Unraveling the Gastroesophageal Junction (GEJ): A Radiologist's Perspective

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Disclaimer: We do not have any conflict of interest or financial gain to disclose
GE junction normal Anatomy

- GEJ is the part of the GIT where the esophagus and stomach are joined
- Normally intra-abdominal & is 3-4 cm in length.
- Lined by the squamous epithelium (superiorly) and columnar epithelium (inferiorly) and a Z-line in between
- The esophageal hiatus is an elliptical opening in the muscular part of the right crus of the diaphragm at about the T10 vertebral level through which esophagus passes into the abdomen
- The esophagus slides in & out of abdomen during respiration & during elevated intra-abdominal pressure

Barium swallow: Normal **GEJ (yellow arrow)** below the diaphragm (blue arrow); CT abdomen: Normal GEJ (yellow arrow) at the level of fissure for ligament of sinus venosum (green arrow)
# GEJ abnormalities

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Pseudomass

- Normal soft tissue appears as a mass like lesion in gastric fundus near GEJ
- The fissure of the ligamentum venosum points directly at the normal position of GEJ
- Any soft tissue mass on the medial aspect of the fundus of the stomach adjacent to this fissure, should raise the possibility of pseudo tumor
- Scans in left lateral decubitus or prone position would be helpful in troublesome cases
Epiphrenic esophageal Diverticulum (ED)

- ED is a pulsion diverticulum which is usually the result from increased intraluminal pressure due to an esophageal motility disorder.
- It is a focal herniation of mucosa and submucosa through the muscularis propria.
- Classified as a pseudo diverticulum, since it lacks the muscular layer.
- Less common than traction diverticulum which occurs in the mid esophagus.
- Typically occurs within 10 cm of the GEJ.
• Delay in diagnosis & treatment of ED can lead to severe complications
• Patients are at risk of regurgitation, gastrointestinal bleeding, and aspiration pneumonia
• Risk of cancer is 0.3% to 3% in undiagnosed cases and usually advanced at the time of diagnosis
• Barium study is imaging of choice and generally a safe, simple, and effective diagnostic method
• Ostium (neck): connection between the diverticulum & esophagus

Barium swallow: Large epiphrenic esophageal diverticulum with air-barium fluid level (yellow arrows), ostium (green arrows), and esophagus (blue arrow); CT chest axial and coronal images: thin walled epiphrenic esophageal diverticulum (yellow arrow), ostium (green arrows).
Hiatus Hernia

• Herniation of abdominal cavity contents, most commonly stomach and GEJ, through the esophageal hiatus of the diaphragm into the mediastinum
• More common in females than males
• Mostly asymptomatic, or heart burn and reflux
• Predisposing conditions: muscle weakness, Obesity, pregnancy, ascites
• Classification into four types depending on position of GE junction and content of herniation
• Complications: mass effect if large hernia, volvulus, incarceration
Barium swallow oblique views show vestibule (green arrow), B ring (yellow arrow) and small sliding hiatus hernia (blue arrow).

**Type I (Sliding) hiatus hernia**

- Most common (>90%)
- Esophageal hiatus is abnormally widened up to 3-4cm (normal: 1.5cm)
- GEJ is >2 cm above the diaphragm.
- Small hernia reduces in upright position
- Associated with reflux disease
- Diagnosis is usually made on in Upper GI studies in symptomatic patients
- Very common incidental finding in cross sectional imaging in asymptomatic patients
CT chest aortic angiogram axial, coronal and sagittal images show GEJ (green arrow) above the diaphragm (yellow arrows) and herniated stomach (blue arrow) through the esophageal hiatus.

Type I (Sliding) hiatus hernia
Type II (Para esophageal / rolling) hiatus hernia

- Less common
- Gastric fundus herniates through the localized defect in the phrenoesophageal membrane or widened hiatus while the GEJ remains below diaphragm.
- Angle of his (angle between stomach & gej) is maintained.
- Not associated with significant gerd

Barium meal AP and Lateral views: Normal position of the GEJ (yellow arrow) and herniation of the stomach fundus through the esophageal hiatus (green arrow)
• Large hernia may have organo-axial gastric volvulus with or without obstruction
• Prone to mechanical obstruction, incarceration, or perforation

CT chest: axial, coronal, and sagittal images of a different patient showing normal position of GEJ (blue arrows) below the diaphragm (yellow arrows) and herniation of gastric fundus through the esophageal hiatus (green arrows)
Type III (Mixed) Hiatus hernia

- Have elements of both type I and type II hiatus hernia
- Progressive enlargement of the hernia through the hiatus stretches the phrenoesophageal membrane displacing GEJ above the diaphragm
- Confirmation: GEJ above the diaphragm usually by upper GI study thus helps in differentiating type II and type III hernias

X-ray chest PA view: Large opacity with air-fluid level overlapped with cardiac shadow (black arrow); Barium meal AP and right oblique: GEJ (green arrows) above the diaphragm (blue arrow) and gastric fundus herniation filled with barium (yellow arrows)
Type III (Mixed) Hiatus hernia

CT chest axial, coronal, and sagittal images: GEJ (yellow arrow) above the diaphragm (green arrow) and para esophageal gastric herniation (blue arrow) and omentum (red arrow).
Type IV Hiatus hernia

- Large defect in the phrenoesophageal membrane or large hiatus allows other organs, such as colon, spleen, pancreas and small intestine to herniate along with stomach.

CT chest axial, coronal and sagittal images: Herniation of the almost complete stomach in the mediastinum with non obstructing organo-axial volvulus (yellow arrows) and herniation of transverse colon (green arrow)
Mixed Hiatus hernia complicated with omental fat necrosis

CT chest: Axial and coronal images show mixed hiatal hernia stomach (blue arrows) with soft tissue stranding in the herniated omentum (red arrows) consistent with fat necrosis (omental infarct). The findings were confirmed on surgery.

CT chest in a 54-old-year old male patient with chest pain demonstrating intrathoracic stomach (yellow arrows) concerning for volvulus. It was confirmed on surgery.
Mixed Hiatus Hernia with organo-axial gastric volvulus and necrosis

50-year-old male with severe chest pain. CT chest axial, coronal, and sagittal images: distended stomach with food debris and air-fluid level (yellow arrows) in the posterior mediastinum displacing heart (green arrows), and gastric intramural air (red arrows) suggesting gastric volvulus with necrosis. It was confirmed post operatively.
Achalasia

- Esophageal motility disorder characterized by absent primary peristalsis and incomplete relaxation of LES
- Primary (idiopathic)- Due to loss of ganglion cells in esophageal myenteric plexus
- Secondary (pseudo achalasia)- due to malignant tumor (>75%) or Chagas disease
- Dysphagia to solid and liquid, chest pain and regurgitation
- Usually diagnosed with manometry in early stage in suspected cases when barium study is normal

Dilated esophagus mixed with food debris (yellow arrow) and smooth narrowing of the distal most esophagus (green arrow)
• Barium study: smooth tapering of the distal esophagus (bird beak sign) & proximal dilatation
• Distal esophageal narrowing is long & irregular with less dilatation of proximal esophagus in secondary achalasia
• CT is useful in assessing common complication like focal esophageal thickening which may indicate carcinoma and aspiration
• Treated with Heller myotomy
CT chest axial, coronal, and sagittal images: Dilated esophagus filled with fluid and food debris (yellow arrows), no mass in the distal esophagus and GEJ (green arrows)
Boerhaave syndrome

- Described by Hermann Boerhaave in 1724
- Vertical complete transmural laceration of esophagus (1-4 cm long)
- Etiology:
  - Spontaneous (retching, alcohol intake)
  - Secondary to endoscopy, trauma, vagotomy, foreign body
- Meckler’s triad- vomiting, chest pain, and subcutaneous emphysema
- Other symptoms like epigastric pain, shock, dyspnea, cyanosis
- Grave prognosis (20%-75% mortality)
- M > F
- Usually on left (90% cases)
- Uncommonly sub-diaphragmatic
Boerhaave syndrome Imaging

- **X-ray**: May be normal, usually pneumomediastinum, left pleural effusion & pneumothorax; V-sign of Naclerio (left Para spinal radiolucency above diaphragm)
- **Fluoroscopy**: 10% negative, esophagopleural fistula
- **CT**: Non enhanced- intramural hematoma and peri esophageal air collection, pneumomediastinum, pleural effusion & pneumothorax

CT chest (A & B): esophagus with deformed lumen (green arrow), peri-esophageal air-fluid collection (yellow arrow), pneumothorax (blue arrow), pneumomediastinum (red arrow), pleural effusion (purple arrows); Follow up CT chest with oral contrast (C): esophageal tear (black arrow) and contrast leakage (blue arrow)
Esophageal Varices (EV)

- Dilated submucosal veins due to increased collateral blood flow from cirrhotic portal venous system to azygos system (arrows)
- Classification of EV Grade:
  - F0-no EV
  - F1-small straight EV
  - F2- slightly enlarged tortuous EV occupying <1/3rd lumen
  - F3- large coil shape EV occupying >1/3rd lumen
- Causes: Cirrhosis, Portal vein thrombosis, splenic vein thrombosis, Hepatic vein obstruction & IVC obstruction
- UGI: serpiginous /worm eaten filling defects
- CT: thickened wall, scalloped luminal masses, para esophageal varices and marked enhancement following dynamic contrast
GEJ Leiomyoma (arrows)

- Most common benign mesenchymal tumor of the esophagus
- Young males (Male: Female =2:1)
- Usually involves distal 1/3 of esophagus
- Usually solitary; multiple in 3%
- Usually asymptomatic, may cause dysphagia, hematemesis
- Arise from the muscularis mucosae or muscularis propria
- 10% have circumferential growth pattern
- Barium shows smooth filling defect with obtuse margin
- CT shows lobulated homogenous soft tissue mass, occasional calcifications
GEJ Leiomyoma

Barium swallow AP view: Well defined lobulated smooth narrowing of the GEJ (yellow arrow) and filling defect in the fundus (green arrow); CT chest axial image: Lobulated soft tissue mass in GEJ (yellow arrows) causing luminal narrowing (blue arrow)

Different patient: calcifying lobulated soft tissue mass in GEJ (blue arrows)
GEJ Lipoma

- Extremely rare mesenchymal tumor
- Usually asymptomatic
- Dysphagia when > 4cm
- Mostly found incidentally, mean age 50 years; Male: Female = 2:1
- Usually in cervical/upper thoracic esophagus
- Barium study: Smooth filling defect with obtuse margin & “squeeze sign” manifested as change in contour/configuration with peristalsis
- CT: homogenous fatty intramural lesion
- Symptomatic lesion requires surgical resection
Gastrointestinal stromal tumor of lower esophagus

- Most common mesenchymal tumor in GIT, rare in esophagus (1%)
- Male>Female, usually in 5th decade
- Usually asymptomatic, dysphagia, weight loss and bleeding
- Worse prognosis than gastric GIST
- Barium: well defined filling defect with luminal narrowing
- Cross sectional: small tumor (<5cm) is homogenous, smooth margin with endoluminal growth; large tumor usually with irregular margin, heterogeneous density and extra luminal growth

GIST of lower esophagus seen as a large irregular soft tissue mass with extra luminal component
Intra thoracic posterior mediastinal ascites

- Rare complication of extension of abdominal ascites through esophageal hiatus into the posterior mediastinum
- Usually seen in cirrhosis and peritoneal carcinomatosis with severe tense ascites
- CT/MRI: posterior mediastinal fluid of same density to ascites fluid and communication at esophageal hiatus

CT chest: Axial, coronal, and sagittal images: abdominal ascites (yellow arrow) extended through the esophageal hiatus (green arrow) into the posterior mediastinum (red arrow) around the esophagus (blue arrow)
GEJ Adenocarcinoma

- Esophageal cancer accounts for 4%-10% of all GI malignancies
- More common in North America and Europe, Male > Female
- Predisposing factors: Alcohol, achalasia, Barrett esophagus, obesity
- Presents with chronic GERD, progressive dysphagia, weight loss
- Polypoidal fungating, ulcerated, or infiltrated mass
- Barium study: Long irregular stricture and proximal dilatation
- CT:
  - Eccentric or circumferential soft tissue thickening (>5mm)
  - Peri esophageal soft tissue and fat stranding
  - Invasion of adjacent structures, regional and distant lymph nodes
- PET-CT:
  - Increased uptake of FDG
  - Primarily used in detecting distant metastasis like hepatic & bone
GEJ Adenocarcinoma

CT chest: circumferential soft tissue thickening of GEJ and lower esophagus (yellow arrows), hypodense metastatic lesion in the liver (green arrows)

PET CT: increased uptake of FDG in the region of thickened GEJ (blue arrow)
Pathology: GEJ Adenocarcinoma
CT chest of an other patient with GEJ adenocarcinoma: Mural thickening with endoluminal soft tissue mass (yellow arrows)
CT chest axial, coronal, and sagittal images: soft tissue mass at GEJ (yellow arrows) and extra luminal fluid and air collection (green arrows) suggesting perforation. This finding was confirmed post-operatively.

- Esophageal perforation is a rare complication of esophageal carcinoma with very high mortality rate, especially if the diagnosis is delayed.
- Complications of perforation include acute mediastinitis, esophagopleural fistula, empyema, and pneumonia.
Squamous cell carcinoma of esophagus extending up to GEJ

CT chest axial and coronal (a , b) images show normal lower esophagus and GEJ (yellow arrow) in a patient with lymphoma.
Metastasis at GEJ

- Metastasis to the esophagus/GEJ is rare
- Incidence: 0.2%-6.1%
- 1\textsuperscript{st} case of metastasis to esophagus from prostate was reported in 1942
- Lung malignancy is the most common to metastasize to esophagus; others are breast, stomach, larynx, and hypopharynx
- Most patients have other metastatic disease at the time of esophageal lesion
- The most characteristic esophagoscopic finding is stricture with normal mucosa
- Upper GI study: Concentric smooth stricture
- Usually treated with palliative chemotherapy, radiation and occasionally palliative surgery
Metastasis at GEJ

CT chest axial and coronal (a, b) images show normal lower esophagus and GEJ (yellow arrow) in a patient with lymphoma.

Follow up CT chest axial, coronal and sagittal images show interval soft tissue mass in the distal esophagus and GEJ (green arrow)
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