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## ■ RADIOGRAPHIC FINDINGS

Abrupt change in the caliber of the mid third of the esophagus with irregular stricture, somewhat nodular defects (varicoid appearance) and pre-stricture dilatation.

## ■ DIAGNOSIS:

Squamous cell carcinoma of the esophagus.

## BRIEF OVERVIEW OF THE DISEASE

Esophageal cancer is the third most common gastrointestinal malignancy and is among the 10 most prevalent cancers worldwide. As with all other tumors, the outcome for patients with esophageal cancer is strongly associated with the stage at initial diagnosis.

Squamous Cell Carcinoma (SCC) is a malignant tumor of epithelial cells with stratified squamous differentiation that progresses from precursor lesions of intraepithelial neoplasia. It is the most common esophageal neoplasm worldwide, although its prevalence in the United States has been decreasing over the past several decades, most likely as a result of declining tobacco consumption.

SCC of the esophagus is more common in men than in women and its prevalence increases with age: Approximately 65% of patients are men, and the peak age group is 60–74 years of age. There is striking ethnic and geographic variation. In the United States, black men are at highest risk, with a rate of SCC four times that of white men. Esophageal cancer is most common in eastern and southern Africa and eastern Asia, where more than 20 cases per 100,000 people have been reported, in comparison with 1.8 cases per 100,000 people in the United States.

Tobacco and alcohol use are the major risk factors for SCC of the esophagus in the United States and appear to have a synergistic effect in increasing the risk of cancer. Other risk factors include a diet low in fresh fruit and vegetables or high in nitrosamines, achalasia, celiac disease, acid or lye burns, and Plummer-Vinson syndrome (characterized by the triad of dysphagia, iron-deficiency anemia, and upper esophageal webs). A genetic predisposition exists in patients with tylosis, a rare hereditary condition caused by a defect in the tylosis esophageal cancer gene on chromosome 17q25.

Progressive dysphagia, odynophagia, and weight loss are the most common symptoms of SCC of the esophagus. Patients with mediastinal tumor invasion may have chest pain unrelated to swallowing. Unfortunately, symptomatic patients usually have advanced disease at the time of diagnosis. Superficial cancers, defined as tumors limited to the mucosa or submucosa, regardless of lymph node status (T1 cancers), cause no symptoms in more than 85% of patients.

The majority of SCCs involve the middle third of the esophagus, followed by the lower third and then the upper third. These tumors can exhibit a variety of gross morphologic patterns, appearing as polypoid, flat, or ulcerated lesions.

While not a primary imaging modality for esophageal disease, chest radiography may be performed during evaluation of chest complaints. According to a study of 103 patients with

esophageal cancer by Lindell et al, the most sensitive findings at chest radiography were an abnormal azygoesophageal line convex to the right in 27% of cases, a widened retrotracheal stripe greater than 3–4 mm in width in 11%, and tracheal deviation in 10%, but at least 50% of patients had no findings attributable to their disease.

Most SCCs of the esophagus detected at barium esophagography are advanced tumors at the time of diagnosis, appearing as infiltrative lesions with irregular luminal narrowing, ulceration, and abrupt shouldered margins. Primarily ulcerative, polypoid, and varicoid appearances are less common. Superficial SCCs can demonstrate plaquelike, polypoid, or ulcerative appearances but can also be quite subtle, with poorly defined nodules that merge with one another, producing a confluent area of disease. Elevated lesions and rigidity of the esophageal wall have been shown to correlate with submucosal extension of tumor.

At CT, esophageal cancer causes localized thickening of the esophageal wall or a soft-tissue mass. Wall thickening may be asymmetric in early esophageal cancer and progress to circumferential involvement. In a study of dynamic contrast-enhanced CT by Umeoka et al, esophageal SCC demonstrated peak enhancement in the late arterial phase (35 seconds) compared with more gradual enhancement of the normal esophagus; all 30 SCCs were identified in this phase, including eight T1 lesions, only two of which were also identified in the venous phase.

CT plays an important role in staging of esophageal cancer, especially in evaluating mediastinal invasion and distant metastatic disease, and may show complications, such as esophageal obstruction and tracheoesophageal fistula formation.

CT is sensitive for detection of distant metastases, most commonly involving the liver, lungs, and bones; however, CT is less sensitive for detecting nodal metastases, as involved lymph nodes often are not enlarged.

At endoscopic US, esophageal carcinoma is characterized by the presence of a homogeneous or heterogeneous hypoechoic mass. The depth of invasion is determined by the extent of disruption of the esophageal wall, beginning at the mucosa and progressing through its various layers. Features suggestive of lymph node involvement include a diameter greater than 1 cm, homogeneous hypoechoicity, a rounded shape, and sharp borders.

Compared with other imaging modalities, endoscopic US better demonstrates the depth of invasion in the esophageal wall, allowing distinction between T1, T2, and T3 disease (tumor invasion of the mucosa or submucosa, muscularis propria, and adventitia, respectively) with an accuracy of 84%. Endoscopic US is also better for evaluating regional lymph nodes, with a reported accuracy of 92% when combined with fine-needle aspiration. However, stenotic tumors may not allow passage of the echoendoscope in up to 50% of patients. At MR imaging, esophageal carcinoma demonstrates intermediate T2 signal intensity, but fibrosis from neoadjuvant treatment may produce a similar appearance. Although not a primary modality for staging, MR imaging has been reported to be comparable to CT in determining various pa-

rameters of resectability, including mediastinal invasion, lymph node involvement, and distant metastases.

In general, SCC of the esophagus and its metastases display avid uptake at FDG PET. Pitfalls include uptake in regional lymph nodes obscured by the activity of the primary tumor as well as lack of uptake in esophageal carcinoma confined to the mucosa or microscopic malignant foci in lymph nodes. The primary role of PET/CT is detection of distant metastases. In up to 20% of patients, FDG PET prevents unnecessary surgery by demonstrating metastatic disease not found with conventional modalities.

Surgical resection is currently the best curative treatment for patients without distant metastases or locally advanced tumor growth.

The overall prognosis is dismal, with a 5-year survival rate of only about 10%. The most important prognostic factor is the extent of tumor at the time of diagnosis, including the depth of invasion and lymph node status. Invasion limited to the mucosa is associated with a 5-year survival rate of more than 80% and can potentially be treated with endoscopic resection. However, most symptomatic patients have involvement of the periesophageal tissue or lymph nodes with a 5-year survival rate of less than 5%.

Patients with locally advanced disease have a poor prognosis despite aggressive attempts at resection, and patients with distant metastatic disease are considered to have an incurable disease. Consequently, accurate preoperative staging and assessment of response to neoadjuvant therapy are crucial in determining the most suitable therapy and avoiding inappropriate attempts at curative surgery.

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# Answer to Radiographic Quiz

- Which choices characterize the findings?
  - Beak-like narrowing of the distal esophagus.
  - Retained foreign body with erosion of the esophagus.
  - Large Zenker's diverticulum.
  - Killian-Jamieson diverticulum.
  - Large amounts of fluid and debris, concern for imminent aspiration.
  - Irregular varicoid lesion narrowing the mid third of the esophagus.
- What is the most likely diagnosis?
  - Caustic ingestion.
  - Scleroderma esophagitis.
  - Barrett's esophagus.
  - Esophageal carcinoma.
  - Esophageal candidiasis.
  - Reflux esophagitis.
- Which of the following statements are correct?
  - A. Barium esophagography is a useful initial examination in the evaluation of a patient with esophageal complaints because it allows the assessment of esophageal morphology and motility.
  - B. Esophageal endoscopy permits direct inspection and biopsy of the esophageal mucosa for histologic diagnosis.
  - C. Esophagram is considered the best imaging modality for assessing achalasia.
  - D. PET/CT can provide valuable information for esophageal malignancy staging.
  - A and C.
  - B and D.
  - All of the above are correct.
- Respond True or False.
  - CT scan has a notable limitation in diagnosis of metastatic lymph nodes because:
    - Lymph nodes may be enlarged due to infectious or inflammatory etiologies.
    - Subcentimeter lymph nodes may harbor metastatic tumor.