

“Role of CT in evaluation of Upper GI tract pathology”

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Aims & Objectives:-

- To evaluate the importance of CT in diagnosing the presence of upper gastrointestinal pathology.
- To evaluate the nature and extent of disease in patients with known upper gastrointestinal lesions and determining the presence, location, and severity of complications associated with primary upper gastrointestinal pathology.

Material and Methods :-

Study was conducted in GCS medical college, Ahmedabad and included patients with clinically suspected upper GI tract pathology.

CT was done using 16 slice siemens CT machine including standard scan protocol. Upper GI tract pathologies were categorized as benign or malignant on the basis of clinical details and imaging features. The sensitivity and specificity of CT to correctly distinguish benign from malignant pathologies was calculated over a period of 12 months from January 2021 to December 2021.

Inclusion criteria :-

- Patient with suspected for malignancy.
- Patient with upper GI tract symptoms.
- Patient with known case of malignancy for extent and follow up.

Exclusion criteria :-

- Pregnant females.
- Impaired renal function.

Result –

CT imaging is used to differentiate between benign and malignant lesions of upper GI tract and It is also used frequently to determine stage of cancer and to follow the progress. CT is far more accurate for evaluating the intramural and extra intestinal components. Overall sensitivity for detection of lesion by CT was 100%, specificity was 98.56%, positive predictive value 98.15%, and negative predictive value 100%.

Conclusion -

CT imaging is an excellent investigation to evaluate the upper GI tract pathology due to its high spatial resolution and multiplanar imaging capability. Characterization of lesions's origin, nature, extent helps in the surgical planning.

Keywords:-, Computed tomography, Duodenum, Esophagus, Stomach, Upper gastrointestinal tract.

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I. Introduction

• The upper GI tract is made up of the mouth, esophagus, stomach, and duodenum. Computed tomography is a sensitive method for diagnosis of upper gastrointestinal disease. It is also a useful test to investigate patients with stomach pain, difficulty in swallowing and nausea which is common presentation of upper GI tract pathology.

• To differentiate between benign and malignant lesions of upper GI tract and It is also used frequently to determine stage of cancer and to follow progress.

• CT is far more accurate for evaluating the intramural and extraintestinal components.

II. Result

CT imaging is excellent investigations to evaluate the upper GI tract pathology .Total 90 cases were studied. There were 40 patients detected with esophageal lesions, 25 patients with stomach lesions, 5 patients with duodenum lesions and 20 patients with diaphragmatic hernia.

Table:1 Distribution of esophageal pathologies.

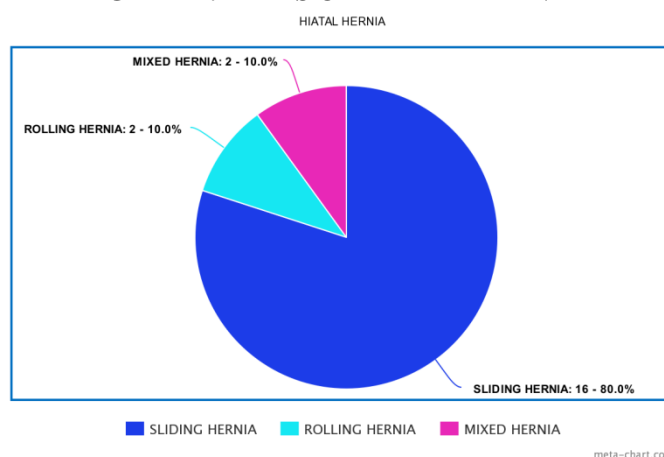
DIAGNOSIS		CASES
BENIGN	ACHALASIA CARDIA	3
	ESOPHAGEAL DIVERTICULUM	1
	ESOPHAGEAL PERFORATION	2
	ESOPHAGEAL DUPLICATION CYST	1
	ESOPHAGEAL STRICTURE	3
	ESOPHAGEAL LEIOMYOMA	5
MALIGNANT	UPPER ESOPHAGEAL CARCINOMA	5
	MID ESOPHAGEAL CARCINOMA	9
	LOWER ESOPHAGEAL CARCINOMA WITH GE JUNCTION INVOLVMENT	11
	TOTAL	40

Table:2 Distribution of stomach and duodenum pathologies.

DIAGNOSIS		CASES
STOMACH	CA STOMACH	16
	GIST	5
	GASTIC POLYP	1
	NEUROENDOCRINE TUMORS	1
DUODENUM	DUODENUM POLYP	2
	NEUROENDOCRINE TUMORS	2
	GIST	1

Out of 16 case of CA stomach, there were 4 cases with liver metastasis and 3 cases with omental deposits. In 5 cases lesion was involving GE junction.

GRAPH : TYPES OF HIATAL HERNIA



Sliding hernia is most common type of hiatal hernia

Overall sensitivity for detection of lesion by CT was 100%, specificity was 98.56%, positive predictive value 98.15%, and negative predictive value 100%.

III. Discussion

Upper GI tract pathologies mainly involve esophagus, stomach and duodenum pathology. Esophageal lesions occur in various diseases it can be benign or malignant. Computed tomography permit the assessment of wall thickness, mediastinal involvement, adjacent lymphadenopathy, and distant spread. In diseases such as

polyps, leiomyoma, duplication cysts, scleroderma, trauma, caustic esophagitis, hiatal hernia, esophageal diverticulum, achalasia, paraesophageal varices, esophageal cancer and stricture.

The stomach may be involved by a myriad of pathologies ranging from benign aetiologies like inflammation to malignant etiology like carcinoma or lymphoma. Various pathologies like gastritis, carcinoma, lymphoma, carcinoid, metastases, bezoar or corrosive injury may affect the stomach. CT is usually the initial imaging investigation of choice for evaluation of these cases. Conventionally, CT could evaluate the mural and extramural extent of diseases and could not provide any mucosal information.

Duodenal tumours are uncommon, but they can cause significant morbidity and mortality.

Esophageal cancer

Esophageal cancer carries a poor prognosis unless it is of early stage and can be surgically resected for cure. Resectability is determined by the stage of disease at diagnosis and therefore accurate staging is of importance in patients diagnosed with esophageal cancer ⁽¹⁾. Imaging studies that play a role in the evaluation of esophageal cancer include barium studies, computed tomography, endoscopic ultrasound and positron emission tomography. Imaging provides important information regarding the local extent and any distant spread of disease, which in turn helps in determining optimal management for these patients.

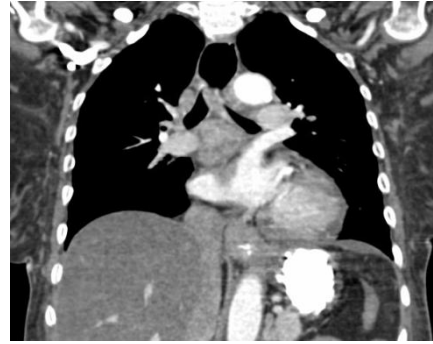
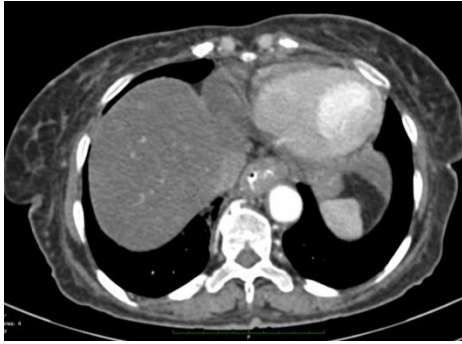
Most esophageal cancers are epithelial in origin. The esophagus is lined by squamous epithelium and therefore the prevalent histology of esophageal tumours is squamous cell carcinoma in most parts of the world ⁽²⁾.

The esophagus is divided into three anatomic parts: cervical, thoracic, and abdominal (lower thoracic). Tumor location is defined by the distance of its epicenter from the incisors rather than by its upper edge the cervical esophagus, which extends 15–20 cm from the incisors, lies between the hypopharynx and the sternal notch; cancer within this anatomic part is classified as cervical esophageal cancer.

The thoracic esophagus is divided into the upper, middle, and lower thoracic esophagus according to distance from the incisors. The upper thoracic esophagus lies between the sternal notch and the inferior aspect of the azygos vein and extends from 20 to 25 cm from the incisors on endoscopy. The middle thoracic esophagus extends from the inferior aspect of the azygos vein to the inferior aspect of the inferior pulmonary vein and is located between 25 and 30 cm from the incisors. The lower thoracic esophagus lies 30–40 cm from the incisors and extends from the inferior aspect of the inferior pulmonary vein to the stomach.



Heterogeneously enhancing circumferential wall thickening is noted involving mid esophagus suggestive of mid esophageal carcinoma.



Heterogeneously enhancing circumferential wall thickening involving middle and lower esophagus extending upto GE junction and luminal narrowing & proximal dilatation of esophagus. The lesion shows arch contact < 90* between descending aorta with preserved fat plane. Findings are suggestive of esophageal carcinoma.

Achalasia cardia

Achalasia is an esophageal motility disorder involving the smooth muscle layer of the esophagus and the lower esophageal sphincter (LES) ⁽³⁾ It is characterized by incomplete LES relaxation, increased LES tone, and lack of peristalsis of the esophagus in the absence of other explanations like cancer or fibrosis. ^(4,5) Achalasia is in two forms, the primary type if the pathology is due to abnormality of esophageal Aurbach plexus, which is the commonest and secondary type or pseudoachalasia which is seen in small proportions. The secondary is seen in esophageal cancer, chagas disease, diabetes mellitus and scleroderma.



Short segment luminal narrowing seen at gastro-esophageal junction with proximal dilatation of entire thoracic oesophagus suggestive of Achalasia cardia.

Esophageal stricture

An esophageal stricture refers to the abnormal narrowing of the esophageal lumen. It often presents as dysphagia, commonly described by patients as difficulty swallowing. Generally, the term esophageal stricture is reserved for intraluminal esophageal disorders resulting in narrowing, although extrinsic esophageal compression and luminal compromise can sometimes occur by direct invasion of malignancy or lymph node enlargement, for example, and therefore result in esophageal stricture as well.

A stricture is either benign or malignant. Appropriate management depends on identifying the correct etiology for stricture. The majority of esophageal strictures result from benign peptic strictures from long-standing gastroesophageal reflux disease (GERD), which accounts for 70 to 80% of adult cases. ⁽⁶⁾ Early and preventive use of proton pump inhibitors (PPI) has somewhat decreased the incidence of such peptic strictures. In young children and adolescent populations, corrosive substance ingestion is the leading cause of stricture formation in the esophagus. ⁽⁷⁾ The following classification and list of common and uncommon causes for stricture formation in the esophagus can guide physicians in their approach to management:

Benign Strictures:

Corrosive substance ingestion: Accidental ingestion of, or suicidal poisoning with household cleaning products are not uncommon occurrences. Substance ingestion could cause anything from mild injury to extensive full-thickness necrosis of the esophagus.

Eosinophilic esophagitis (EoE): It represents a distinct chronic, local immune-mediated esophageal disease clinically characterized by dysphagia and histologically by eosinophilic-predominant inflammation

Radiation injury: Radiation therapy, when offered alone or combined with surgery, can cause esophageal stricture as a side effect. Radiation is an integral part of head and neck cancer and lung cancer treatment.

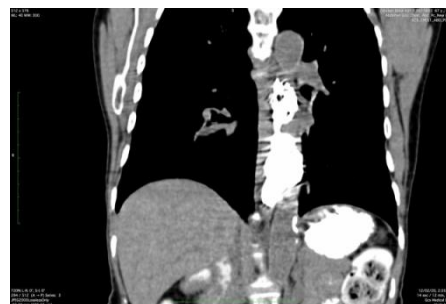
Iatrogenic stricture post-endoscopic therapy: Upper GI endoscopy is commonly an option for diagnostic and therapeutic interventions involving the esophagus. A side effect of these interventions includes damage to the underlying regenerative cell layer, leading to fibrosis and stricture formation. The risk of stricture increases with extensive circumferential resection.

Other Rare Etiologies:

- Prolonged use of nasogastric tube
- Collagen vascular diseases such as scleroderma or SLE.
- Benign mucosal pemphigoid
- Graft versus host disease
- Esophageal web in Plummer-Vinson syndrome.
- Crohn's disease
- Tuberculosis

Malignant Stricture

- Esophageal adenocarcinoma
- Esophageal squamous cell carcinoma
- Metastatic esophageal neoplasm - usually from lung cancer.



Smooth well defined circumferential short segment stricture is noted in mid esophagus with proximal dilatation of upper 1/3rd of esophagus suggestive of benign stricture.

Esophageal diverticulum

An esophageal diverticulum is a relatively rare disorder of the esophagus.⁽⁸⁾ An esophageal diverticulum can be characterized by how it is formed: pulsion or traction. Pulsion diverticula are created when there is increased intraluminal pressure causing herniation of the esophageal wall in an area of weakness and usually occur in the setting of dysmotility of the esophagus.⁽⁹⁾ Traction diverticula occur when there is an external force on the esophageal wall such as mediastinal inflammation that adheres and pulls on the esophageal wall creating a defect or diverticulum.

An esophageal diverticulum can also be categorized based on location as pharyngeal (Zenker) diverticula, mid-esophageal diverticula, and epiphrenic diverticula. Pharyngeal diverticula are considered false diverticula. They usually occur in the hypopharynx where there is a weakness in the area known as Killian's triangle. Killian's triangle is an area bound by the cricopharyngeus muscles and inferior pharyngeal constrictor muscles. These are usually formed by pulsion. A mid-esophageal diverticulum is usually true diverticulum and normally caused by traction from mediastinal inflammation. Epiphrenic diverticula are usually false diverticula located in the distal 10 cm of the esophagus. Similar to pharyngeal diverticula, they are also usually caused by pulsion from motility disorders that cause an increase in lower esophageal sphincter pressure such as achalasia.



Small contrast filled outpouching seen arising from left lateral wall of the esophagus suggestive of diverticulum.

Esophageal duplication cyst

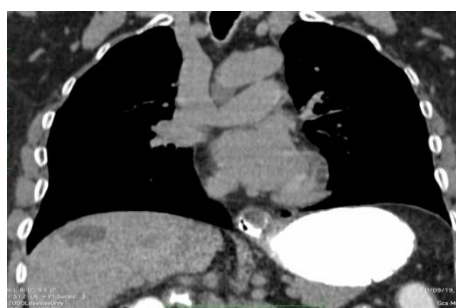
The esophageal duplication cyst represents one of the two most common types of bronchopulmonary foregut malformations.⁽¹⁰⁾ The bronchogenic-type cyst occurs more frequently and is usually located in the mediastinum around the tracheo-bronchial tree, whereas esophageal duplication cysts are most frequently located in the right posterior inferior mediastinum.⁽¹¹⁾



Well defined non-enhancing hypodense lesion seen arising from middle mediastinum in right paratracheal region extending into posterior mediastinum suggestive of esophageal duplication cyst.

Esophageal leiomyomas

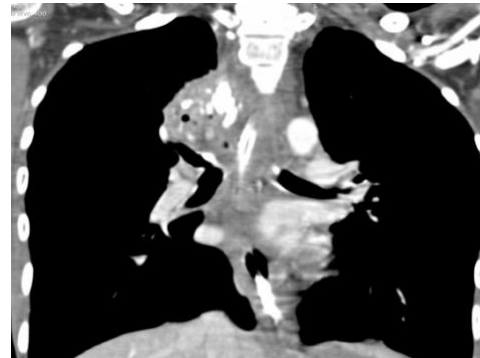
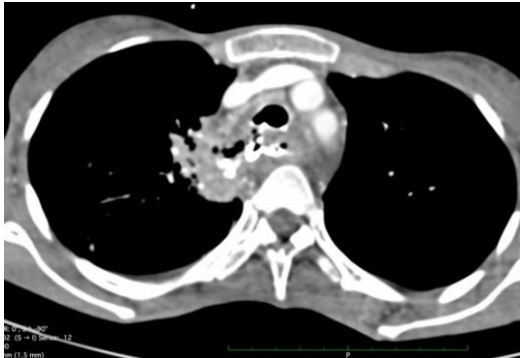
Leiomyomas are the most common, benign mesenchymal tumors of the esophagus. Mesenchymal tumours account for two-thirds of all benign lesions of the esophagus.⁽¹²⁾ These tumours originate in the smooth muscle cells.



Well defined soft tissue density lesion noted in intramural region of anterior wall of esophagus at the level GE junction which is projecting lumen itself causing minimal lumen narrowing suggestive of leiomyoma.

Esophageal perforation

Esophageal perforation is a life-threatening condition that can be quickly diagnosed on the basis of findings on contrast esophagograms when the typical signs and symptoms of vomiting, chest pain, and subcutaneous emphysema occur.



There are few defects in esophageal wall through which oral contrast is seen leaking into mediastinum which is seen communicating with an ill-defined collection with internal air foci is noted in right para-esophageal region suggestive of perforation.

Gastric carcinoma (GC)

Gastric carcinoma (GC) is the fourth most common cancer worldwide and the second most common cause of cancer-related death⁽¹³⁾ Surgical excision of the GC remains the only cure available and is dependent on the stage of the disease at presentation. The extent of stomach wall invasion by the tumor, spread to the lymph nodes and the presence of distal organ metastases determines the stage of the tumor. Detection of GC in the early stages makes survival highly favorable. However, due to the non-specific symptoms of GC, patients often present at inoperable stages with locally advanced or metastatic disease.

Adenocarcinomas account for 95% of all GCs.⁽¹⁴⁾ Most GCs are polypoid or ulcerated. Based on the level of invasion, GCs are divided into early gastric cancer (EGC) and advanced gastric cancer (AGC). EGC or the superficial form is limited to the mucosa and submucosa, regardless of the presence or absence of lymph node metastases and can appear as a small circumscribed, sometimes ulcerated thickening of the gastric wall.⁽¹⁵⁾ AGC involves the muscularis propria or beyond and can be polypoid, ulcerating, ulcerating infiltrating and diffusely infiltrating (linitis plastica). The most commonly used staging system for GC was developed by the American Joint Committee on Cancer (AJCC)⁽¹⁶⁾



Heterogeneously enhancing circumferential wall thickening seen involving body and pylorus of stomach without extraluminal extension suggestive of carcinoma.

Gastrointestinal stromal tumor (GIST)

Gastrointestinal stromal tumor (GIST) is the most common subepithelial neoplasm that can be found throughout the gastrointestinal tract, but most of them occur in the stomach. They arise from interstitial cells of Cajal, which are pacemaker cells for gut movement. Therefore, GIST usually arises from the muscularis propria and exhibit

characteristics of subepithelial neoplasms .The tumours can be extraluminal, intraluminal or mixed (dumbbell-shaped) pattern.

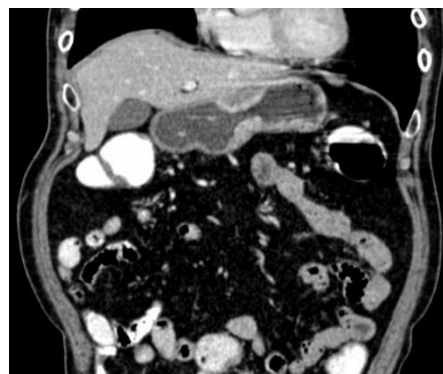
GIST typically grows into a well-defined exophytic mass, but intraluminal masses can also be seen. Small tumours are often of homogeneous density or signal and large tumours tend to show irregular lobulated margins, mucosal ulceration, central necrosis, haemorrhage, cavitations, and heterogeneous enhancement. Extensive necrosis can result in fistula formation with air-fluid level or oral contrast materials in the cavity. Malignant GIST commonly metastasizes to the liver or peritoneum, whereas metastases to the lymph nodes and extra-abdominal metastases are rare.



**Well defined endophytic heterogeneously enhancing soft tissue density lesion with central non enhancing necrotic area seen arising from greater curvature of body of stomach causing partial narrowing of lumen.
No evidence of any exophytic component is noted.
Findings are suggestive of GIST.**

Neuroendocrine neoplasias (NEN)

NEN are rare neoplasms that arise from cells of the endocrine and nervous systems. These tumours originate within the pancreas or from similar neuroendocrine cells outside of the pancreas.They are classified as functioning or non-functioning (if they secrete hormones or not); and they can be benign or malignant (60–92%).Insulinomas and gastrinomas are the most common of these rare tumors.



Heterogeneously enhancing nodular wall thickening seen involving GE junction,cardia,fundus and body along the lesser curvature without exophytic component suggestive of neuro endocrine neoplasm.

Duodenal and gastric polyps

Gastric polyps are a heterogeneous group of epithelial and subepithelial lesions that can vary in histology, neoplastic potential, and management .⁽¹⁷⁾ Even though most are asymptomatic (>90%), larger polyps may present with bleeding, anemia, obstruction, or abdominal pain. Most have no risk of cancer, but there are certain subsets of polyps with malignant potential, necessitating further endoscopic treatment and/or periodic surveillance.

Duodenal polyps smaller than 2 cm are benign and asymptomatic Except in polyposis syndrome polyps tend to be solitary and rarely produce duodenal obstruction. The most common epithelial polyps in the duodenum are adenomatous, which tend to appear in the sixth decade of life .According to their growth pattern, they are

classified as tubular, tubulovillous, or villous. Villous adenomas have malignant potential, so resection is indicated. Other adenomas are resected when symptomatic. CT has poor sensitivity for ampullary adenomas, detecting less than 50%. On contrast-enhanced CT, ampullary adenomas appear as smooth, frond like, flat or lobulated filling defects in the duodenal lumen, as an enhancing mass with smooth margins, or as a bulging and enhancing papilla.



Multiple heterogeneously enhancing polypoidal lesions seen along the fundus , greater curvature and lesser curvature of stomach causing luminal narrowing without exophytic extension suggestive of multiple gastric

Hiatal hernia:

A hiatal hernia (HH) is the herniation of abdominal organs and structures from the esophageal hiatus of the diaphragm to the thoracic cavity. There are four types of hiatal hernia: sliding (type 1), paraesophageal (rolling) (type 2), mixed (type 3) and mixed type accompanied by the herniation of visceral organs (type 4) (1, 2). The sliding type constitutes 90% of HHs. In the paraesophageal type, the gastro esophageal junction is herniated into the thoracic cavity of the stomach without displacement. The paraesophageal type is seen in less than 10% of HH cases. In type 4 hernia, in addition to the stomach, the intestines and spleen may also be herniated from the hiatal region.⁽¹⁸⁾

Preoperative imaging is very important in surgical planning since it shows abnormally placed anatomical structures. Therefore, the classification of HH types and their complications should be well known. Early diagnosis is important for the proper treatment of HHs.



The GEJ remains in its normal location while a portion of the stomach herniates above the diaphragm. With ill defined heterogeneously enhancing exophytic soft tissue density lesion and calcification within lesion raise possibility of rolling type of hernia with Gastro intentional stromal tumour.

IV. Conclusion

CT imaging is an excellent investigation to evaluate the upper GI tract pathology due to its high spatial resolution and multiplanar imaging capability. CT’s usefulness for 1) evaluating the nature and extent of disease in patients (2) Useful in differentiating in benign from malignant lesion.(3) It is a very good modality for the tumor staging and follow-up of the cases. Characterization of pathologies helps in the surgical planning.

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