LARGE AIRWAY STENOSIS:
NARROWING THE DIFFERENTIAL DIAGNOSIS

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There are no conflicts of interest in this presentation.
Large airway stenosis may have neoplastic or non-neoplastic origin;

Clinical recognition of tracheobronchial stenosis is notoriously difficult, especially in its early course;

Earlier diagnosis is possible with the use of computed tomography (CT) imaging.
Normal tracheal anatomy

- C-shaped cartilage
- Posterior membranous portion of the trachea
1. To determine disease location and extent along the airways: focal or diffuse;

2. Characterize the type of airway wall thickening: irregular or smooth, circumferential or if it spares the posterior membranous portion of the trachea.

3. Look for associated features in the mediastinum, hilum, and lung parenchyma, besides clinical and laboratory data.
1. Diffuse tracheal wall thickening
A- Sparing the posterior membranous portion of the trachea (cartilage disease)
Relapsing Polychondritis

- Diffuse and regular thickening of the anterior and lateral walls of the trachea and main bronchi (cartilage)
- Note that the tracheal posterior membranous portion is spared (arrow)

Relapsing polychondritis is a multisystemic disease of unknown origin
- It is characterized by recurrent inflammation of the cartilaginous structures of the nose, external ear, joints, larynx, trachea and bronchi
- Airway involvement is present in up to 50% of patients
Tracheobronchopathia osteochondroplastica

Note the diffuse thickening of the cartilaginous walls of the trachea with multiple calcified nodules projecting into the tracheal lumen (arrow)

- This rare disorder is characterized by the presence of multiple submucosal osteocartilaginous nodules
- Patients are usually older than 50 years old and asymptomatic, but may present with chronic cough, hoarseness, stridor, or wheezing
1. Diffuse tracheal wall thickening
   B- Circumferential thickening

Cross-section

Circumferential thickening

Posterior membranous portion of trachea involved
Circumferential and diffuse thickening of the bronchial walls, with foci of calcifications and stenosis of the right upper lobe bronchus (arrows)

- Amyloidosis is a rare disease caused by deposition of amyloid fibrils in the tissues.
- Airway involvement is usually diffuse. Calcifications in the tracheobronchial wall are common.
- Patients are often asymptomatic for a long time before diagnosis and the disease usually progresses slowly.
Diffuse concentric tracheal wall thickening (arrow). Note associated findings of a cavitation (arrowhead) and centrilobular nodules with a tree-in-bud pattern (circle). The diagnosis of pulmonary and tracheal tuberculosis was confirmed with an endobronchial biopsy.

- Endobronchial tuberculosis is common in patients with pulmonary tuberculosis
- Tuberculosis typically involves the distal trachea and proximal bronchi
- Bronchiectasis and bronchial stenosis may be seen after treatment
Circumferential and diffuse tracheobronchial wall thickening (arrows) associated with mild stenosis of the left main bronchus (arrowhead). This patient was treating a mantle cell lymphoma and had a diagnosis of tracheobronchial aspergillosis by endobronchial biopsy.

- Tracheobronchial aspergillosis is rare and usually occurs in severely immunocompromised individuals.
- The tracheobronchial wall thickening may be multifocal or diffuse.
1. Diffuse tracheal wall thickening
   C - Irregular thickening

   Cross-section

   Irregular thickening

   Posterior membranous portion of trachea involved
Laryngotracheal Papillomatosis

Irregular laryngeal and tracheal wall thickening with multiple nodules of soft-tissue density (arrows)

Laryngotracheal papillomatosis is caused by a viral infection (human papilloma virus – HPV)

- It can be contracted at birth or acquired through sexual transmission
- The larynx is the most commonly affected site and these lesions may transform into squamous cell carcinoma, requiring careful follow-up
- Upper airways disease may seed to the trachea and lung
- Lung involvement with multiple cavitating pulmonary nodules may be seen especially in children and young adults
Irregular thickening of the trachea wall (arrowhead). Note also bilateral pulmonary nodules associated with parenchymal distortion in the superior lobes (arrows). There is also a cavitated pulmonary nodule in the left (circle)

- PCM is caused by a fungus (Paracoccidioides brasiliensis), endemic in South America.
- PCM is characterized by pulmonary involvement, lymphadenopathy, and mucocutaneous lesions.
- Tracheal disease usually demonstrate irregular circumferential thickening of the tracheal wall.
- Extrapulmonary abnormalities includes osseous lesions and adrenal masses.
2. Focal tracheal wall thickening

Cross-section

Circumferential thickening

Posterior membranous portion of trachea involved
Iatrogenic Stenosis

Iatrogenic tracheal stenosis in a patient with a previous history of prolonged intubation. Note tracheal focal narrowing at the subglottic level (arrows).

- The most common iatrogenic airway stenosis are tracheal strictures secondary to prolonged intubation or tracheostomy
- Strictures of the trachea are usually secondary to damage from a cuffed endotracheal or tracheostomy tube
- The main site of stenosis is the subglottic region
Patient with previous history of cranial trauma, with aspiration of a tooth. Note the impacted tooth in the bronchus intermedius (arrows).

- Children are more prone to foreign body aspiration, and sometimes the incident is not noticed immediately. It may lead to recurrent pulmonary infections
- Trauma is also a common cause of foreign body aspiration
- Other risk factors include neurologic or psychiatric disorders and alcohol or sedative use
Granulomatosis with polyangiitis (GPA)

- Severe stenosis of the left main bronchus (arrowhead). Also note cavitating lesions in the lung parenchyma (arrows).

GPA is a systemic vasculitis that affects small and medium-size vessels
- Tracheobronchial involvement is usually focal and may lead to stenosis
- It is most common in the subglotic region
- Lung involvement with nodules and masses that usually cavitate may help in the diagnosis
Carcinoid Tumor

Mass with endobronchial component in the right inferior lobar bronchus. Also note the marked contrast enhancement in the mass and the distal bronchocele (arrowhead).

- Carcinoid tumors are rare thoracic neuroendocrine neoplasms with no relation to cigarette smoking.
- In most cases (80%) these tumors are centrally located within the airways, affecting the main, lobar, and segmental bronchi.
- They can be partially encased in the bronchial wall, creating an iceberg growth pattern.
Endobronchial hamartoma

Endobronchial nodule with fat component and a small calcification in the right inferior lobar bronchi (arrows).

- Hamartoma is a benign tumor of the lung that contain cartilage, fat, fibrous tissue and an epithelial component
- Calcification is identified in up to 50% of hamartomas and fat in up to 60%
- It can be intraparenchymal (90%) or endobronchial
- Obstructive pneumonia and atelectasis may be seen
Squamous Cell Carcinoma

Focal concentric parietal thickening involving the larynx and the first tracheal rings (arrows). Note that the lesion obstructs the airway and there is a tracheal tube.

- Squamous cell carcinoma is the most frequent primary malignancy of the trachea
- Predominantly in men (sex ratio 4:1, between 50 and 60 years old
- It’s strongly associated with cigarette smoking and with other smoking-related cancers
- Regional extension into the esophagus or the main bronchi are frequent. Metastatic lymphadenopathy is common at presentation
Mucoepidermoid Carcinoma

Endobronchial nodule with contrast enhancement in the carina and main right bronchus.

- This rare tumor originates from the minor salivary glands lining the tracheobronchial tree.
- It usually occurs in patients younger than 40 years old and affects mainly the lobar and segmental bronchi, leading to atelectasis.
- Prognosis is usually good.
Severe irregular wall thickening in the trachea (arrow). 18F-fluorodeoxyglucose positron emission tomography (FDG PET-CT) shows increased uptake in the lesion (arrowhead). Patient with histopathologic diagnosis of non-Hodgkin lymphoma

- Rare and usually related to the mucosal-associated lymphoid tissue (MALT)
- Low-grade malignancy
Endobronchial metastasis of osteosarcoma. Lesion with ossification within the left main bronchus, extending into the lower lobe (arrow). There is cystic bronchiectasis throughout the left lung (arrowhead).

- Direct invasion of the central airways by neoplasms is much more frequent than hematogenous metastases
- Although rare, many cancers have the potential to metastasize to the trachea and bronchi, such as breast cancer, colorectal, renal, lung, melanomas and sarcomas
Take home message

- There are multiple causes of airway stenosis.
- It is important to define whether the involvement of the airway is focal or diffuse; circumferential or if it spares the posterior tracheal membrane.
- Mediastinal, pulmonary and extrapulmonary findings also may help to narrow the differential diagnoses.
Relevant References

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