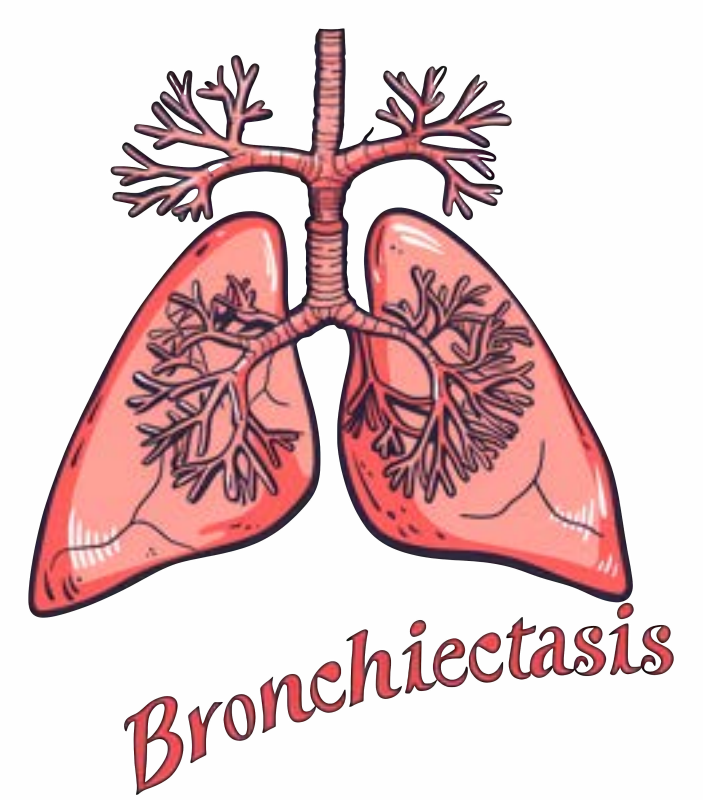


DR. Mohsen Farrokhpour
Pulmonology and critical care department

Bronchiectasis - Overview

- Bronchiectasis is a chronic condition characterized by irreversible dilatation of the bronchi, resulting from destruction of the muscular and elastic components of the bronchial wall.
- Caused by chronic inflammation and infection
- Impaired mucociliary clearance leads to recurrent infections
- Vicious cycle perpetuates airway damage

Conditions Associated With Brochiectasis

POSTINFECTIOUS CONDITIONS
Childhood lower respiratory tract infections
Granulomatous infections
Necrotizing pneumonias in adults
Other respiratory infections
PRIMARY IMMUNE DISORDERS
Humoral defects
Cellular and/or mixed disorders
Neutrophil dysfunction
Other
CYSTIC FIBROSIS (CF)
Classic CF
Variants of CF
Young syndrome
ALPHA$_1$-ANTITRYPSIN ABNORMALITIES
Deficiencies
Anomalies
HERITABLE STRUCTURAL ABNORMALITIES
Primary ciliary dyskinesia
Williams-Campbell syndrome
Mounier-Kuhn syndrome
Marfan syndrome
Sequestration, agenesis, hypoplasia
IDIOPATHIC INFLAMMATORY DISORDERS
Sarcoidosis
Rheumatoid arthritis
Ankylosing spondylitis
Systemic lupus erythematosus
Sjögren syndrome
Inflammatory bowel disease
Relapsing polychondritis
INHALATION AND OBSTRUCTION
Gastroesophageal reflux/aspiration
Pneumonia
Toxic inhalation/thermal injury
Postobstruction accident
Foreign body
Tumors, benign and malignant
Extrinsic airway compression
Allergic bronchopulmonary aspergillosis/mycosis
MISCELLANEOUS
Human immunodeficiency virus infection
Yellow nail syndrome
Radiation injury

Epidemiology

- The prevalence of non-cystic fibrosis (non-CF) bronchiectasis, based on narrow case-finding criteria, is estimated to be 139 cases per 100,000 persons, to be higher among women versus men (180 vs. 95 per 100,000), and to increase substantially with age (from 7 per 100,000 for ages 18–34 years to 812 per 100,000 for ages ≥75 years)
- increasing numbers of bronchiectasis cases associated with nontuberculous mycobacteria (NTM)

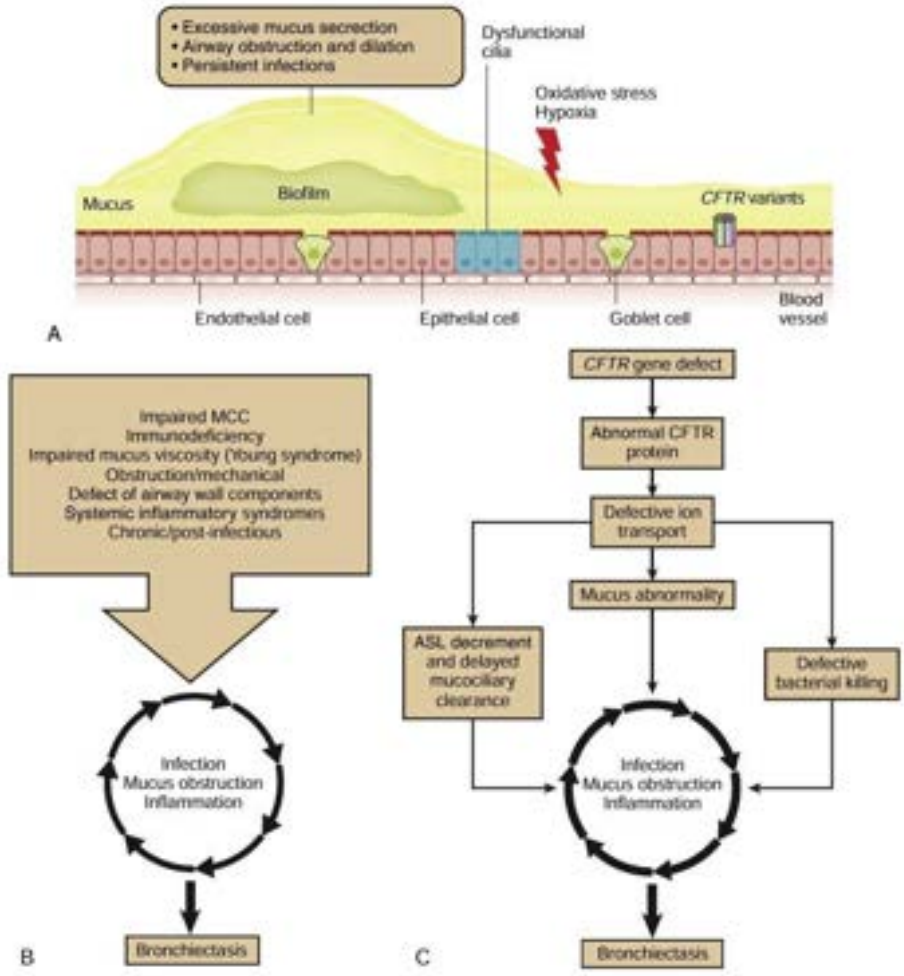
Pathophysiology

- Various mechanisms operate to produce bronchiectasis.

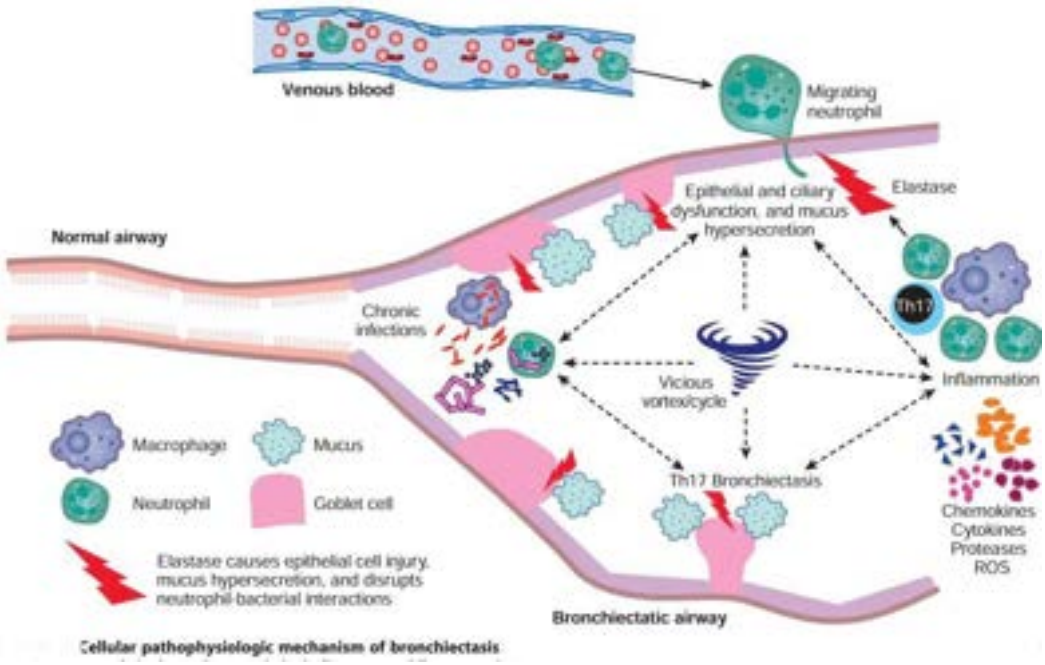
In the simplest terms, they may be thought of in terms of traction, pulsion, and weakness of the airways. In most cases, the pathogenesis becomes inextricably linked with and pro-pelled by the destructive effects of chronic infection

- Initial insult → airway inflammation → protease-mediated wall damage
- Loss of mucociliary clearance → mucus retention → bacterial colonization
- Chronic infection → inflammation → airway remodeling
- Forms a 'vicious cycle' of progression

More recently, it has been proposed that a tetrad of events leads to bronchiectasis, the so-called “vicious vortex,” a new term proposed because each of these factors may help per-petuate the other three (1) airway epithelial and ciliary dysfunction, and mucus hypersecretion; (2) chronic infections that induce further mucus hypersecretion; (3) inflammation, resulting in permanent airway injury and dilation; and (4) resultant bronchiectatic airways that are poor in mucociliary clearance, perpetuating the chronic infection, inflammation, and airway epithelial cell and ciliary dysfunction.



General pathophysiologic mechanisms for the development of bronchiectasis.



Cellular pathophysiologic mechanism of bronchiectasis

BIOFILMS

- In 1984, Costerton, hypothesized that P. aeruginosa in human infections “attaches to solid or tissue surfaces

and grows predominantly in biofilms.” These natural and pathogenic biofilms are covered by an exopolysaccharide matrix (glycocalyx) that serves as a barrier against hostile factors, such as host immune cells and antibiotics, since this discovery, there has been clear evidence for the importance of biofilms in promoting chronic bacterial infection in the airways of CF patients, and in promoting infections with NTM and methicillin-resistant Staphylococcus Aureus.

- In vitro testing indicates that bacteria embedded in biofilms can survive despite exposure to concentrations of antimicrobials that exceed the minimal inhibitory concentration by 1000 fold

ASSOCIATED DISEASE STATES AND ETIOLOGIC CONSIDERATIONS FOR BRONCHIECTASIS

- Post-infectious: TB, pneumonia
- Cystic Fibrosis (CF)
- Primary ciliary dyskinesia
- Immunodeficiency
- Allergic bronchopulmonary aspergillosis (ABPA)
- Obstructive lung disease related (COPD, asthma)

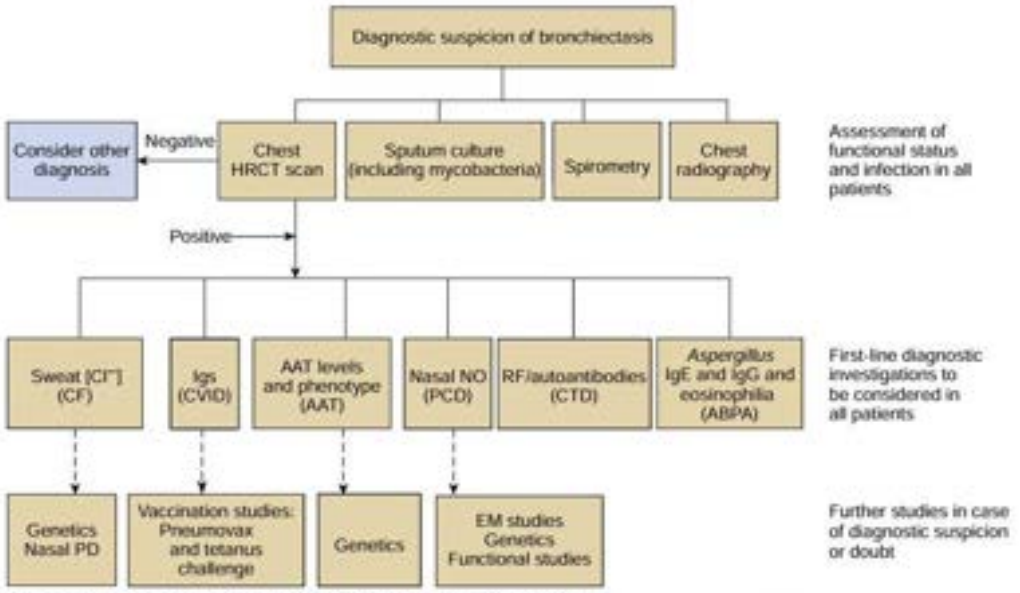


Figure 69.4 Diagnostic algorithm for the evaluation of suspected bronchiectasis.

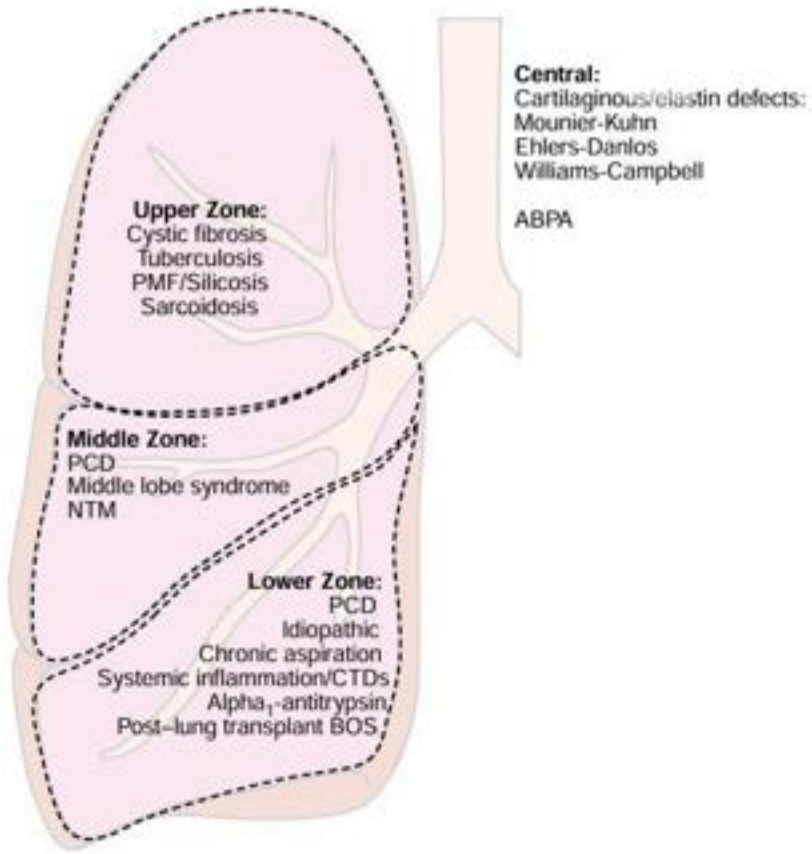


Figure 69.5 Anatomic clues to diagnosis of bronchiectasis.

LUNG INJURY DUE TO ACUTE INFECTION

- In the modern era in industrialized nations, most adequately treated episodes of lower respiratory tract infection resolve without residual damage. However, among the older generations who were not protected by readily available antibiotics and vaccines, some individuals offer a convincing history of recurring, localized infections after a discrete episode of “pneumonia” in their childhood or early adult years that presumably produced irreversible damage leading to bronchiectasis.
- Specific pathogens believed to cause bronchiectasis include Bordetella pertussis, mucoid strains of S. pneumoniae, S. aureus, Klebsiella pneumoniae, adenoviruses,rubeola (measles), and influenza. Chronic granulomatous
- pathogens commonly related to bronchiectasis include Mycobacterium tuberculosis, Histoplasma capsulatum, and NTM such as Mycobacterium avium complex (MAC) addition, mixed infection, including anaerobic mouth
- flora related to aspiration, may result in extensive damage to the parenchyma (“lung abscesses”) with subsequent bronchiectasis.

BRONCHIECTASIS ASSOCIATED WITH NONTUBERCULOUS MYCOBACTERIA

- NTM- associated bronchiectasis is discussed separately because the NTM may be a primary cause of bronchiectasis or a secondary infection complicating preexisting bronchiectasis
- Chronic lung disease due to NTM is manifested by two main radiographic patterns, although both types may be found in a single patient: (1) an upper lobe fibrocavitary pattern seen mostly in persons with underlying lung disease, such as COPD, and (2) a nodular-bronchiectasis pattern with or without cavitary disease that often involves the right middle lobe, lingula, and/or right upper lobe seen in those with neither preexisting lung disease nor known genetic predisposition
- NTM can exacerbate preexisting bronchiectasis, such as that associated with CF, primary ciliary dyskinesia (PCD), prior tuberculosis, and COPD, it is also believed to cause bronchiectasis.

- there is increasing evidence that heterozygosity of the cystic fibrosis transmembrane regulator (CFTR) or alpha1- antitrypsin (AAT) gene prediposes individuals to NTM infections resulting in secondary bronchiectasis.
- In patients with NTM lung disease, a careful family history should be obtained for bronchiectasis. We recommend that patients with NTM lung disease be screened for CFTR abnormalities, AAT anomalies, CVID, and swallowing dysfunction and, in certain groups such as those with sinusitis, infertility, and lower lung zone bronchiectasis, for PCD.
- Individuals with NTM-associated bronchiectasis who have no known predisposing factors have been observed by clinicians to possess marfanoid physical features, such as constitutively slender body habitus, scoliosis, and pectus excavatum, more commonly than anticipated by chance alone

CYSTIC FIBROSIS

- CF and CF variants are arguably the most common causes of bronchiectasis in the United States and other industrialized nations of the Western Hemisphere today.
- patients in this cohort had a high frequency of chronic airflow obstruction, sinusitis, difficulties with conception, and coinfection with pathogens typical of CF, including mucoid strains of P. aeruginosa, all features compatible with clinical CF.94 Among another series of patients with bronchiectasis and/or NTM lung disease, 24 of 50 (48%) had one or more CFTR mutations
- Bronchiectasis has been described in a condition identified in the 1970s called Young syndrome. Although Young syndrome is not CF, it has a number of similar clinical features, such as bronchiectasis, sinusitis, and infertility.However, unlike CF, the genetic basis for Young syndrome is not known and, because the definition includes azoospermia, it is seen only in men

DISORDERS OF IMMUNITY

- The most common immunodeficiency associated with bronchiectasis is CVID. CVID is mostly sporadic but familial inheritance is seen in approximately 10% of cases.
- CVID is best considered a syndrome comprised of a collection of diseases with different genetic defects and characterized by reduced or absent serum IgG, IgA, and/or IgM, as well as reduced or absent antibody production to specific antigen challenge after exclusion of defined causes of hypogammaglobulinemia.
- It is believed that the recurrent infections with encapsulated bacteria, such as S. pneumoniae and H. influenzae, and subsequent uncontrolled inflammation underlie the pathogenesis of bronchiectasis in CVID.

- CVID in individuals older than 2 years is diagnosed by decreased serum levels of IgG and IgA of at least two standard deviations lower than normal for age and abnormal antibody responses to specific antigen challenge. For a specific diagnosis of CVID, the IgG level should be less than 4.5g/L (normal: 7–18 g/L for adults), IgA should be absent or markedly reduced (normal: 0.7–3.5 g/L), and IgM should be normal or reduced (normal: 0.4–2.6 g/L).
- exclude other causes of hypogammaglobulinemia, such as(1) nephrosis and other causes of Ig loss; (2) myriad drugs that can reduce Ig levels, including glucocorticoids, rituximab, alkylating agents, anticonvulsants (carbamazepine,valproic acid, phenytoin), and sulfasalazine; (3) underlying malignancy, such as chronic lymphocytic leukemia,lymphoma, and thymoma; and (4) various genetic abnormalities, such as X-linked agammaglobulinemia, WiskottAldrich syndrome, ataxia telangiectasia, and severe combined immunodeficiency.
- Determining antibody responses to specific antigens(using commercially available vaccines) is most useful when there is a mild to moderate reduction in IgG.103 Antibody responses to at least two protein-based vaccines(e.g., tetanus, diphtheria toxoid, or H. influenzae type b vaccine) should be assessed. A fourfold or greater increase in IgG level 4 weeks after immunization (or at least the presence of protective titers if less than a threefold increase from baseline) argues against CVID. The 23-valent pneumococcal vaccine (Pneumovax), which contains only polysaccharides, can be used to assess B cell responses independent of T cell help.103 In contrast, the 13-valent pneumococcal vaccine (Prevnar) is used to assess B cell responses dependent on T cell help. In addition, in patients already receiving intravenous immunoglobulin, a Salmonella typhi polysaccharide vaccine may be used to assess the antigen response without discontinuing the therapy.

Autosomal dominant hyper-IgE syndrome (AD-HIES)

due to heterozygous STAT-3 mutation is a primary immunodeficiency characterized by eczema, elevated serum IgE, and connective tissue and skeletal findings, and recurrent infections of the skin (abscesses), joints, gums,sinuses, middle ear, airways, and lung parenchyma. These infections include severe recurrent bronchopneumonia, especially due to S. aureus, which leads to bronchiectasis and pneumatoceles. In addition, bronchiectasis in AD-HIES can also result from impaired remodeling of lung tissue due to a STAT-3 defect.Bronchiectasis in AD-HIES predisposes to opportunistic NTM infection and invasive fungal infection, which contribute significantly to mortality in AD-HIES.

Chronic granulomatous disease (CGD)

- is caused by a mutation in one of the components of the reduced nicotinamide adenine dinucleotide phosphate (NADPH)-oxidase complex, subsequently resulting in deficient NADPH-dependent reactive oxygen species production. Individuals with CGD are vulnerable to severe recurrent bronchopneumonia, particularly with S. aureus and fungal infections, which can result in structural lung damage.127 Although patients are often identified in early childhood due to the typical and severe infections, mild forms of CGD may present in adulthood, and thus CGD could be a cause of unexplained bronchiectasis.

ALPHA1-ANTITRYPSIN ANOMALIES

- AAT deficiency may be associated with bronchiectasis
- AAT anomalies are uncommon in unselected patients with bronchiectasis, whereas bronchiectasis is common in patients with known AAT deficiency.

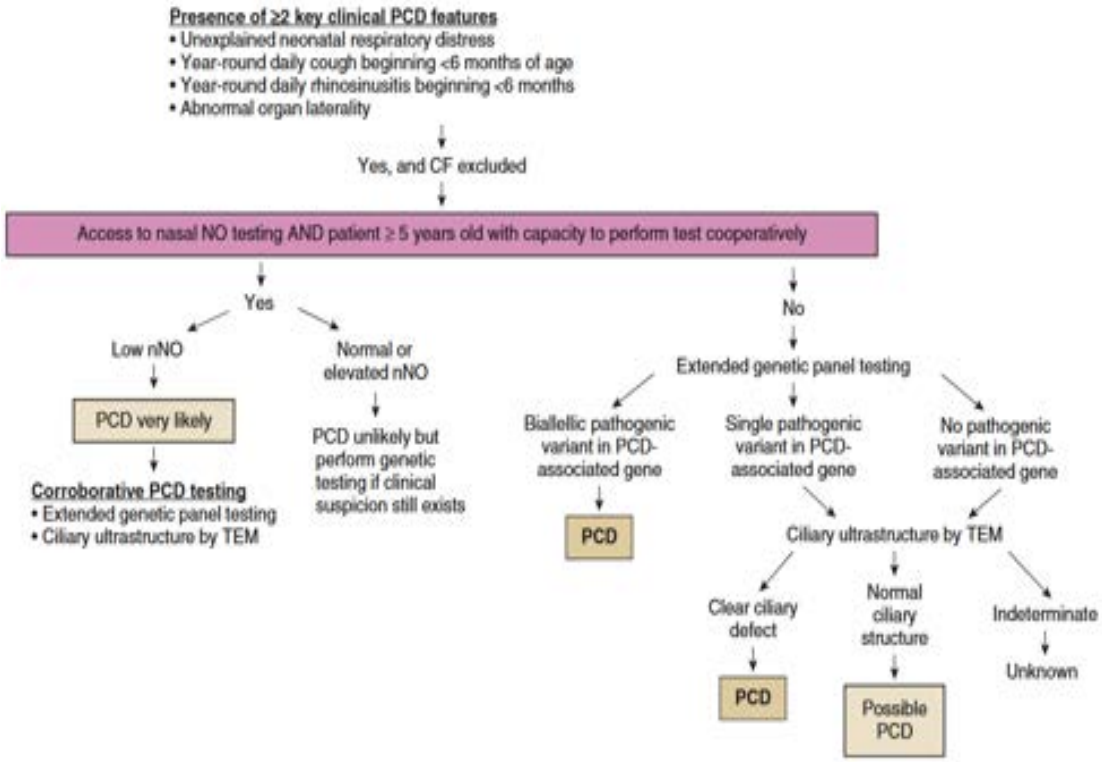
COPD

- bronchiectasis has been reported in patients with moderate to severe COPD and the presence of bronchiectasis has been associated with increased morbidity and mortality.
- In one study, COPD patients with bronchiectasis had higher levels of the neutrophil chemoattractant IL-8 in their sputa, increased bacterial colonization of their lower airways, and more severe exacerbations than those without bronchiectasis. Whether bronchiectasis is a sequela in COPD patients with frequent exacerbations, identifies a subgroup of COPD patients with a different pathogenic mechanism, or both, remains to be determined.

PRIMARY CILIARY DYSKINESIA

- PCD is an uncommon inherited condition, with an estimated prevalence of 1:10,000. PCD is caused by mutations of various genes that encode for dynein proteins that are components of cilia or for cytoplasmic proteins responsible for cilia assembly.
- Respiratory manifestations result from defective ciliary structure and function in the middle ear, nose, sinuses, and tracheobronchial tree, and include chronic otosinopulmonary disease
- Because ciliary function is critically important for proper organogenesis and laterality of organs during embryonic development,there may also be complex congenital heart disease and inversion of the normal anatomic locations for the organs of the thorax and abdomen, whether situs inversus universalis (Kartagener syndrome) or partialis.
- Reduced fertility is another hallmark feature among men and women with PCD due to abnormal ciliary function that results in impaired sperm motility or fallopian tube dysfunction.

Diagnostic algorithm for primary ciliary dyskinesia



- the Primary Ciliary Dyskinesia Rule(PICADAR), to help clinicians diagnose PCD in patients with chronic productive cough, using seven clinical parameters:

situs inversus (4 points)

full-term gestation (2 points)

neonatal chest symptoms (2 points)

neonatal intensive care admittance (2 points)

congenital cardiac defect (2 points)

chronic rhinitis (1 point)

ear symptoms (1 point)

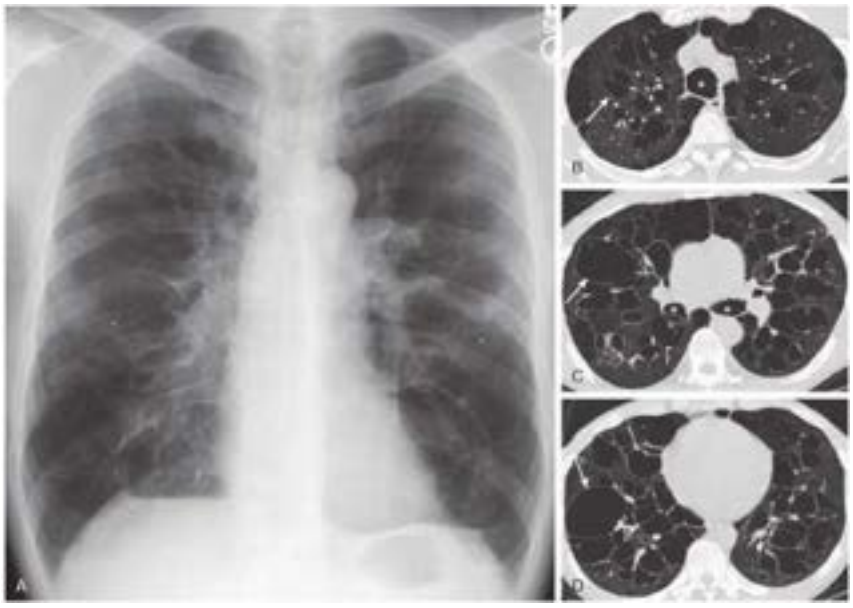
- PICADAR tool demonstrated a sensitivity and specificity of 90% and 75% for PCD diagnosis with scores of 5 or more out of a possible 14 points.

- Nasal nitric oxide (nNO) is a noninvasive test that has emerged as a screening test due to its high sensitivity for PCD
- Affected individuals have nNO that is significantly lower (<77 nL/min) than the range seen in unaffected individuals.
- It should be noted that approximately one-third of patients with CF have nNO below the diagnostic threshold for PCD, which underscores the importance of eliminating CF as a potential cause in anyone suspected of having PCD
- nNO is measured by aspirating nasal air while instituting measures to prevent sampling air from the lower respiratory tract (exhaled NO), which typically has much lower NO levels than nNO
- ransmission electron microscopy (TEM) alone or TEM plus genetic testing found nNO had a sensitivity of 98% and specificity of 96%

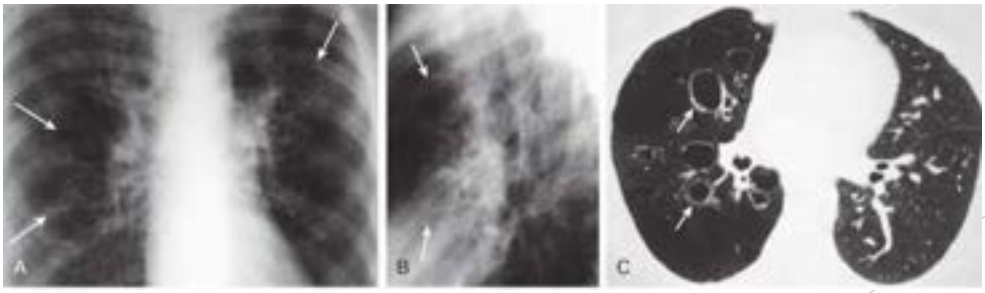
- Genetic testing for PCD is becoming more available with development of commercial testing panel
- mutations of more than 40 genes have been identified to cause PCD
- The traditional gold standards for diagnosis of PCD are TEM of ciliated epithelium revealing ultrastructural defects of the cilia ultrastructure (e.g., absence of outer and/or inner dynein arms) and measurements of ciliary beat frequency or coordination via high-speed video microscopy
- Among adult men, semen analysis may be useful to diagnose PCD. Dysmotile or immotile spermatozoa may be demonstrated using traditional light microscopy, using a slide prepared with a drop of nondiluted semen at 200× to 400× magnification. Abnormal motility is diagnosed if greater than 50% of sperm are immotile or nonprogressive, meaning that they move but do not make forward progression.

BRONCHIAL CARTILAGE OR ELASTIC FIBER DEFECTS

- **Mounier-Kuhn syndrome**, or congenital tracheobronchomegaly, is a rare disorder associated with gross enlargement or dilation of the trachea and segmental bronchi
- **Williams-Campbell syndrome** arises due to absence of cartilaginous rings in the fourth- to sixth-generation subsegmental bronchi in a symmetrical distribution, although more proximal bronchi may also be involved. In addition to the subsegmental and segmental bronchiectasis, bronchomalacia of the more proximal airways may be seen



Bronchiectasis: Mounier-Kuhn syndrome



Bronchiectasis: Williams-Campbell syndrome

CONNECTIVE TISSUE DISORDERS

- Among the various formally described heritable disorders of the connective tissues, Marfan syndrome, caused by mutations of the fibrillin 1 (FBN1) gene, with more than 600 different mutations of FBN1 identified, has been reported to be associated with bronchiectasis.
- Other lung disorders associated with Marfan syndrome include distal acinar emphysema, cystic degeneration, spontaneous pneumothorax, bullae, apical fibrosis, and a congenital pulmonary malformation known as middle lobe hypoplasia.

CONGENITAL AND DEVELOPMENTAL ANOMALIES

- Conditions such as sequestration, agenesis, hypoplasia,and atresia may primarily cause bronchiectasis or may predispose to infections that secondarily cause bronchiectasis
- **Sequestrations** presumably develop from accessory primordial lung buds, which may be invested within normal lung tissue (intralobar) or external to the normal lungs (extralobar). Sequestrations may or may not connect with the bronchial tree and often derive their blood supply directly from the aorta.
- **Unilateral hyperlucent lung (Swyer-James-MacLeod syndrome**) is characterized by unilateral bronchiolitis leading to hyperinflation. In some cases, bronchiectasis is present. The etiology and pathogenesis of this rare disorder are uncertain but may involve developmental or acquired disturbances of the bronchial tree.

IDIOPATHIC INFLAMMATORY DISORDERS

- **Sarcoidosis** is by far the most common of these disorders.Broadly, sarcoidosis may involve the airways by several fundamental mechanisms:

1.diffuse parenchymal scarring resulting in traction and airway distortion;

2.endobronchial granulomatous inflammation,

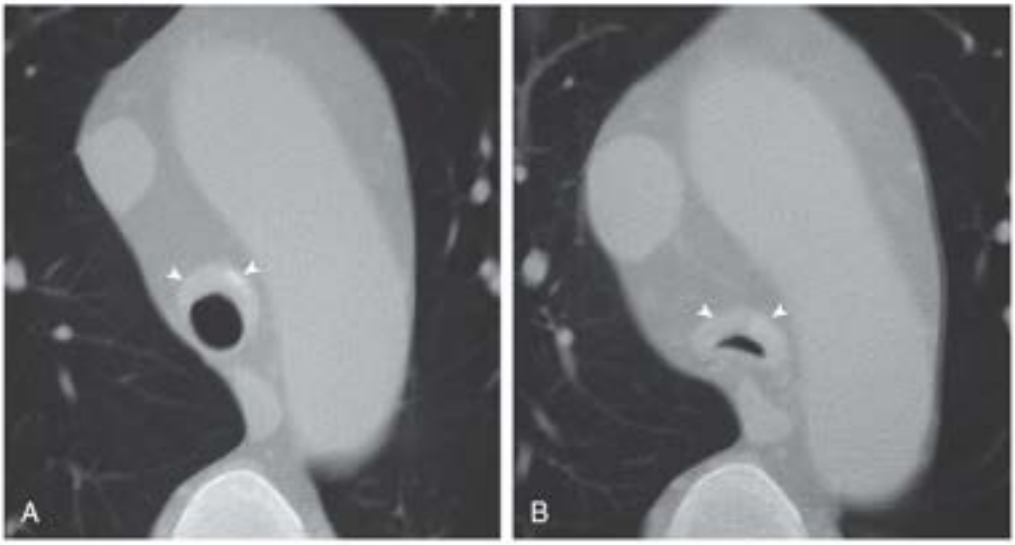
3.including stricture with poststenotic infection;

4. compression secondary to hypertrophic peribronchial lymphadenopathy

- **Rheumatoid arthritis (RA)** may entail a variety of pulmonary manifestations. In two early series, bronchiectasis was seen in 3.2% and 5.2% of RA patients. More recently, bronchiectasis has been described in considerably higher percentages of RA patients undergoing HRCT scanning (20–35%). However,bronchiectasis was seen in 8% of RA patients without respiratory symptoms.
- Potential causal mechanisms include increased propensity for infections, either intrinsic to RA or secondary to glucocorticoid or cytotoxic therapy.
- Clinically, the presence of bronchiectasis in RA patients was associated with an unfavorable prognosis in one series.

- **Ankylosing spondylitis** has been classically associated with upper lung zone fibrocystic degeneration and ankylotic fusion of the junctions of the ribs and vertebrae, resulting in restricted ventilation.
- **Systemic lupus erythematosus** may involve an assortment of pulmonary complications, including those intrinsic to the disorder itself, whereas others may be iatrogenic Bronchiectasis was described in 21% of systemic lupus erythematosus patients studied with HRCT.As with RA, the presence of Sjögren syndrome may be a comorbid element that predisposes to bronchiectasis.
- **Sjögren syndrome**, keratoconjunctivitis sicca, and xerostomia (dry eyes and mouth) may exist in the primary formor in association with other collagen vascular diseases, such as RA or systemic lupus erythematosus.
- Pulmonary complications of Sjögren syndrome include lymphocytic interstitial pneumonia, lymphoma or pseudolymphoma, and/or pulmonary hypertension.It is reasoned that lymphocytic inflammation results in impaired function of mucous glands,in turn resulting in decreased volumes and increased desiccation and viscosity of mucus. This leads to airway obstruction, poor clearance, and chronic infection. There have not been large CT scan surveys in patients with Sjögren syndrome to quantify the incidence of bronchiectasis

- **Inflammatory bowel disease**–associated bronchiectasis appears to be more common with ulcerative colitis than with Crohn disease. In the majority of cases, the bowel disease antedates the lung manifestations, but the conditions may be temporally reversed. One unique observation of ulcerative colitis–associated bronchiectasis is that it may develop after therapeutic colectomy. Proposed pathogenic relationships include a cryptogenic infection that incites both airway and intestinal inflammation, common epithelial targets of autoimmunity, or sensitizingagents that are inhaled and/or ingested, resulting in both lung and bowel disease.
- **Relapsing polychondritis** is identified essentially as progressive inflammation, weakness, and deformity of cartilaginous structures, including the ears, nose, larynx, and tracheobronchial tree, typically associated with nonerosive polyarthritis. In addition, there may be inflammatory and or functional disturbances of the eyes, auditory/vestibular components of the ears, and aorta (vasculitis with aneurysm). Respiratory involvement is characterized by tracheal and bronchial cartilage inflammation, resulting airway collapse, and airflow limitation .Bronchiectasis in such patients may be due to primary bronchial damage and/or recurrent infection.



Relapsing polychondritis

ASPIRATION/INHALATION ACCIDENTS

- One is the direct spillage of secretions from the oropharynx in famous for containing a plethora of microorganisms, including microaerophilic and anaerobic bacteria producing necrotizing pneumonia. The other is introduction of materials refluxed from the esophagus and/or stomach, which, in addition to the microorganisms noted earlier, contain food particles, hydrochloric acid, biliary or pancreatic secretions that contain various proteases,and microbes indigenous to the gut.
- Laryngeal protective functions are imperfect, and “microaspiration” is common. Thus, we might presume that aspiration leading to lower respiratory tract infections involves greater-than-usual volumes and/or more noxious contents.

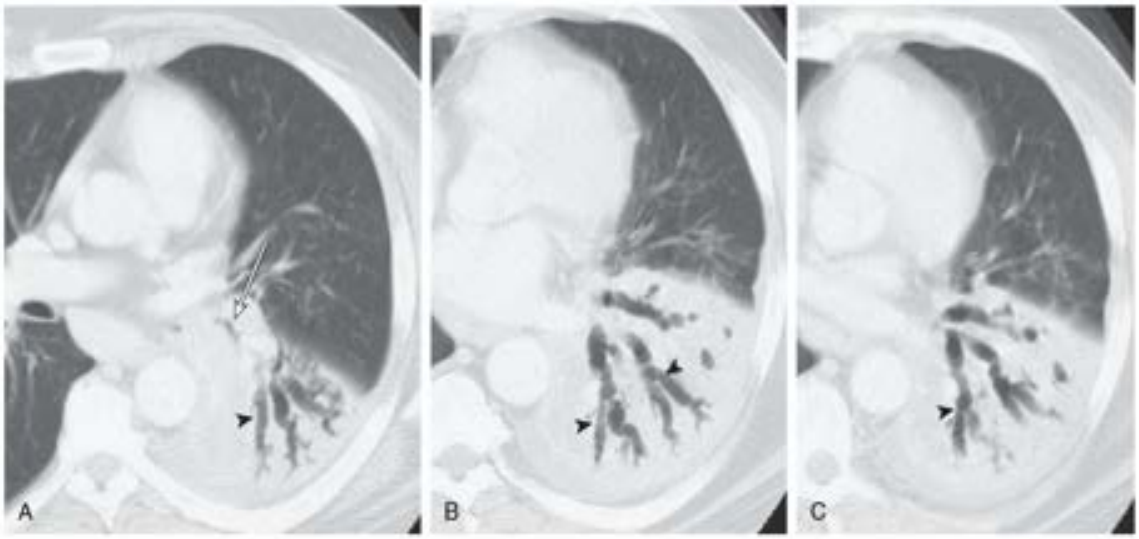
- Many factors influence the likelihood/frequency of aspiration. They include (1) depressed sensorium (trauma,alcohol or drug abuse, postictal confusion state, and general anesthesia), (2) altered brainstem function (cerebrovascular accident, polio, and primary neurologic diseases,such as multiple sclerosis, amyotrophic lateral sclerosis,or syringomyelia), (3) altered laryngeal structure/function (after surgery or irradiation), (4) esophageal disorders(dysmotility, obstruction by tumors or strictures, muscular dystrophy, achalasia, tracheoesophageal fistulas, or lower esophageal sphincter incompetence), and (5) gastric dysfunction (dysmotility or outlet obstruction).
- An additional factor that could contribute to GER disease is the medical therapy used for these lung disorders; anticholinergics, β2-agonists, theophylline, and corticosteroids can impair lower esophageal sphincter function, and broad spectrum antibiotics alter gastroesophageal flora.

- hypopharyngography using contrast materials of varying consistency may identify unsuspected aspiration, even in the absence of awareness or coughing. A speech therapist can also instruct patients on safer techniques for eating, drinking, and swallowing.
- Impaired esophageal motility may be suggested on CT scans of the lungs, manifesting as grossly dilated esophagus, excessive luminal air in the esophagus, and/or thickened esophageal walls.
- Impaired motility may often be demonstrated on a simple barium swallow. The extent of impaired contractility may be measured by esophageal manometry; this is essential if a reconstitution of the lower esophageal sphincter is contemplated.
- If gross reflux is demonstrated on a routine study, it is sufficient for a presumptive diagnosis. However, if symptoms or other clinical features suggest GER disease, and the upper gastrointestinal series has negative results, an 18- to 24-hour pH probe with or without measurement of impedance may both identify and quantify reflux episodes

- Non- acid reflux may result in chronic cough and even lung injury
- Toxic inhalation or thermal injury may also be associated with bronchiectasis.
- Acute and chronic inflammation of the tracheobronchial tree, bronchiolitis, bronchiolitis obliterans, and diffuse alveolar damage may be a consequence of exposure to toxic metal fumes (e.g., aluminum, cadmium, chromium, nickel) or toxic gases (e.g., ammonia, chlorine, phosgene, sulfur dioxide)

POSTOBSTRUCTIVE DISORDERS

- Foreign bodies may be aspirated into the airways, especially in infants and children. Adults may aspirate with eating, trauma, or loss of consciousness. In some cases, the obstructing object may be radiopaque (teeth, bone, or metal objects) but, in most instances, the obstructing material (e.g., peanuts, vegetables) is not discernible by standard chest radiography.
- Tumors, benign or malignant, may also result in airway obstruction, poor drainage, recurrent chronic infection, and bronchiectasis.
- The more common tumor types include bronchogenic carcinomas (particularly the squamous cell variety), carcinoid tumors, and papillomas.
- Extrinsic airway compression due most often to hypertrophic lymphadenitis from granulomatous diseases, such as sarcoidosis or infections and including tuberculosis or histoplasmosis, may severely narrow or even occlude large airways
- In patients with “focal” bronchiectasis, particularly those with disease limited to only one region bronchoscopic examination to exclude an obstructing lesionshould be performed early if other causes are not evident.



Postobstructive bronchiectasis

ALLERGIC BRONCHOPULMONARY ASPERGILLOSIS

- ABPA is a relatively uncommon condition, estimated in approximately 2.5% of patients with asthma.
- ABPA is a hypersensitivity reaction, usually to Aspergillus fumigatus, but other fungi, including Candida albicans, may also be a source of the antigenic stimulus
- ABPA may manifest with fever, wheezing, eosinophilia,and fixed or fleeting pulmonary opacification (often upper lobes). The opacifications range from subsegmental to lobar and are due to eosinophilic infiltration and/or lymphocytic interstitial pneumonia. Other radiographic findings include atelectasis due to mucus plugging, manifesting clinically as expectoration of thick, brown mucous plugs. The inflammation and distention from the plugs typically result in thin- walled bronchiectasis that is often multilobar and central
- Distinguishing ABPA from CF can be difficult, given the similarities between the two disorders, including the presence of bronchiectasis and positive serologic tests for Aspergillus. The CF Foundation has established diagnostic criteria for ABPA in CF patients: (1) clinical deterioration not attributable to another cause, (2) IgE greater than1000 IU/mL, (3) skin test positivity to

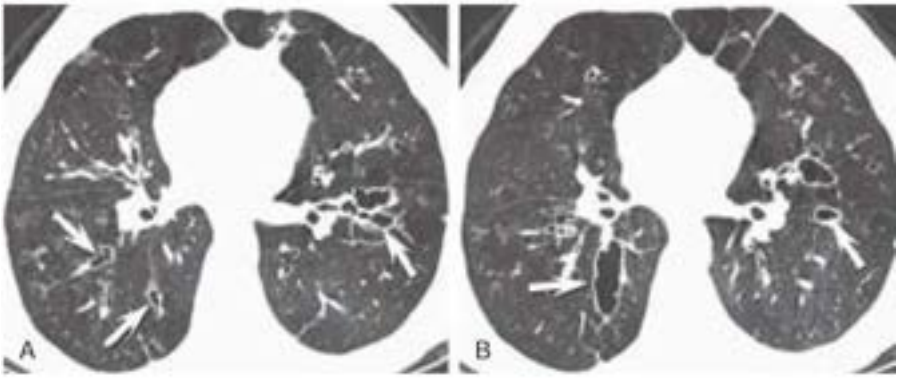
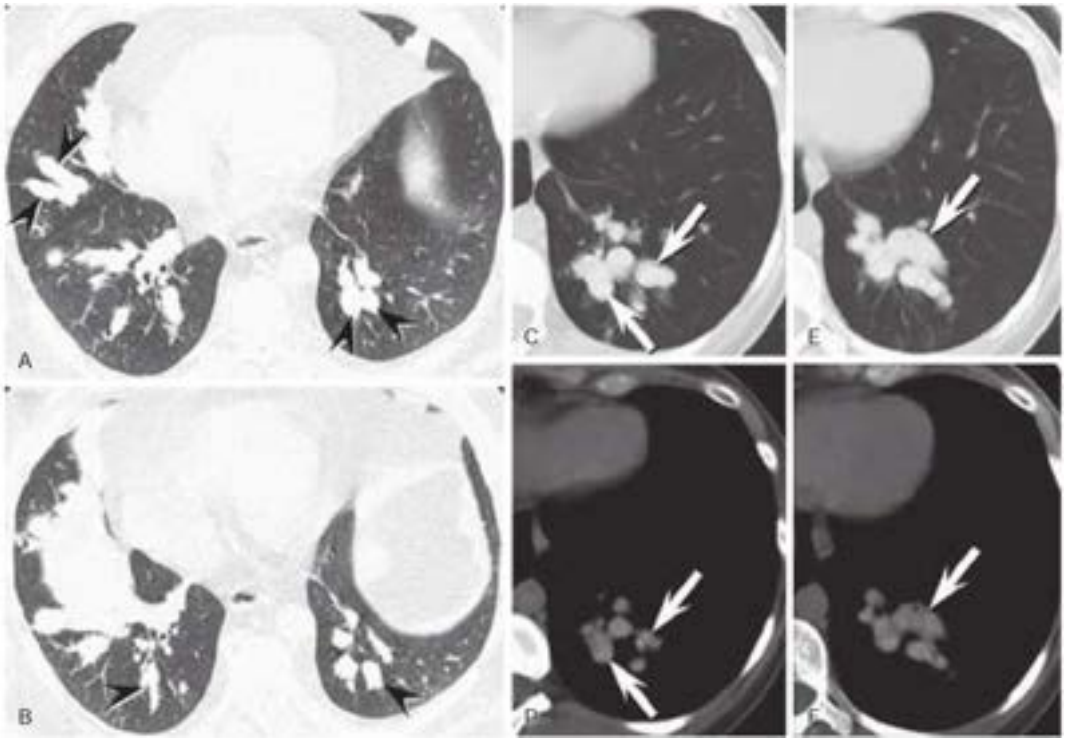


Figure 69.6 Bronchiectasis: allergic bronchopulmonary aspergillosis

Table 69.2 Diagnostic Criterial for Allergic Bronchopulmonary Aspergillosis

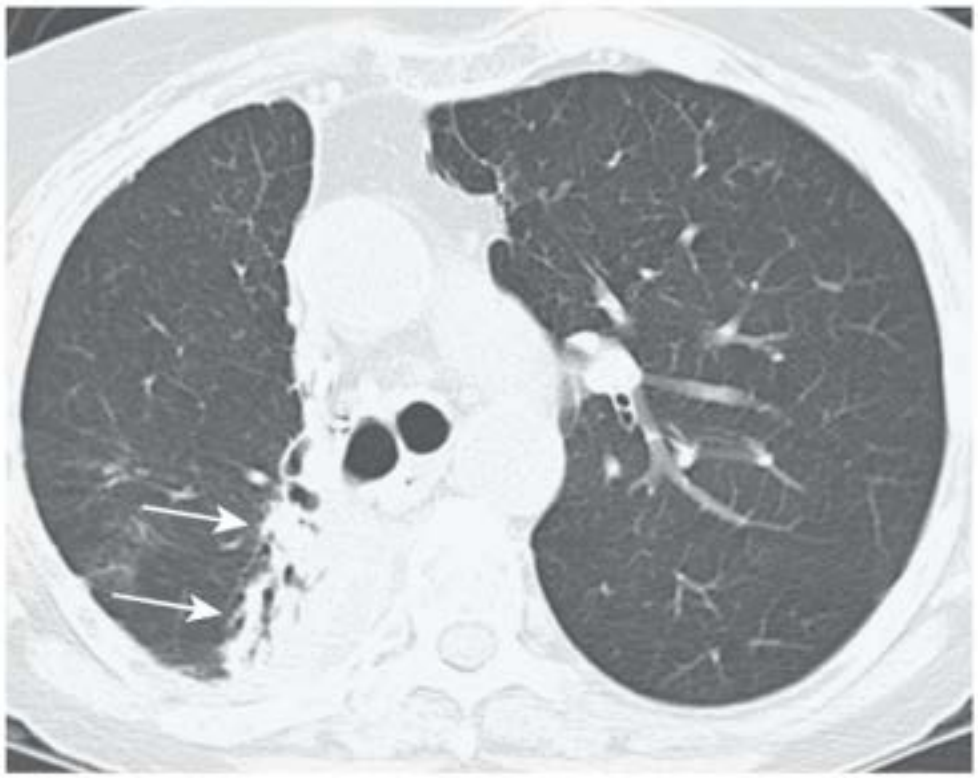
Predisposing condition: asthma or cystic fibrosis
ESSENTIAL CRITERIA
1. Type I immediate cutaneous hypersensitivity reaction (wheal and flare) to *Aspergillus fumigatus** or elevated serum IgE agai *A. fumigatus* and
2. Elevated total IgE (>1000 IU/mL†)
OTHER CRITERIA (≥2 OF 3 NEEDED)
1. Presence of serum precipitating or IgG against *A. fumigatus*
2. Radiographic pulmonary opacities consistent with ABPA (e.g., pulmonary opacification and/or bronchiectasis)
3. Total eosinophil count >500 cells/μL in patients not on recent corticosteroids



Allergic bronchopulmonary aspergillosis with bronchiectasis and bronchial mucus impaction

MISCELLANEOUS

- **Yellow nail syndrome** is an uncommon disorder marked by the triad of yellow, thick, dystrophic nails; chronic lymphedema of the face, hands, and lower extremities; and pleural effusions. Women are more commonly affected than men; the median age of onset is 40 years, with cases ranging from infancy to the seventh decade. The most prominent pulmonary finding is bilateral exudative pleural effusions. Recurrent sinusitis and lower respiratorytract infections are common, the latter resulting in bronchiectasis. Contributing factors for bronchiectasis include abnormal lymphatic structure, increased vascular permeability, deficient immunoglobulin production, and/or ciliary dysfunction.
- **Radiation therapy**, typically delivered for carcinoma of the breast or mediastinal tumors, including lymphomas, may result in profound damage to the central airways.This reaction is marked by focal damage to the cartilage and mucosa of the airways leading to distention and irregularities of the major bronchi in the field of irradiation.Bronchiectasis secondary to radiation therapy for neoplasms has become less common as radiation dosage and field used have become more refined. This condition may be recognized by lung parenchymal scarring in the field of irradiation



Bronchiectasis in a field of therapeutic x-irradiation

Diagnosis

- High-resolution CT (HRCT) is gold standard
- Key signs: bronchial dilation, wall thickening, lack of tapering
- HRCT Patterns: Cylindrical, Varicose, Cystic
- Other tools: sputum culture, pulmonary function tests

HRCT

- Insert HRCT images for teaching

Cylindrical,

Varicose,

Cystic patterns

Signet Ring and Tram-track signs

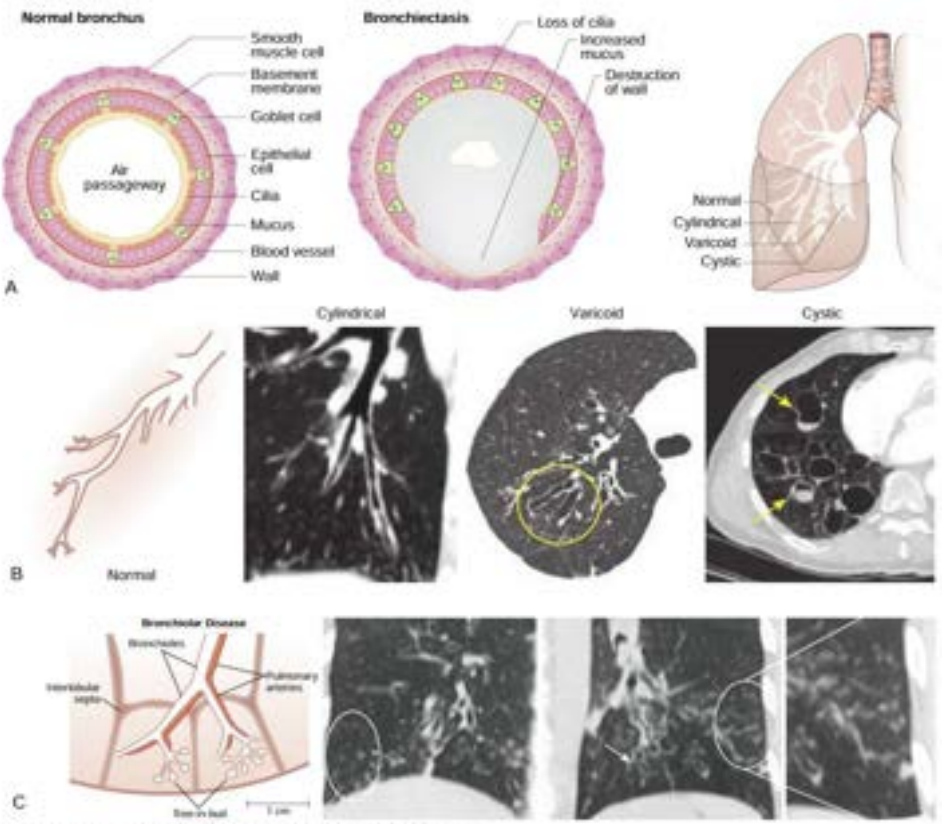
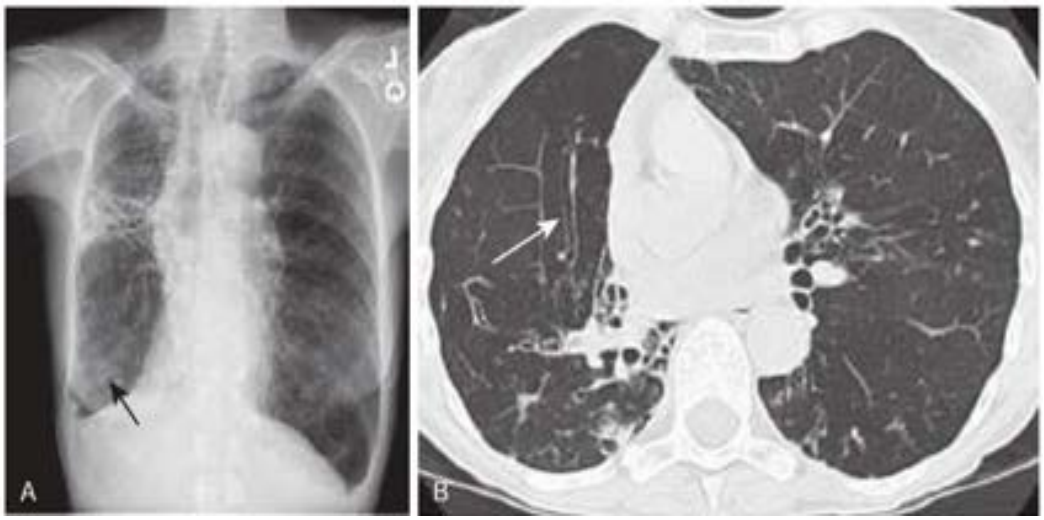
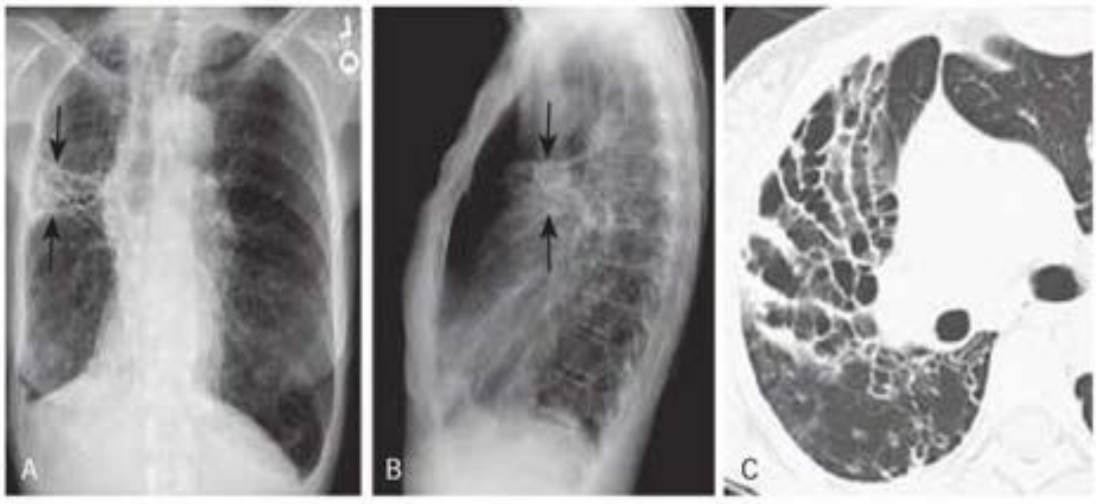


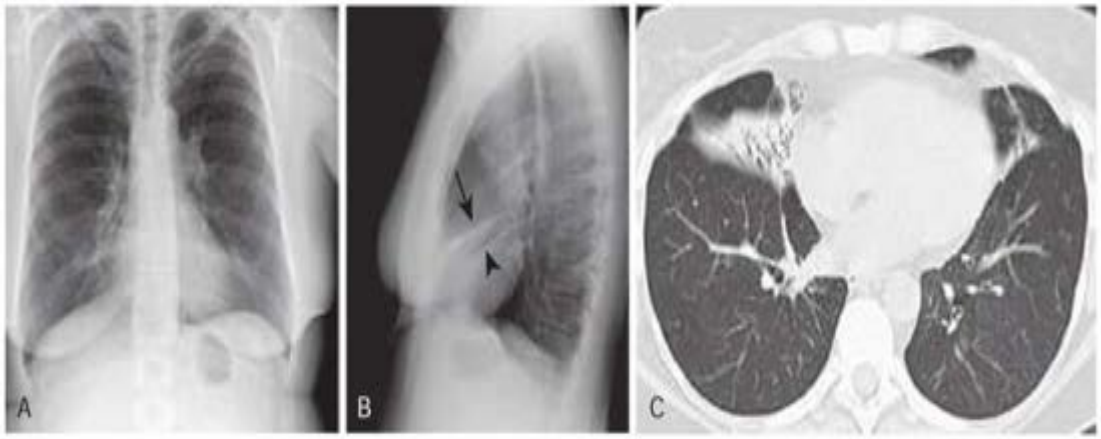
Figure 69.2 **Radiographic examples of different forms of bronchiectasis.**



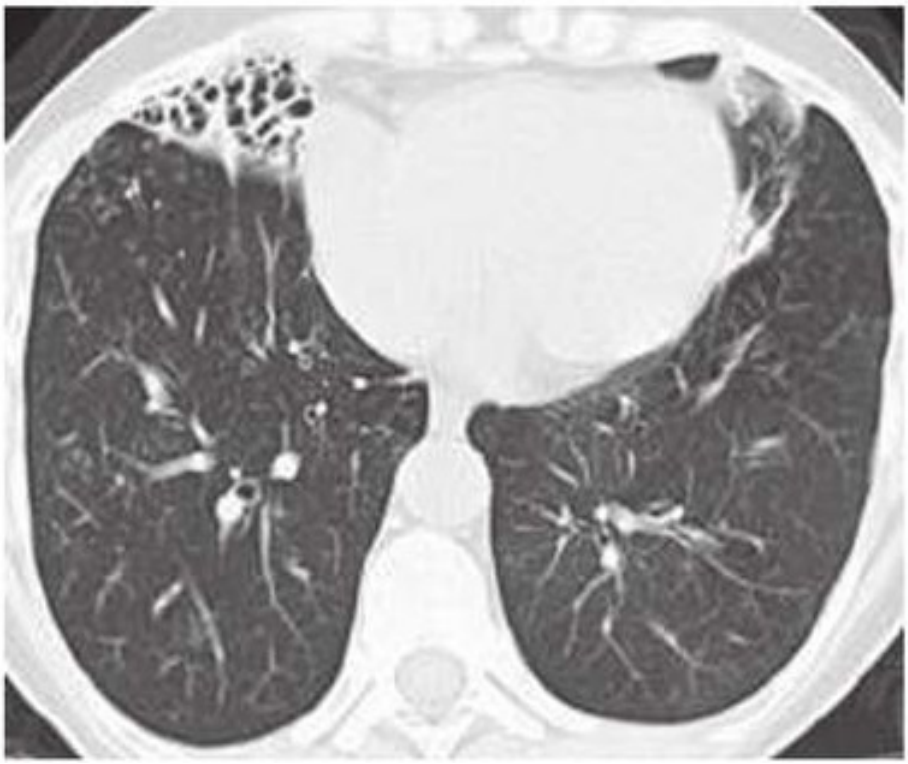
"Tram tracks" on the routine chest radiograph in bronchiectasis



Multiple ring shadows on chest radiography in bronchiectasis



Atelectasis and bronchiectasis involving the right middle lobe and lingula on chest radiographs and a computed tomography scan



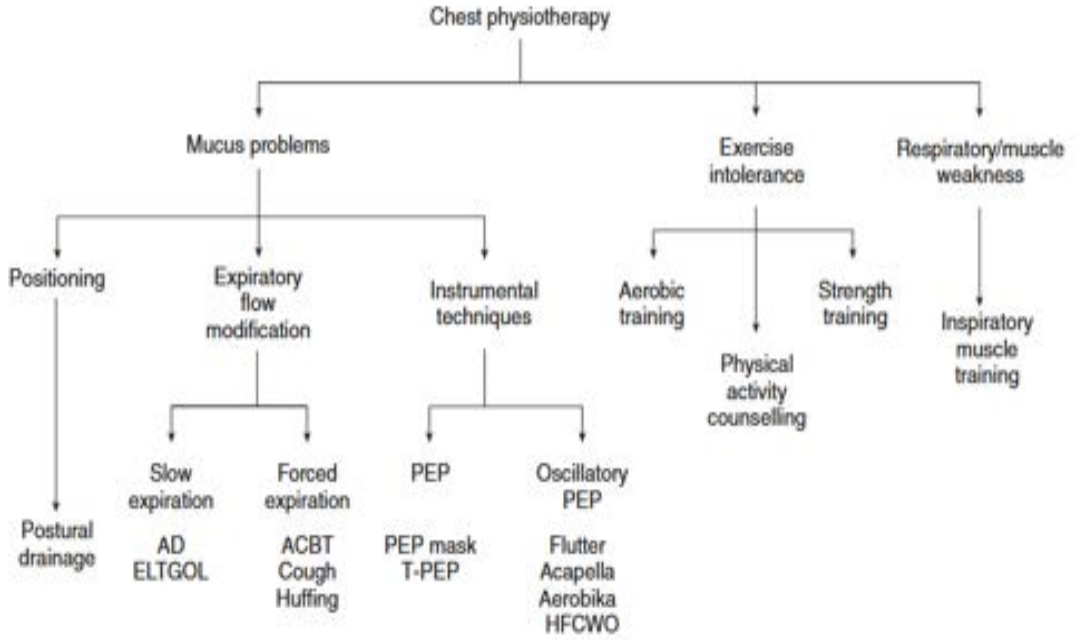
Bronchiectatic consolidation

Management

- AIRWAY HYGIENE AND HYPEROSMOTIC AGENTS
- ANTIMICROBIAL THERAPY
- ANTI-INFLAMMATORY THERAPY
- THERAPIES FOR TREATMENT OF FREQUENT EXACERBATIONS
- SURGERY
- MISCELLANEOUS

AIRWAY HYGIENE AND HYPEROSMOTIC AGENTS

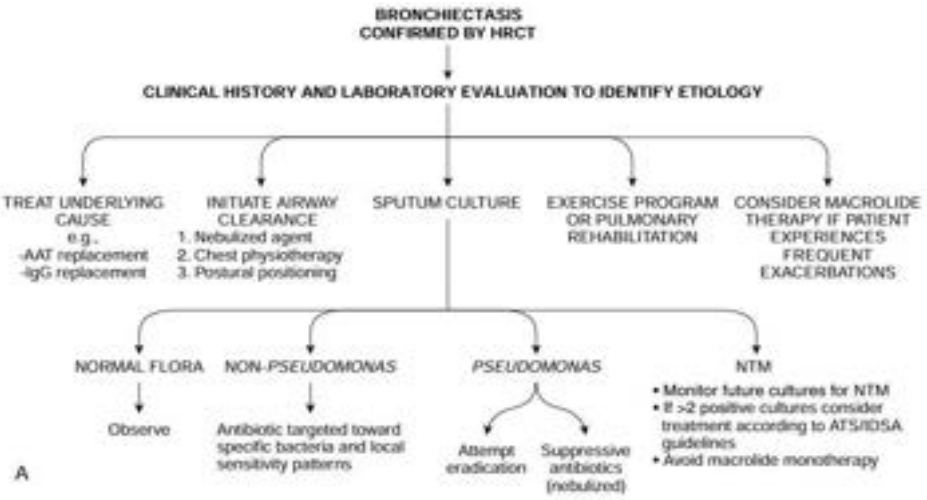
- Airway hygiene consists of nonantibiotic therapies directed toward mobilizing and eliminating inflammatory secretions from the tracheobronchial tree and from the paranasal sinuses
- Hypertonic saline, 3% or 7% two to four times daily, has been shown to accelerate mucus clearance, decrease exacerbations, and improve lung function in CF patients
- Inhaled dry-powder mannitol,recently approved for adult CF patients,appears promising in airway clearance in bronchiectatic patients
- The mucolytic drug N-acetylcysteine (600 mg twice daily)was found to be effective at reducing exacerbations when taken orally, although studies to confirm this small sample size trial are needed.
- Other mucoactive drugs, such as recombinant human deoxyribonuclease, failed to reduce exacerbations and had a trend toward more frequent and severe exacerbations in patients with idiopathic bronchiectasis

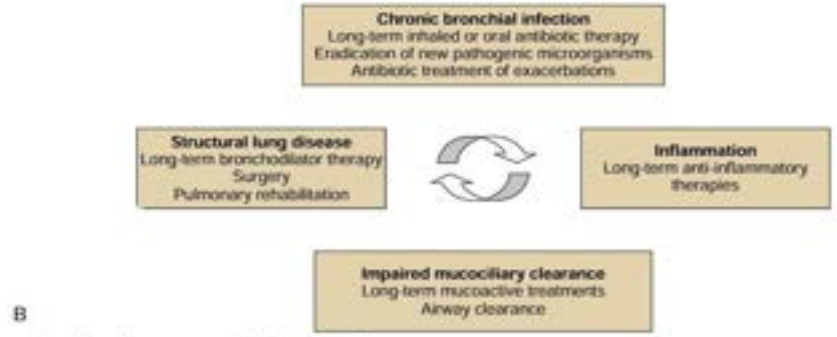


Algorithm for chest physiotherapy

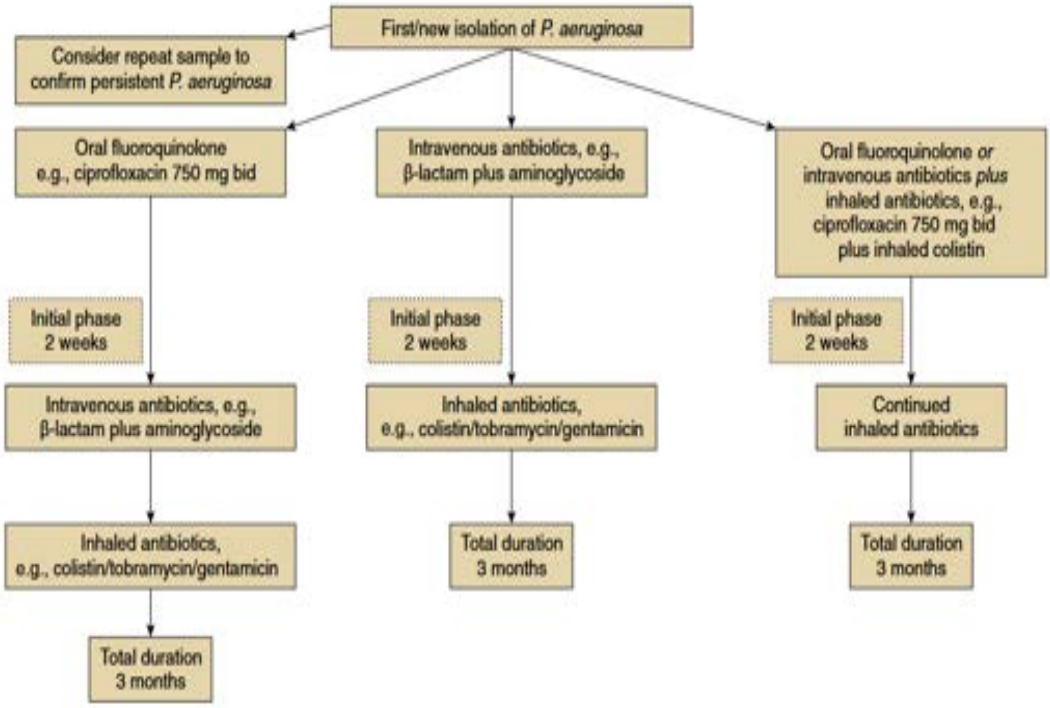
ANTIMICROBIAL THERAPY

- Antimicrobial therapy historically has been the centerpiece of bronchiectasis care
- However, there is no clear consensus on the major questions in this area, including whethertreatment should be given on a routine, periodic schedule(rotating) or an as-needed basis for clinical exacerbations.
- In a meta- analysis of the use of prolonged oral antibiotics for purulent bronchiectasis, sputum volume/purulence was shown to decrease, but there were no significant beneficial effects in regard to rates of exacerbations, lung function, or death.





Comprehensive management of bronchiectasis



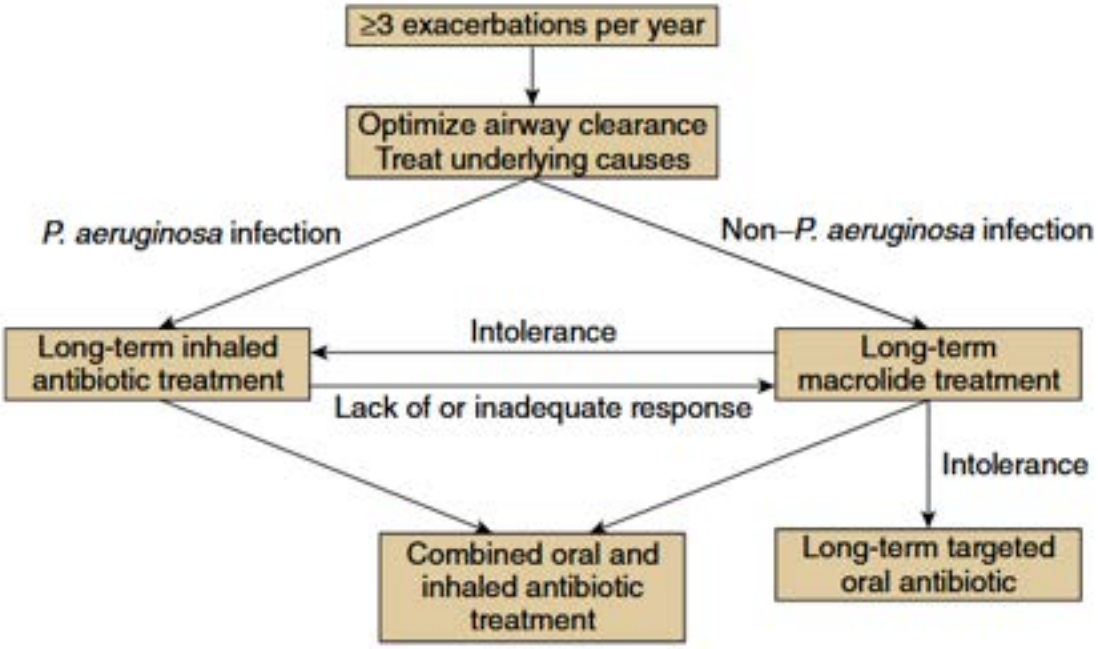
Three potential Pseudomonas aerugin osaeradication pathways

ANTI-INFLAMMATORY THERAPY

- Nonsteroidal Anti-inflammatory Drugs
- Inhaled Corticosteroids

THERAPIES FOR TREATMENT OF FREQUENT EXACERBATIONS

- Intermittent Macrolide Therapy
- Inhibition of Neutrophil Elastase



Summary of recommended long-term antibiotic therapies for bronchiectasis

SURGERY

- The role of surgery in the management of bronchiectasis is uncertain.
- the indications and efficacy of resectional surgery have been conducted among patients with bronchiectasis. Traditional indicationsfor resectional surgery have included chronic disabling infection, recurrent infections of intolerable frequency, or irreversible lung damage distal to a foreign body or benign tumor. Hemoptysis that is life-threatening and/or recalcitrant to bronchial artery embolization may be an indication for surgery.
- However, surgery may be an appropriate palliative measure in selected cases, especially with severe localized disease, as not uncommonly seen in patients with NTM lung disease or in those with localized bronchiectasis and recalcitrant or recurrent superimposed infections.
- Tracheal reconstruction surgeries, including tracheobronchoplasty or tracheal stenting, may confer symptomatic benefit for patients with Mournier-Kuhn

MISCELLANEOUS

- Additional measures, such as smoking cessation and vaccination against pneumococcal disease and influenza, are appropriate for all patients. Intuitively, these measures seem particularly important for those with bronchiectasis;
- early recognition and remediation of exercise limitation and sleep-related hypoxia has demonstrated substantial benefits in regard to morbidity and mortality. As with all individuals
- patients with bronchiectasis have repleted vitamin D levels because this hormone has been hown to induce cathelicidin, an antimicrobial peptide. Recently, it was reported that bronchiectasis patients with vitamin D deficiency have more frequent bacterial colonization (especially P. aeruginosa), worse airflow, more frequent exacerbations, higher levels of inflammatory markers in sputa, and more rapid decline in lung function over a 3-year follow-up than those with higher vitamin D levels.

Prognosis

- twofold increase in mortality in those with bronchiectasis compared to healthy normal subjects

Prospective evaluation of two propensity scoring systems that assess long-term prognosis in non-CF bronchiectasis: the FEV1, Age, Chronic

Thanks
for your attention