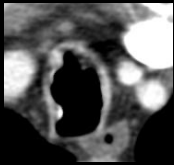


Large Airways

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University of Wisconsin
School of Medicine and Public Health

CHESTRAD 2023

A Case Review and Lecture Series
Saturday 15th July - Sunday 16th July - Monday 17th July
27 CPD Points

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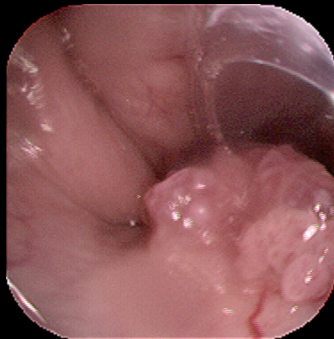
Objectives

- Illustrate CT findings of focal and diffuse tracheobronchial disease
- Review the CT findings of bronchiectasis
- Describe CT findings of tracheomalacia and excessive dynamic airway collapse

2

Large Airway Disease

- Filling defect
- Wall thickening
- Dilation
- Collapsibility



3

Filling Defects

- Neoplasm
- Inflammatory
- Foreign body



4

Neoplasms

- Primary tracheal neoplasms comprise <1% of all bronchial neoplasms
- Squamous cell carcinoma and adenoid cystic carcinoma account for >80%
- Many other tumor types have been described but are rare

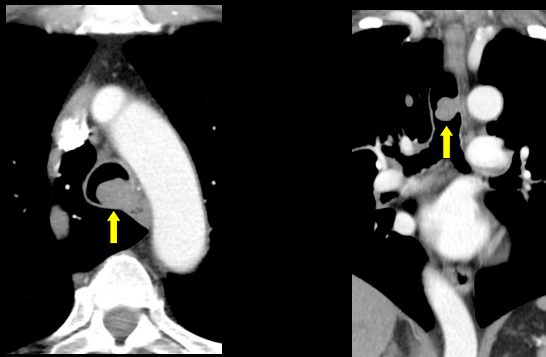
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Squamous Cell Carcinoma

- Most common primary tracheal neoplasm
- Majority of patients are older, male smokers
- Prognosis poor because of local invasion at time of presentation

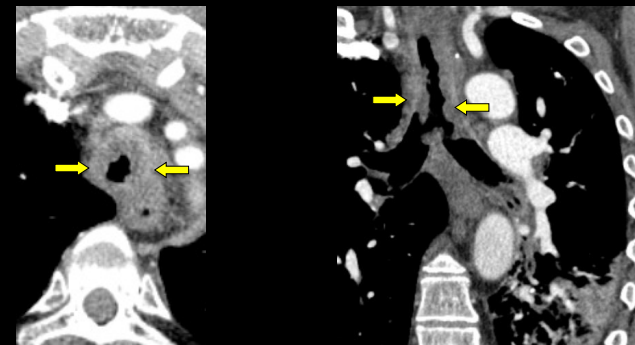
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Squamous Cell Carcinoma



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Squamous Cell Carcinoma



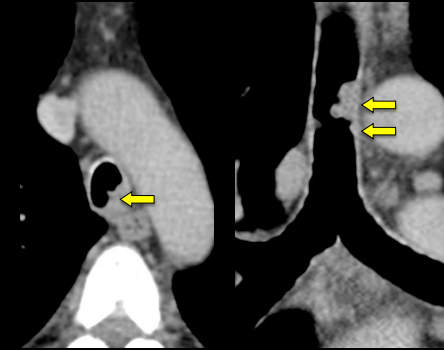
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Adenoid Cystic Carcinoma

- Second most common primary tracheal neoplasm
- Low-grade salivary gland type malignancy
- >50% cases occur in patients under 30 years of age
- Local recurrence common because of submucosal extension

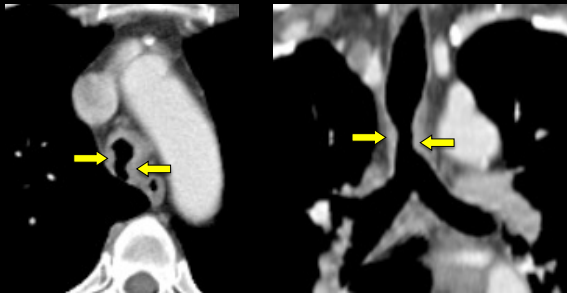
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Adenoid Cystic Carcinoma



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Adenoid Cystic Carcinoma



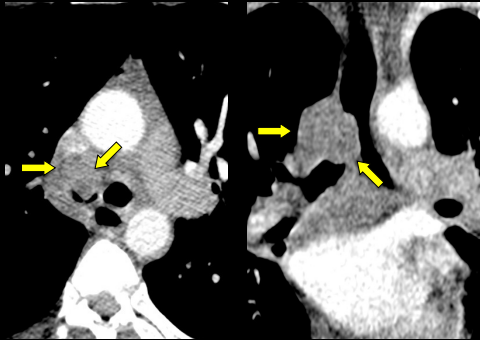
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Adenoid Cystic Carcinoma



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Adenoid Cystic Carcinoma



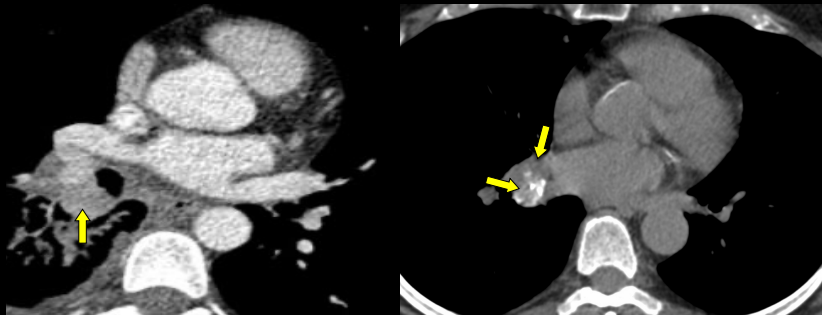
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Carcinoid Tumor

- Low-grade malignant neuroendocrine neoplasm
- Typical carcinoid
 - Mean age 40 years
 - No association with smoking
- Atypical carcinoid
 - Mean age 50 years
 - Associated with smoking

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Carcinoid Tumor



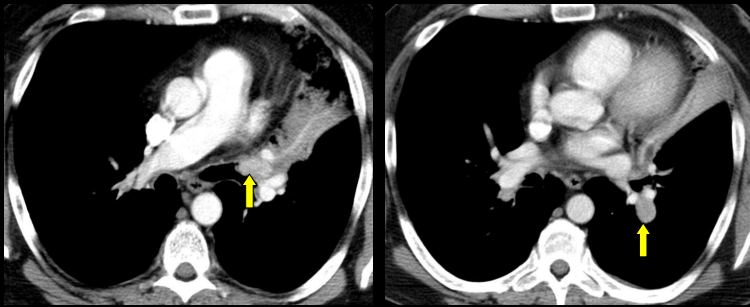
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Metastases

- Renal cell and colon carcinoma most common primary neoplasms
- May cause atelectasis or obstructive pneumonia
- Presence of lung or thoracic lymph node metastases clue

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Metastases



Renal Cell Carcinoma

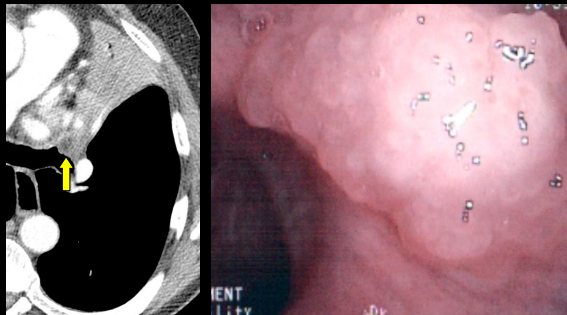
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Malignant Neoplasms

Neoplasm	CT Appearance	Clinical
Squamous cell carcinoma	<ul style="list-style-type: none"> Polypoid endobronchial lesion 	<ul style="list-style-type: none"> Older, male smokers
Adenoid cystic carcinoma	<ul style="list-style-type: none"> Endobronchial filling defect Circumferential narrowing 	<ul style="list-style-type: none"> 50% patients younger than 30 years old No association with smoking
Carcinoid	<ul style="list-style-type: none"> Round or ovoid, hypervascular, stippled calcification 	<ul style="list-style-type: none"> Young and middle-aged adults Lobar collapse, wheezing, hemoptysis
Metastases	<ul style="list-style-type: none"> Solitary or multiple Often smooth 	<ul style="list-style-type: none"> Melanoma, colon, renal carcinoma

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Benign Neoplasms



Hamartoma

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Benign Neoplasms



Lipoma

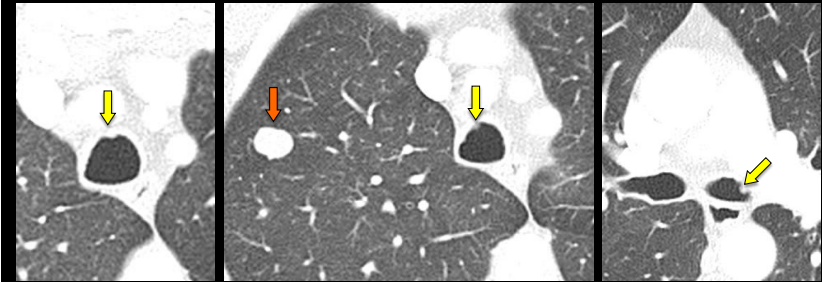
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Respiratory Papillomatosis

- Associated with HPV infection
- Typically presents in early childhood with laryngeal papillomas
- Tracheobronchial involvement 5%
- Pulmonary involvement <1%
 - Nodules → cavitation

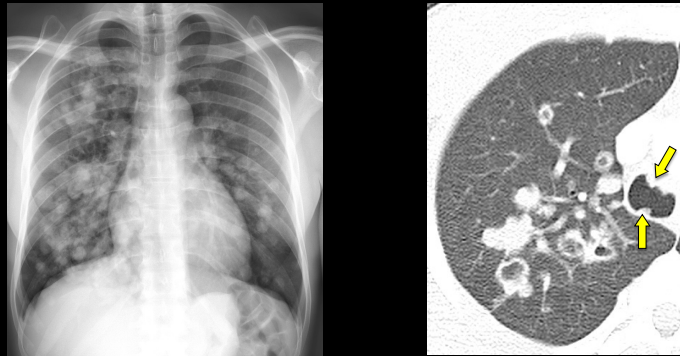
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Respiratory Papillomatosis



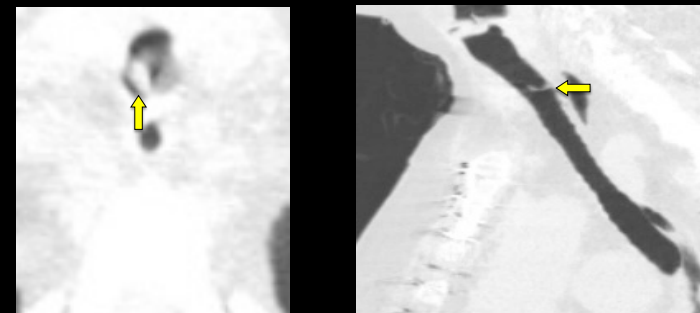
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Respiratory Papillomatosis



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Inflammatory



Granulation tissue from ischemic injury

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Foreign Body

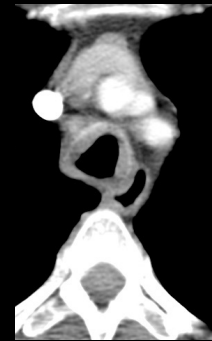


Inhaled field corn kernel

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Wall Thickening

- Infection
- Noninfectious inflammatory
- Infiltrative



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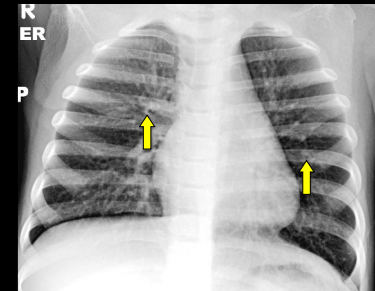
Infection

- Bacterial or viral tracheitis
 - Parainfluenza virus: croup
- Chronic infections more common than acute infections in adults
 - Tuberculosis
 - Fungus (especially *Aspergillus*)
 - Rhinoscleroma

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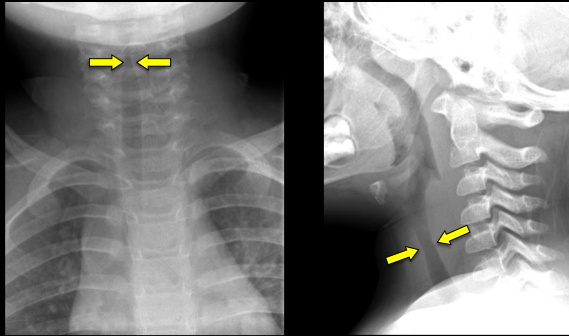
Croup

- Usually affects children
- Subglottic tracheal narrowing
 - “steeple sign”
- Bronchial wall thickening
- +/- small foci of atelectasis



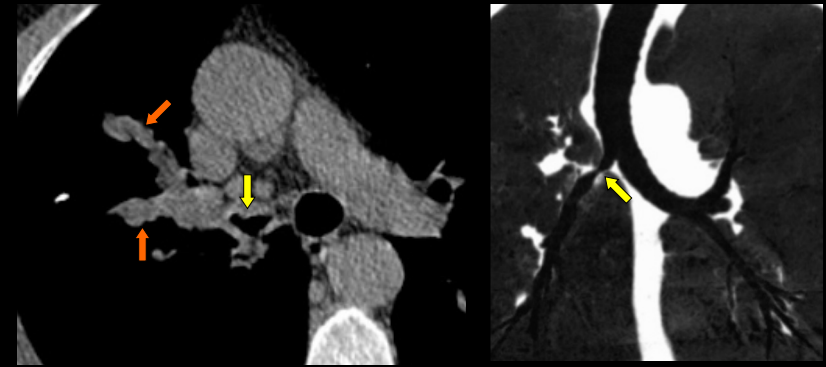
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Croup



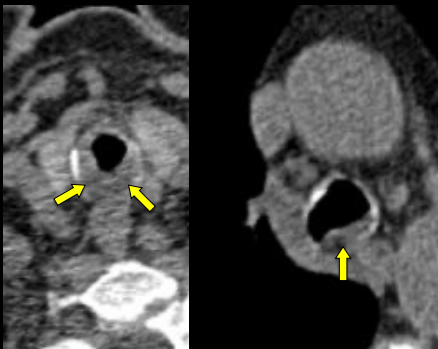
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Tuberculosis



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Cryptococcal Tracheobronchitis



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Allergic Bronchopulmonary Aspergillosis



🔑 Hyperattenuating mucus plugs nearly pathognomonic for ABPA

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Relapsing Polychondritis

- Systemic inflammatory disease of cartilage
- Major morbidity and mortality from airway involvement
- Recurrent infection
- Tracheobronchomalacia

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Relapsing Polychondritis

- Smooth tracheal and bronchial wall thickening
- Characteristic *sparing* of the posterior tracheal membrane
- Increased attenuation of the wall (calcification)
- Diffuse tracheal narrowing (later finding)

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Relapsing Polychondritis



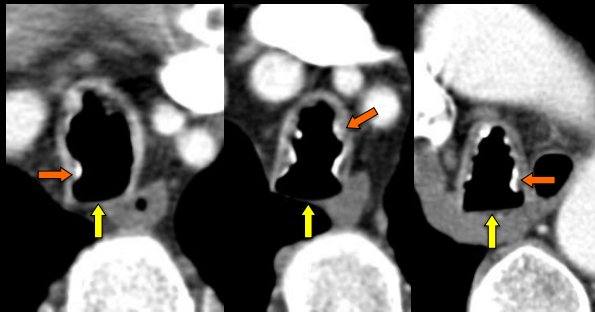
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Tracheobronchopathia Osteochondroplastica (TBO)

- Soft tissue nodules localized to the cartilaginous rings of the trachea and bronchi
- *Spare*s posterior tracheal membrane
- Calcification common
- Significant airway stenosis uncommon

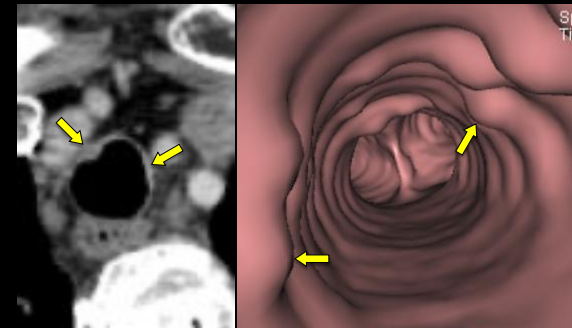
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Tracheobronchopathia Osteochondroplastica (TBO)



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Tracheobronchopathia Osteochondroplastica (TBO)



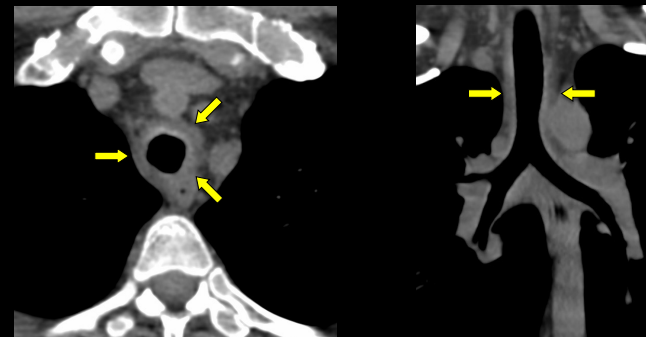
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Granulomatosis with Polyangiitis

- Circumferential wall thickening
- Tracheal or bronchial stenosis (especially subglottic trachea)
- Tracheobronchomalacia
- Obstructive pneumonitis
- Nodules, masses, cavities
- Consolidation

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Granulomatosis with Polyangiitis



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Granulomatosis with Polyangiitis



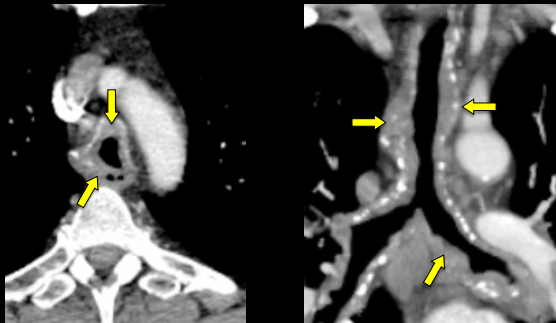
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Tracheobronchial Amyloidosis

- Circumferential multifocal or diffuse tracheal wall thickening
- Luminal narrowing common
- Mural calcifications
- Focal endoluminal mass
- Usually limited to central airways

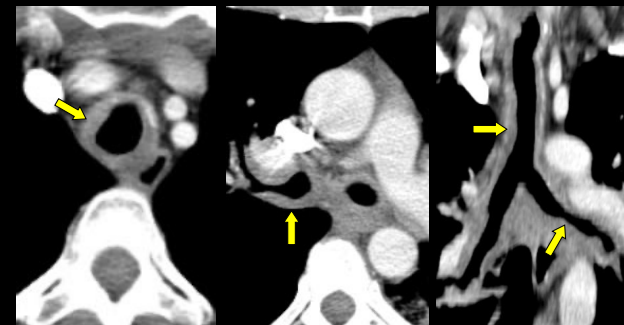
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Amyloidosis



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Amyloidosis



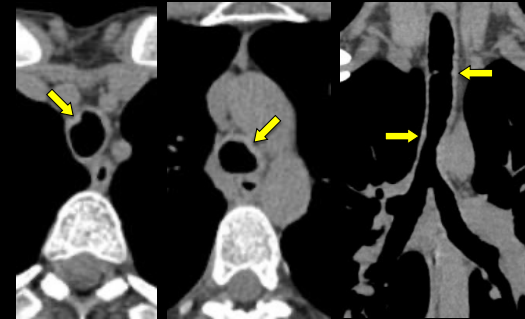
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Inflammatory Bowel Disease

- Diffuse sclerosing tracheobronchitis
 - Very uncommon manifestation
 - Fibrosis or constrictive bronchiolitis more common
- More frequent with ulcerative colitis
- No clear relationship with disease activity in the gastrointestinal system
 - May develop after colectomy or with quiescent gastrointestinal disease

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Inflammatory Bowel Disease



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Sarcoidosis



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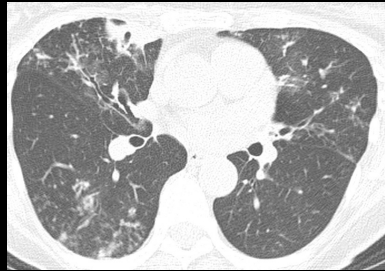
Diffuse Wall Thickening

Disease	CT	Clinical
Relapsing polychondritis	<ul style="list-style-type: none"> • Diffuse, sparing of posterior membrane • Tracheomalacia 	<ul style="list-style-type: none"> • Systemic illness • Recurrent infection
Tracheobronchopathia osteochondroplastica	<ul style="list-style-type: none"> • Tracheobronchial nodules • Sparing of posterior membrane 	<ul style="list-style-type: none"> • Older men • COPD
Granulomatosis with polyangiitis	<ul style="list-style-type: none"> • Circumferential • Irregular • Patchy 	<ul style="list-style-type: none"> • Sinusitis • Renal disease • Caucasian
Amyloidosis	<ul style="list-style-type: none"> • Diffuse • Slightly nodular • +/- calcification 	<ul style="list-style-type: none"> • Usually limited to airways • Recurrent infection
Inflammatory bowel disease	<ul style="list-style-type: none"> • Patchy • Irregular 	<ul style="list-style-type: none"> • May present years after GI • Occasional fulminant presentation
Sarcoidosis	<ul style="list-style-type: none"> • Nodular • Lymphadenopathy • Pulmonary disease 	<ul style="list-style-type: none"> • Systemic illness • Noncaseating granulomata

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Airway Dilation

- Tracheobronchomegaly
- Bronchiectasis



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Tracheobronchomegaly

- Mounier-Kuhn syndrome
- Severe dilation of trachea and main bronchi
 - Without or with bronchiectasis
- Multifactorial
 - Genetic predisposition
 - Deficient smooth muscle and elastic fibers
 - Cartilage abnormality
 - COPD or fibrosis

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Tracheobronchomegaly

- Tracheal scalloping
- Diverticula
- Bronchiectasis
 - Similar structural abnormalities
 - Recurrent infection

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Tracheobronchomegaly



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Bronchiectasis

- Irreversible bronchial dilation
 - Usually associated with structural changes in the bronchial wall
 - Chronic or recurrent infection common
- Myriad causes
 - Infection
 - Cystic fibrosis
 - Asthma

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Bronchiectasis: Direct Signs

- Bronchial dilation
 - Bronchial lumen > adjacent pulmonary artery
 - Contour abnormality
- No tapering > 2 cm beyond bifurcation
- Airway visible < 1 cm of costal pleura



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Bronchiectasis: Indirect Signs

- Bronchial wall thickening
- Mucoïd impaction or retained fluid
- Centrilobular nodules
- Mosaic attenuation
- Air trapping (expiration)
- Bronchial artery hypertrophy
- Atelectasis or emphysema



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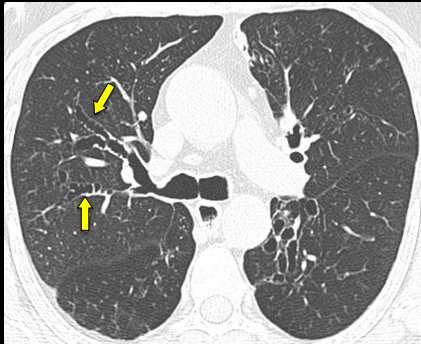
Bronchiectasis



Cylindrical Bronchiectasis

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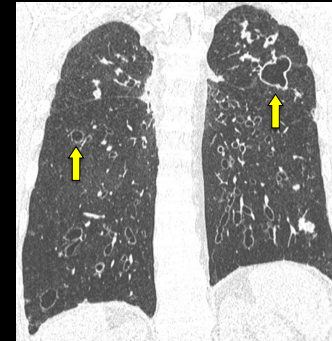
Bronchiectasis



Varicose Bronchiectasis

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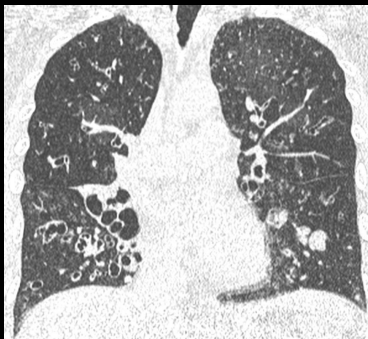
Bronchiectasis



Cystic Bronchiectasis

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Bronchiectasis

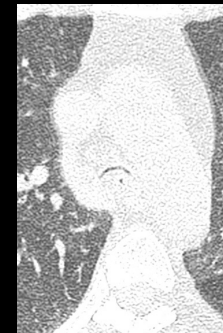


Cylindrical, Varicose, and Cystic Bronchiectasis

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Collapsibility

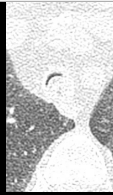
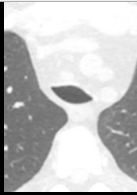
- Tracheobronchomalacia
- Excessive dynamic airway collapse (EDAC)



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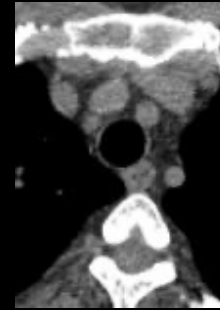
Collapsibility

Tracheobronchomalacia	EDAC
Abnormal softening of cartilage	Weakness of posterior airway membrane
Loss of airway support	Redundancy of membrane
Abnormal cartilage shape	Normal cartilage configuration
Collapse on expiration	Collapse on expiration



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Normal



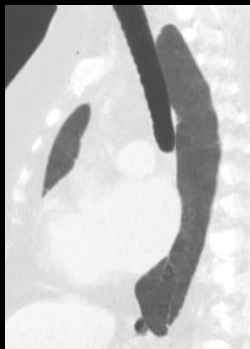
Inspiration



Expiration

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Normal



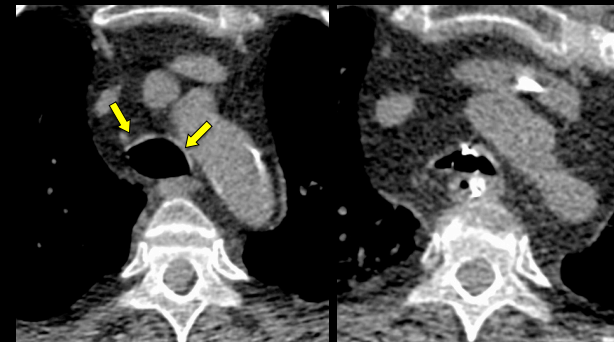
Inspiration



Expiration

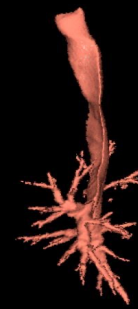
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Tracheomalacia



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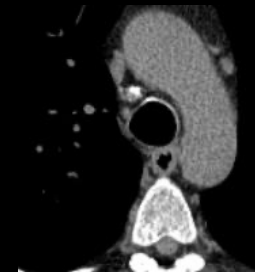
Tracheomalacia



3D-VR

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EDAC



Inspiration



Expiration

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EDAC



Inspiration



Expiration

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Summary

- Volumetric CT is the preferred noninvasive tool for imaging the large airways
- Pattern approach can limit differential diagnosis
- Dynamic expiratory imaging is useful for noninvasive diagnosis of tracheobronchomalacia

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