, and achalasia cardia. Additionally, 5 patients (17%) were diagnosed with cancer, while 9 (30%) showed normal results **(Graph 4)**.

Narrowing patterns showed 5 cases in the distal esophagus (46%), 4 in the middle (36%), and 2 in the proximal (18**%) (Graph 5)**.

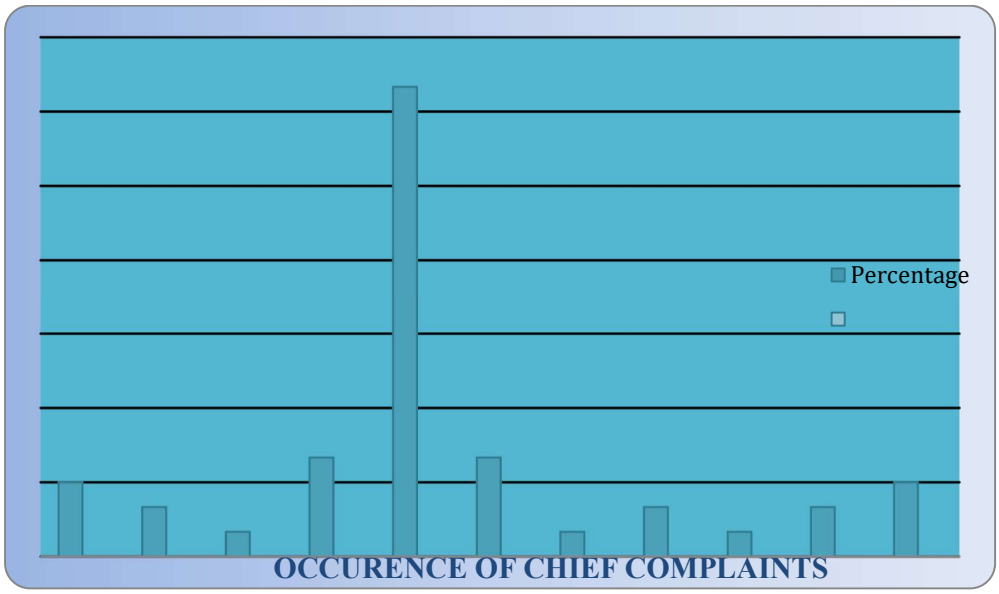
Out of 30 cases, 80% were males, with 4 cases of esophageal cancer, while females had only 1 case, representing 20% of the total (**Table 3**).



Graph 1: Assessing the age range distribution among patients

Table 1: Represents the gender ratio of the patients who participated in this study

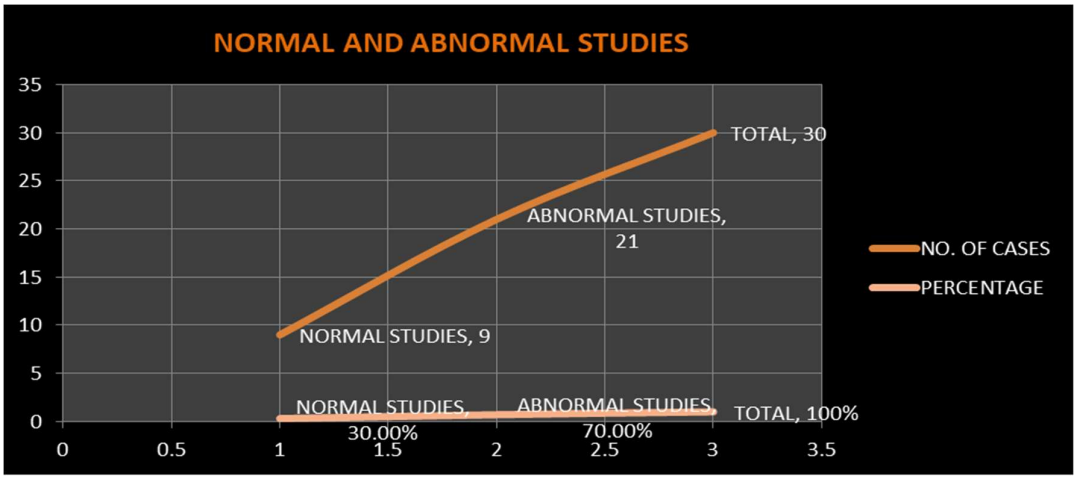
SEX	TOTAL CASES	PERCENTAGE
Female	15	50%
Male	15	50%
Total	30	100%



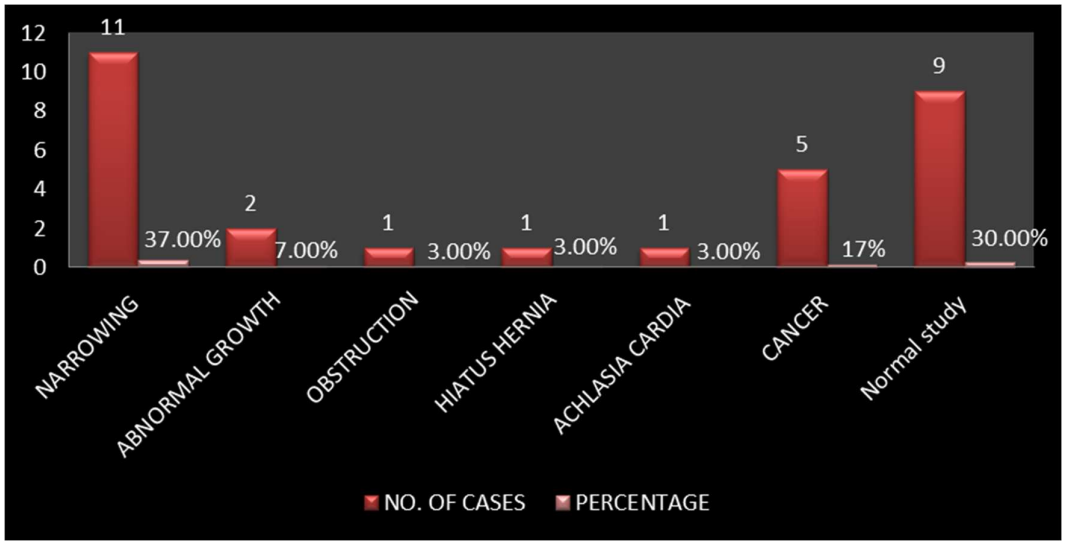
Graph 2: Distribution Of Patients According To The Occurrence Of Chief Complaints

Table 2: Allocation of Patients Across Wards

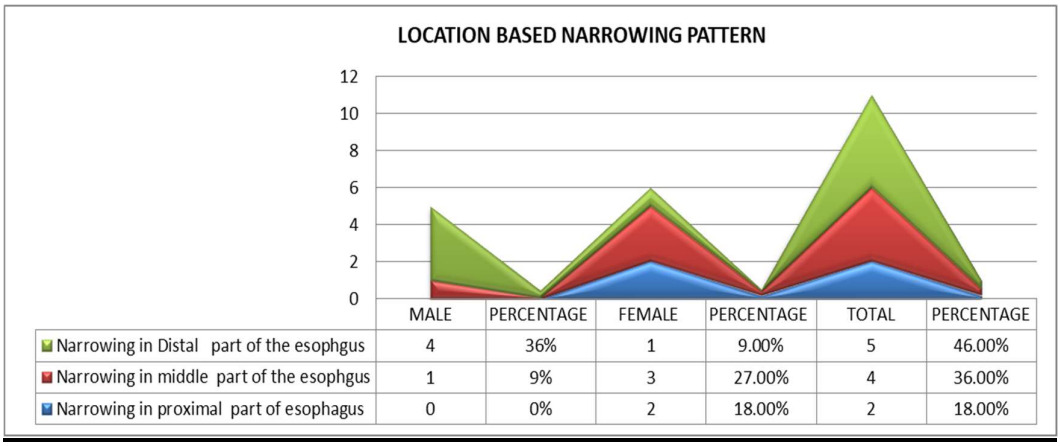
WARDS	PATIENT COUNT	PERCENTAGE
ENT WARD	7	23.00%
SURGERY WARD	4	13.00%
RADIOTHERAPY WARD	9	30%
MEDICINE WARD	2	7.00%
GASTROENTEROLOGY WARD	3	10%
GENERAL WARD	5	17.00%
TOTAL	30	100%



Graph 3: Normal And Abnormal Study



Graph 4: Diagnostic Findings



	MALE	PERCENTAGE	FEMALE	PERCENTAGE	TOTAL	PERCENTAGE
Narrowing in Distal part of the esophgus	4	36%	1	9.00%	5	46.00%
Narrowing in middle part of the esophgus	1	9%	3	27.00%	4	36.00%
Narrowing in proximal part of esophagus	0	0%	2	18.00%	2	18.00%

Graph 5: Location Based Narrowing Pattern

Table 3: Esophageal Cancer

ESOPHAGEAL CANCER	NO. OF CASES	PERCENTAGE (%)
MALES	4	80
FEMALES	1	20
TOTAL	5	100

DISCUSSION

The study aimed to investigate the role of barium contrast in detecting esophageal disorders among 30 patients diagnosed with symptoms such as dysphagia, vomiting, odynophagia, and weight loss. The patients were referred to the radiology department for barium investigation to rule out abnormalities like narrowing in the esophagus, hiatus hernia, Esophageal cancer, obstruction, abnormal growth, and achlasia cardia.

The study involved 50% males and 50% females, with a male-to-female ratio of 1:1. The majority of patients were between 50 and 60 years old.

The mean age of the study was approximately 50.01 years, in correspondence with the study "Frequency of Gastrointestinal Diseases Diagnosed on Barium Contrast Studies" by Aneeqa Khalid et al. The study found that dysphagia was the most common complaint, followed by odynophagia and post-prandial hiccups. Thirteen patients (63.33%) reported dysphagia, while eight patients reported odynophagia and post-prandial hiccups at a rate of 13.33% each.

Vomiting accounted for 26.4% of cases, while dysphagia was reported by 13.4%. The study also found that narrowing, esophageal cancer, obstruction, achlasia cardia, hiatus hernia, and abnormal growth were observed in the current study.

In conclusion, the study highlights the importance of barium contrast in detecting esophageal disorders and identifying potential complications. Further research is needed to further understand the role of barium contrast in diagnosing and treating esophageal disorders.

CONCLUSION

The study involved 30 patients, with 63.33% reporting dysphagia, abnormal growth, obstruction, hiatus hernia, achalasia, and cancer. The most common disorder found was narrowing in the distal part of the esophagus, followed by narrowing in the middle part. The barium contrast radiographic exam was found to be useful in detecting these abnormalities. Out of the 30 patients, 22 (73.33%) were treated in the Out Patient Department, and 8 (27%) were admitted to the, In-Patient Department for a barium swallow examination. The most common abnormality found was narrowing in the distal part of the esophagus, with 11 cases, comprising 46% of the total cases. There were 4 cases of narrowing in the middle part, 36% of the total cases, and 2 cases of narrowing in the proximal part, comprising only females and making up about 18% of the overall cases. The study demonstrates that barium contrast radiographic examination is a safe and well-tolerated diagnostic tool for esophageal disorders, providing early detection, precise localization, and characterization, which

significantly improve patient care and outcomes.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee.

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