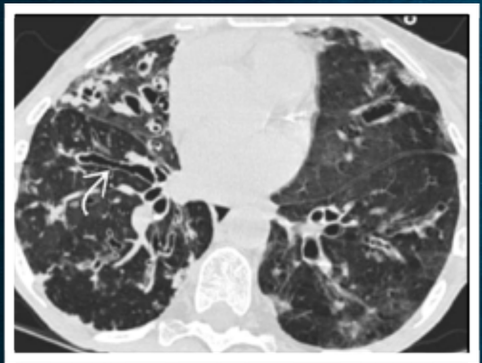
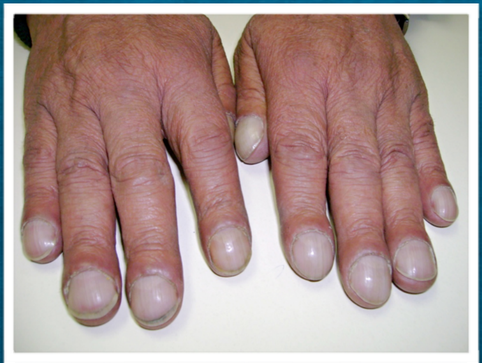
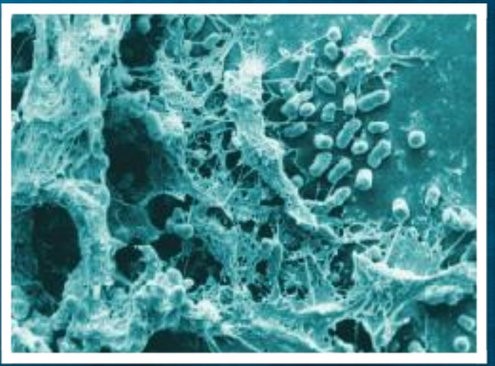
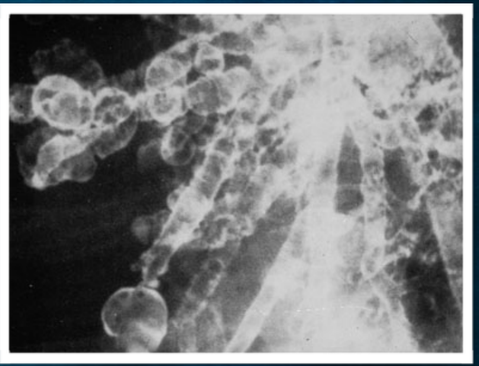
Bronchiectasis

Causes and Diagnosis



Santi Silairatana, MD

Pulmonary Medicine Unit, Department of Medicine,
Faculty of Medicine Vajira Hospital
Navamindradhiraj University

Bronchiectasis: Outline

- Disease definition
- Airway defense mechanisms
- Causes
- Pathology & Pathophysiology
- Diagnosis

Bronchiectasis

/bräŋʹkē ekʹtə sis/

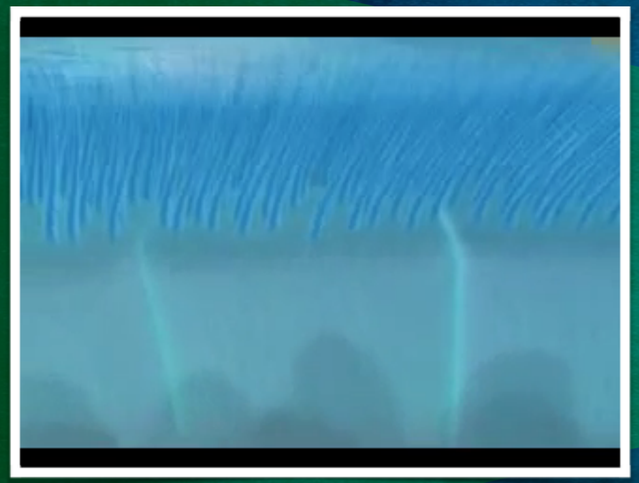
First original pathological description
by René-Théophile-Hyacinthe Laennec in 1819

Abnormal irreversibly **dilated**
and often thick-walled **bronchi**

resulting from a variety of
pathologic process that cause destruction
of the bronchial wall and its surrounding
supporting tissues

Airway Defense Mechanisms

Mucociliary clearance



Adaptive Immunity

- Immunoglobulins
- T and B lymphocytes

Innate immunity

Cellular components

- Neutrophils
- Macrophages and dentritic cells
- NK cells

Protein components

- Toll-like receptors
- Antimicrobial proteins: Lysozymes, lactoferrins, peroxidase, defensin, cathecidins
- Inflammatory cytokines: interferons, cytokines, chemokines, complements

Waterer G W. *Clin Chest Med* 33 (2012) 211-217.

Etiology of Bronchiectasis

Airway defenses

Mucociliary defects
1° ciliary dyskinesia
Cystic fibrosis

Cellular/immune defects
Common variable immune deficiency
X-link agammaglobulinemia
Hyper IgE syndrome
Alpha1-antitrypsin deficiency
HIV infection

Associated conditions
Rheumatoid arthritis
Sjögren syndrome
Relapsing polychondritis
SLE

1st hit

Injury events

Acute/severe
Measles
Influenza pneumonia
inhalation injury
Radiation injury

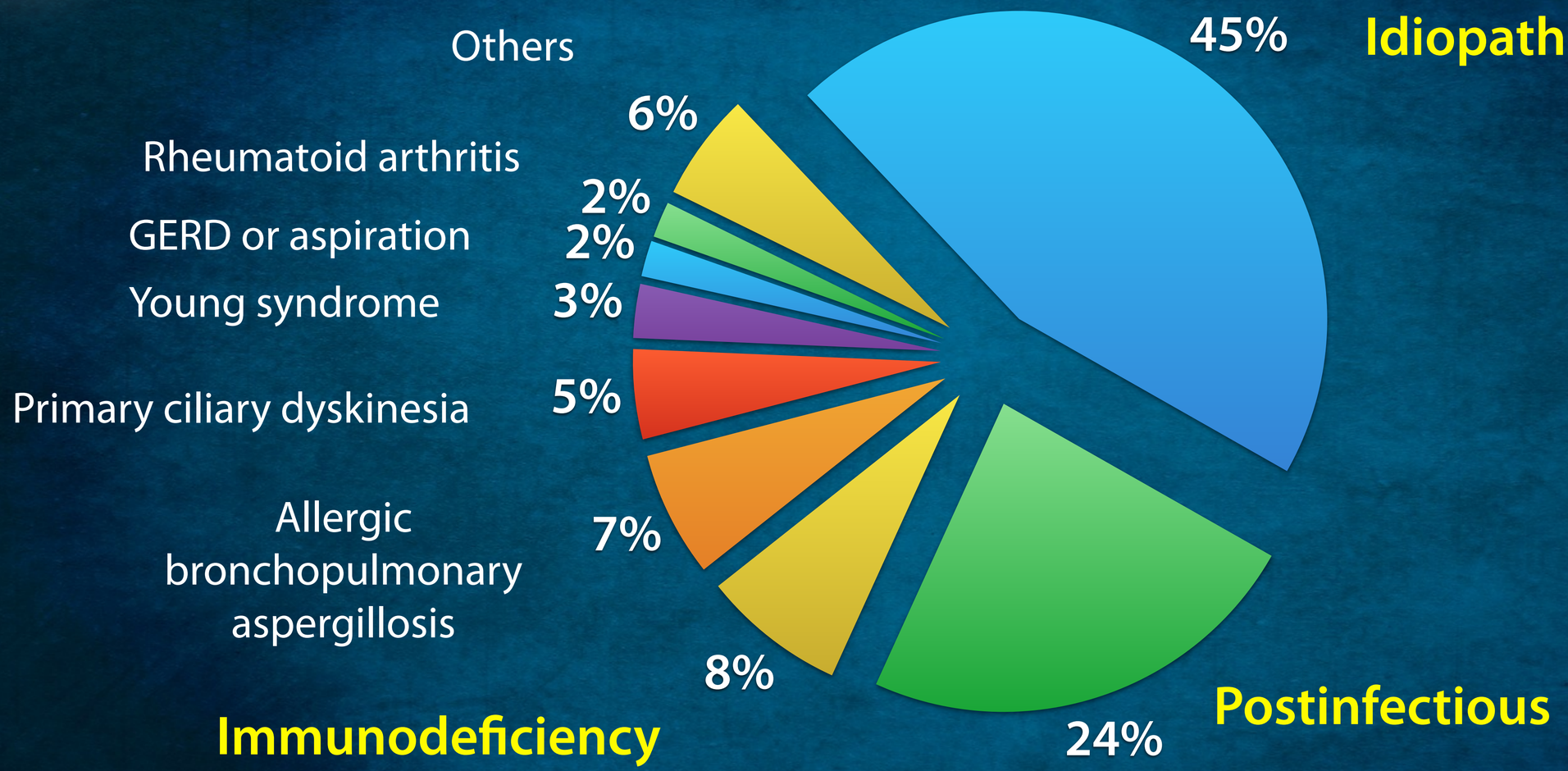
Repeated/episodic
GERD
Aspirations
Posterior nasal drip

Chronic/persistent
Endobronchial TB
Bronchial obstruction
ABPA

2nd hit

Bronchiectasis

Reported Etiologies of Bronchiectasis



Quast T M, Self A R, Browning R F et al. *Dis Mon* 2008; 54: 527-539.

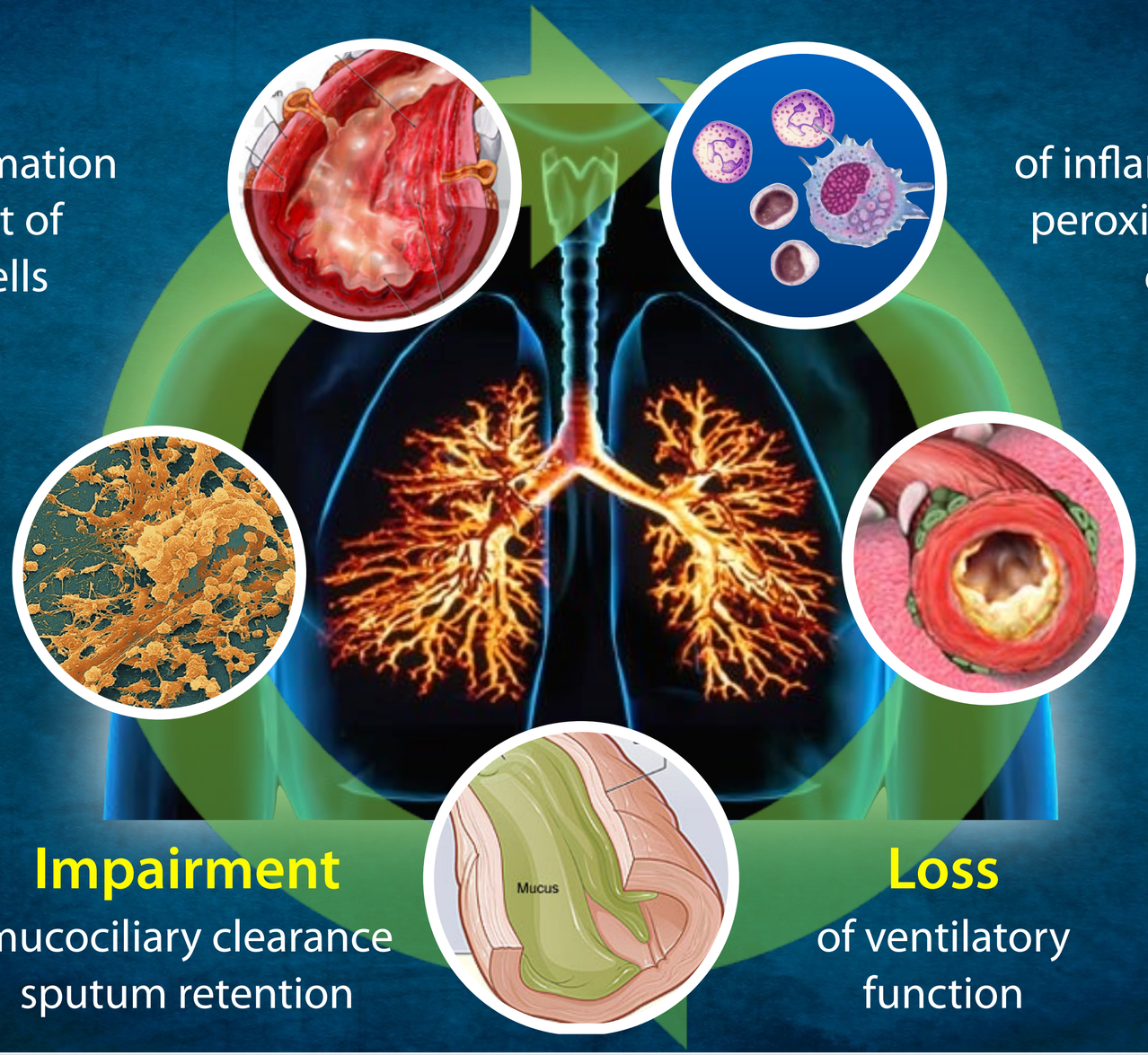
Pasteur M C, Helliwell S M, Hughton S J et al. *Am J Respir Crit Care Med* 2006; 100: 2183-2189.

Pathogenesis of Bronchiectasis: The Vicious Cycle

Infection
with acute inflammation
and recruitment of
inflmmatory cells

Release
of inflammatory cytokines
peroxidases, proteinases
elastase, etc.

Colonization
and biofilm formation
intermittent dispersals



Destruction
of mucociliary and
cartilagenous supporing
structures

Impairment
mucociliary clearance
sputum retention

Loss
of ventilatory
function

Pseudomonas aeruginosa in Bronchiectasis

Lipopolysaccharide

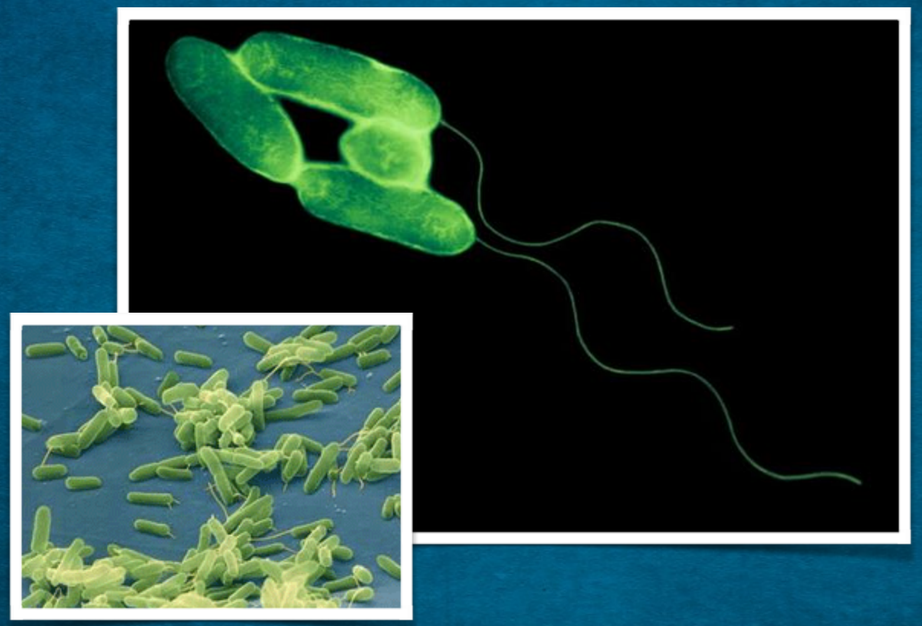
- Systemic inflammation

Quarum sensing

- Production of lactone
- cell-cell signaling

Alginate

- Adherence to the epithelial cells



Flagellum

- Mobility
- Release of the proinflammatory chemokines on attachment

Pili

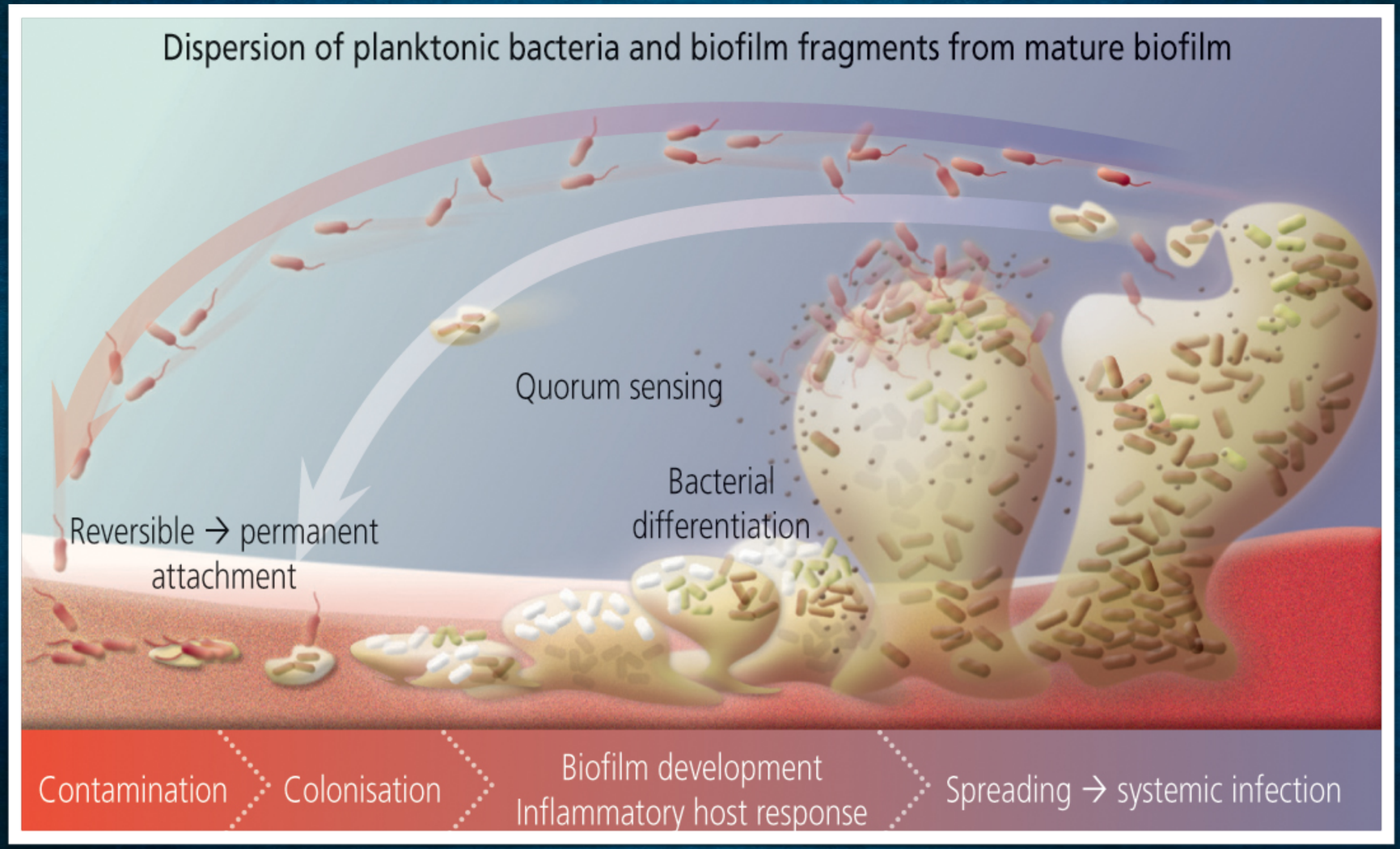
- Adherence to lipid membrane
- Release of toll-like receptors
- Recruitment of phagocytic cells

Pyocyanin

- Disruption of the epithelial cell wall
- Impairment of ciliary function

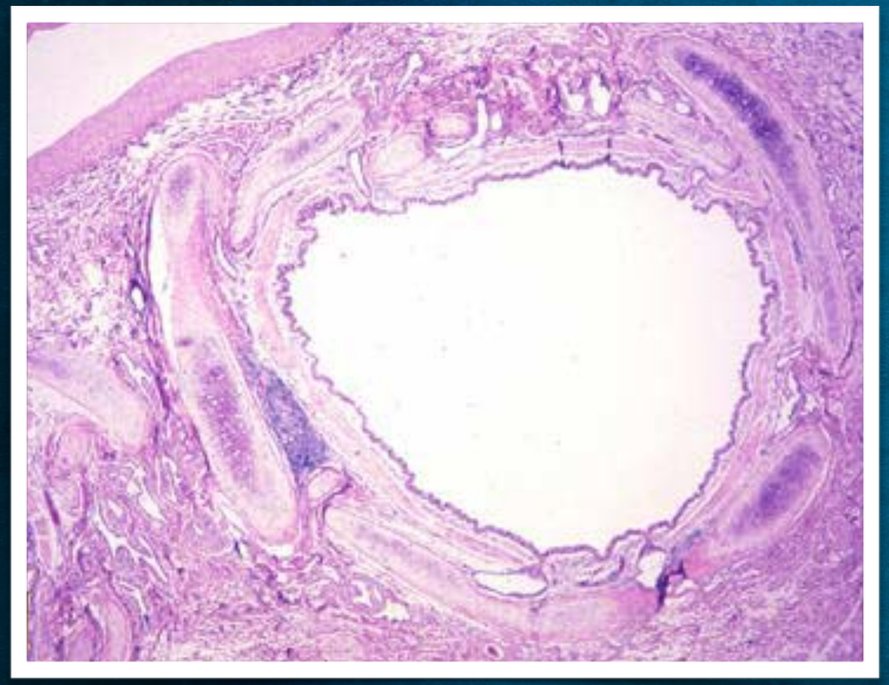
Barker A F, Moulton B C. *Clin Chest Med* 33 (2012) 211-217.

Role of Biofilms

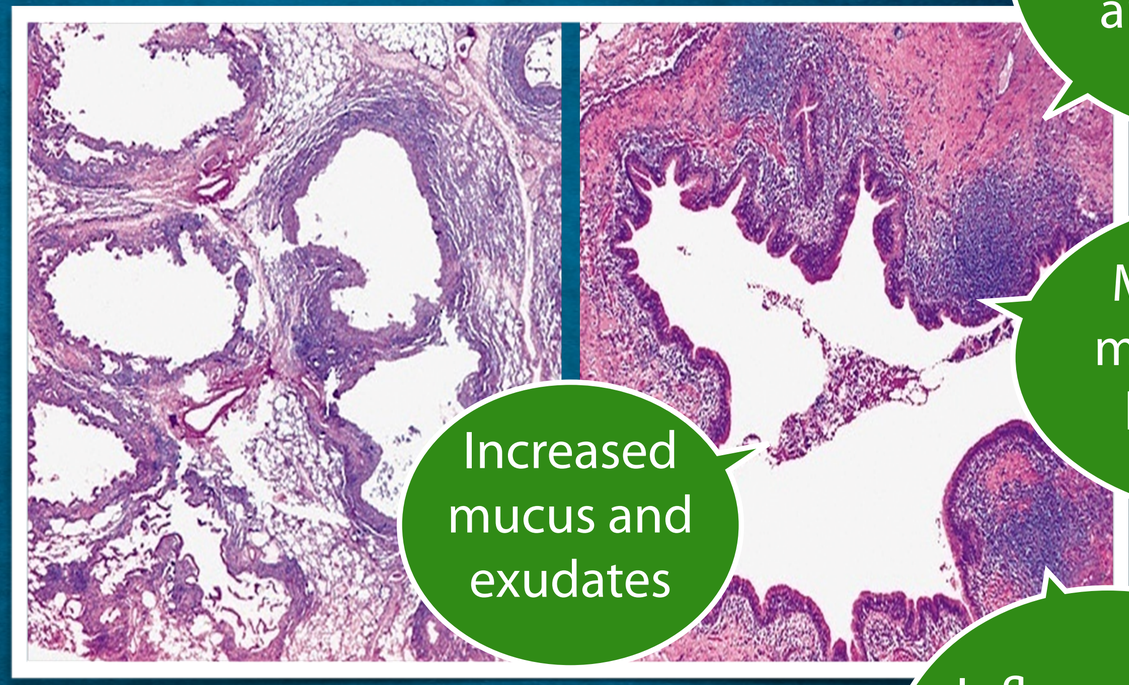


Adapted from Beckford-Ball J. http://woundsinternational.wordpress.com

Histologic Changes in Bronchiectasis



Normal bronchus



Bronchiectasis

Cartilage destruction and fibrosis

Mucosal and mucous gland hyperplasia

Increased mucus and exudates

Inflammatory cells infiltration

Diagnosis of Bronchiectasis: General Consideration

Definitive diagnosis
Severity of impairment

Underlying or associated condition(s)

Microbiology of the bronchiectatic airway

Clinical Manifestations of Bronchiectasis

Clinical Features of bronchiectasis

History
Chronic productive cough*
Sputum production*
Reported bouts of respiratory tract infection

Physical examination
Wheezing, rhonchi, crackles
Clubbing
Cyanosis

Clinical features of the associated/causative condition(s)

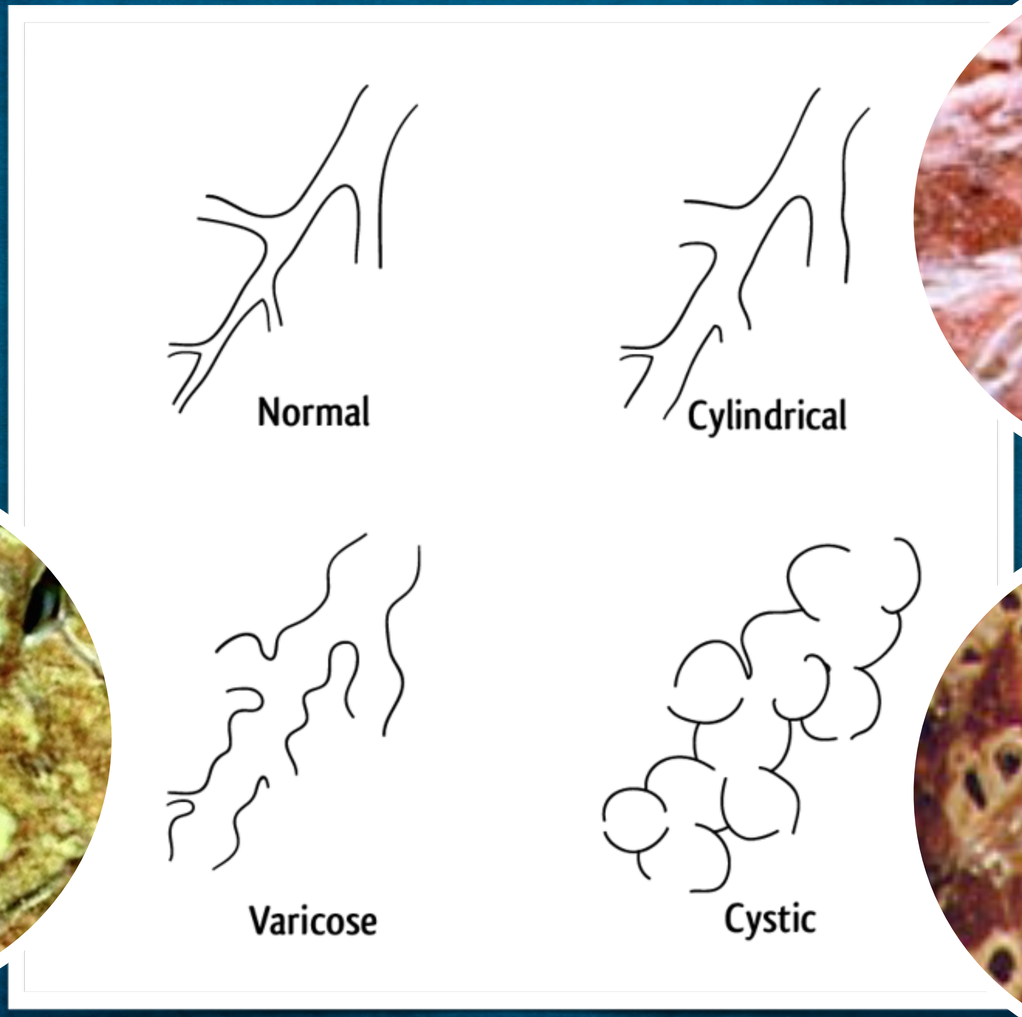
Bronchial obstruction
localized wheezing

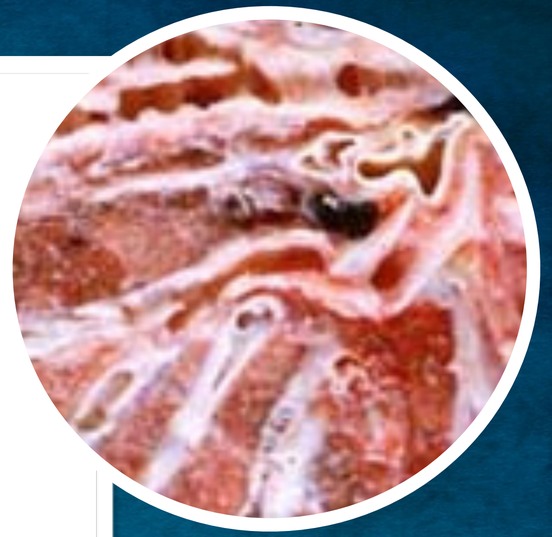
ABPA
Prominent wheezing

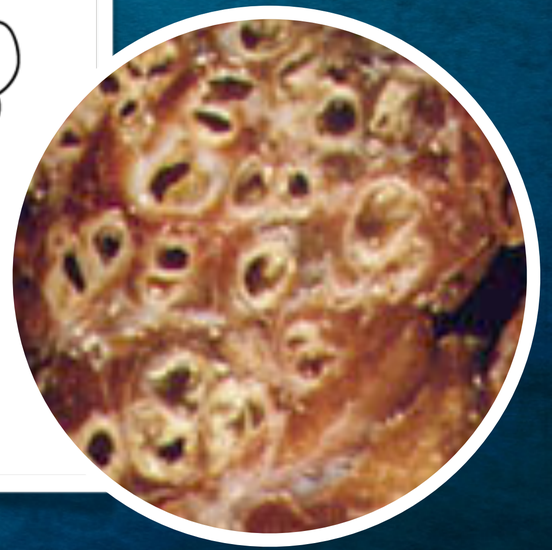
CTDs
Arthritis
Sicca syndrome

PCD, CF, Young Syndrome
Recurrent sinus disease
Infertility

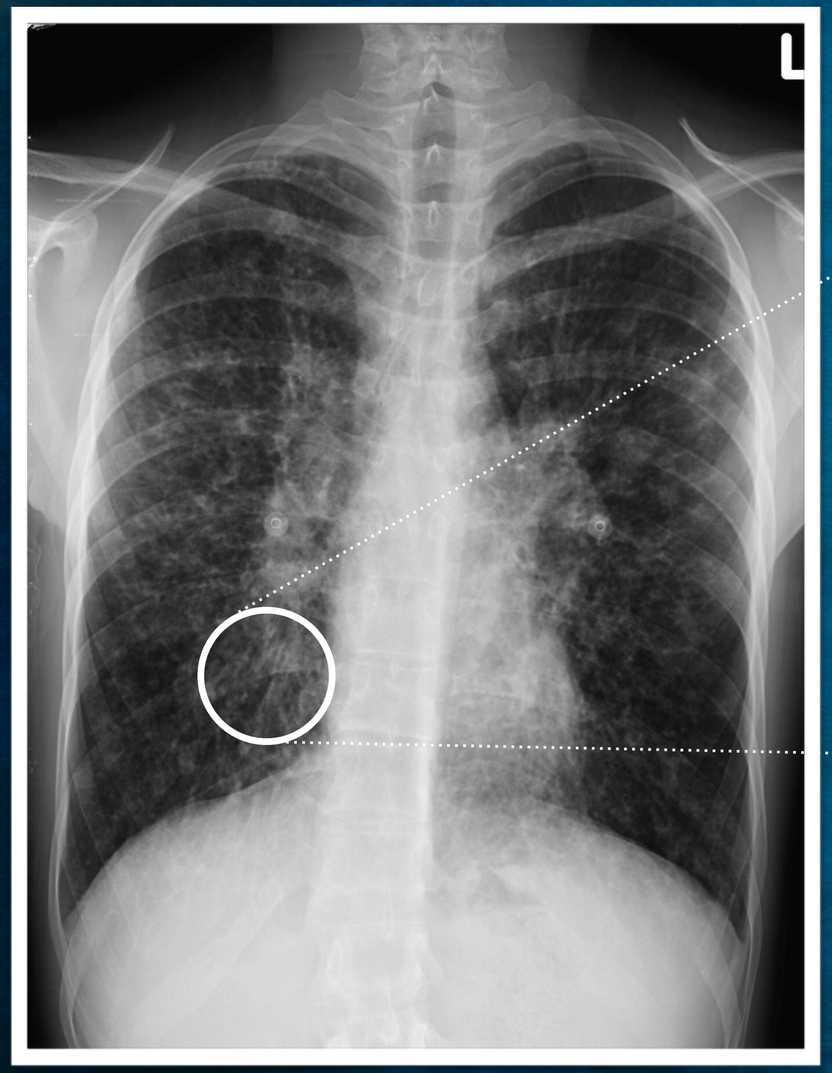
Pathological Classification of Bronchiectasis

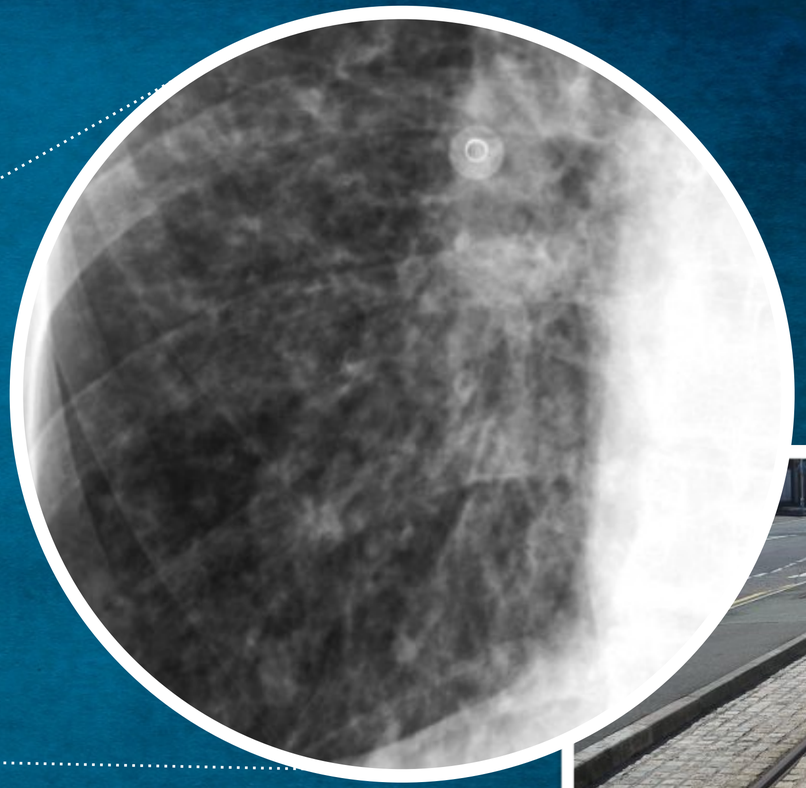






Chest Radiograph

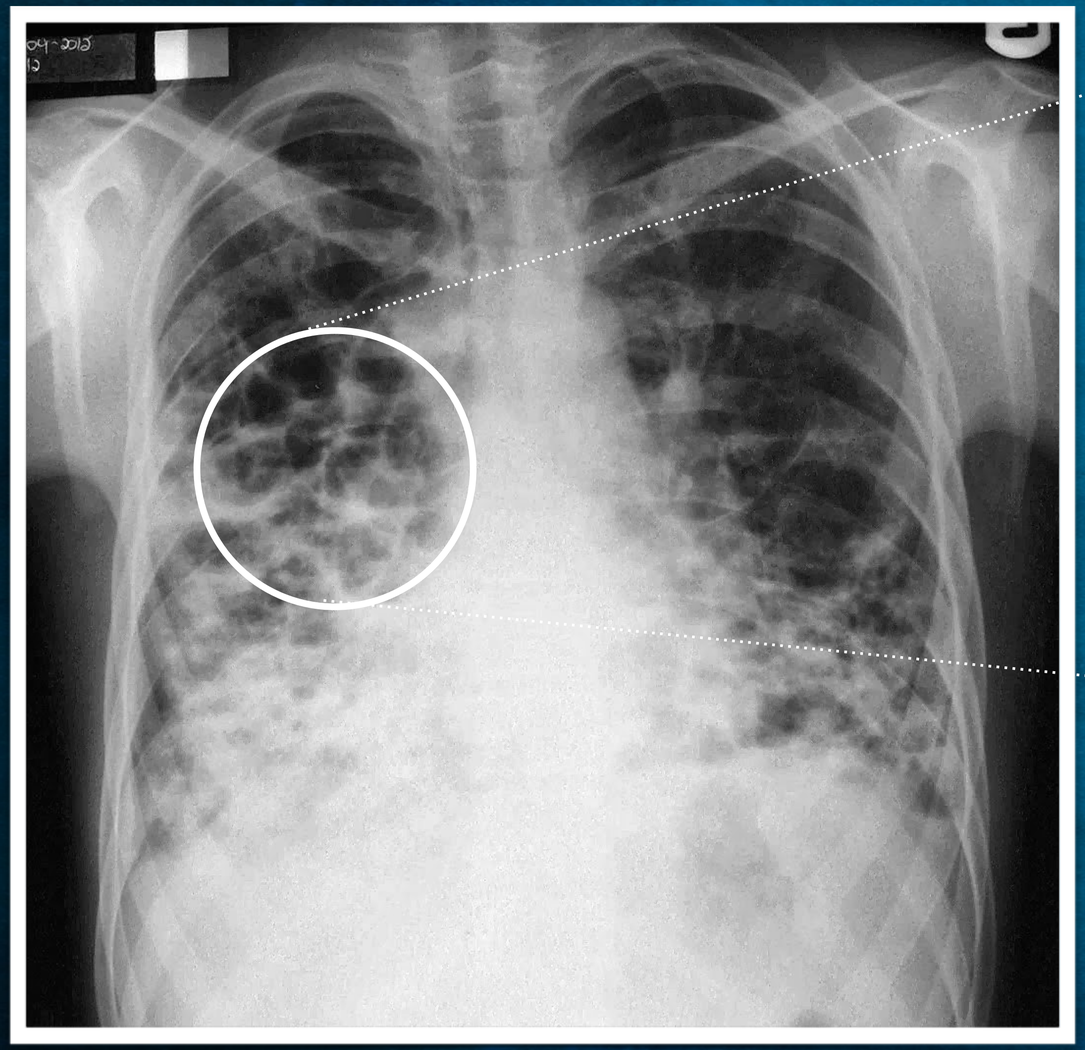


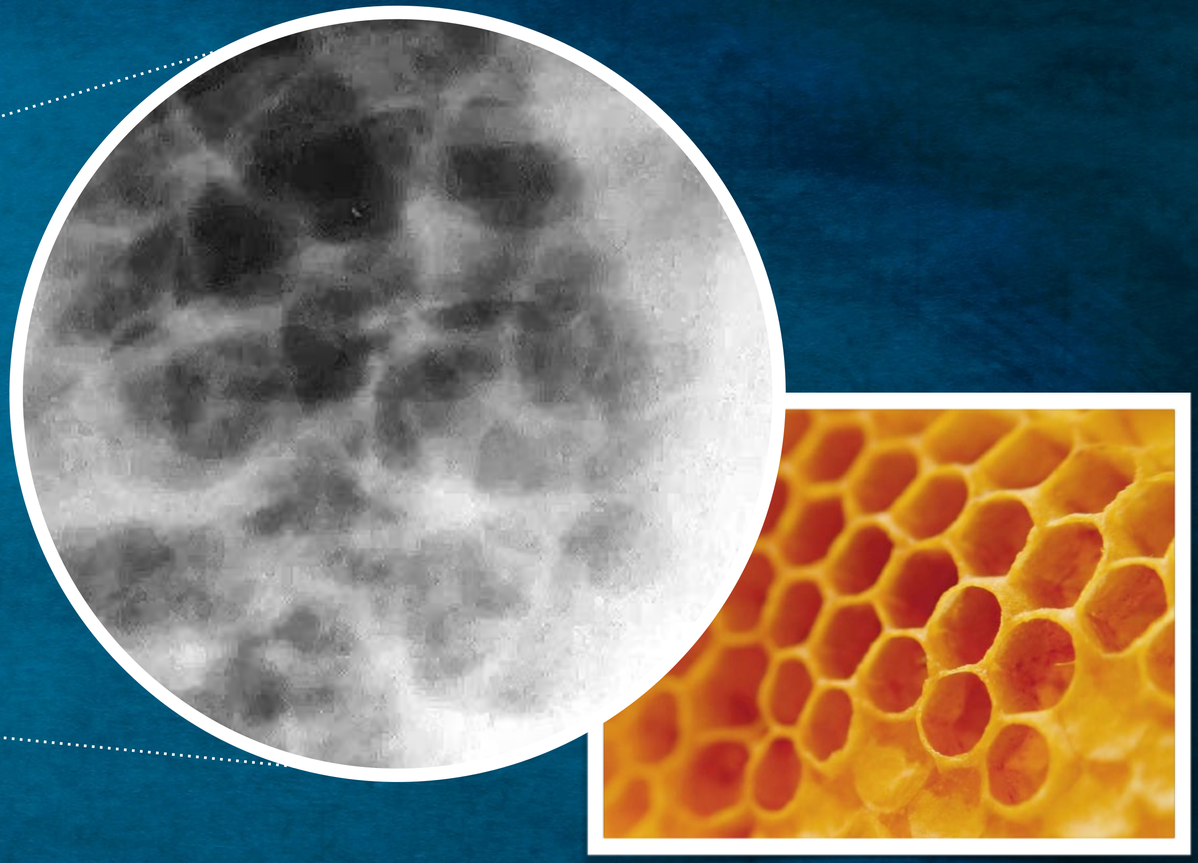


Bronchial wall thickening and widening
with parallel configuration

“Tram track” sign

Chest Radiograph (2)

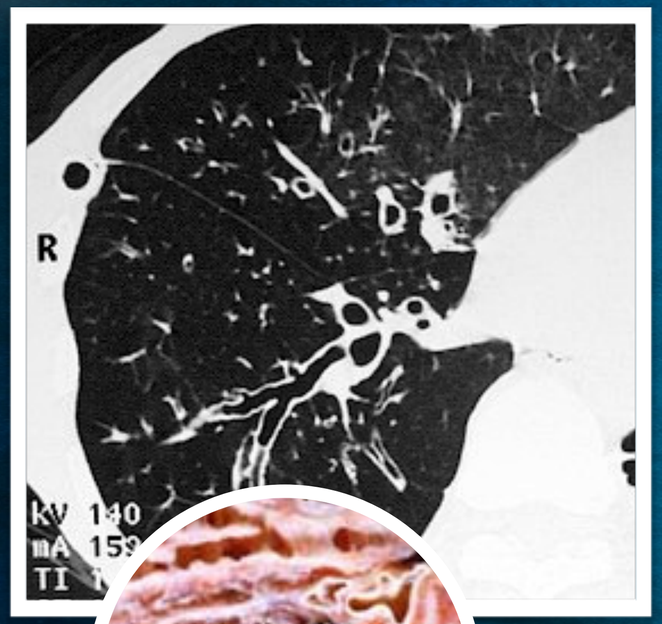


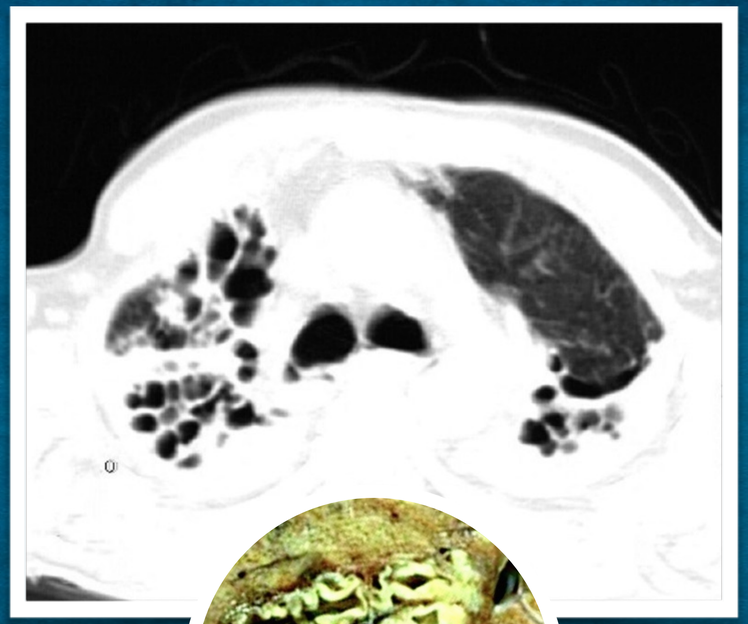


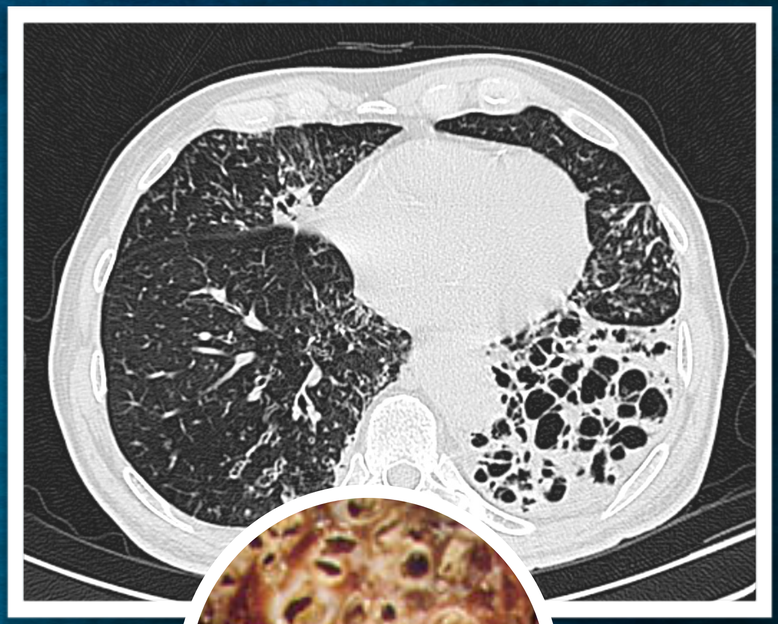
Conglomerating cysts of varying size
and wall thickness

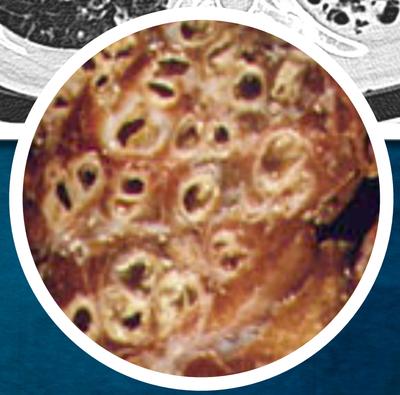
“Honeycomb” sign

High Resolution CT



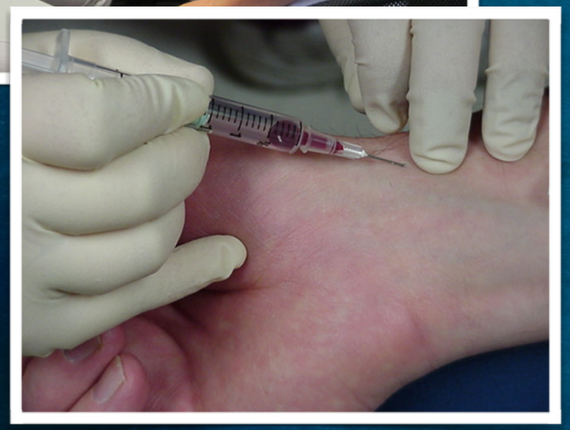






Cylindrical **Saccular/Varicoid** **Cystic**

Spirometry and Arterial Blood Gas Analysis



- Supportive evidence of airway disease (Obstructive defect)
- Severity assessment (Severe impairment = poor prognosis)
- Bronchodilator therapy (Positive bronchodilator response)
- Oxygen therapy (Hypoxemia)

Diagnosis of Bronchiectasis: General Consideration

Definitive diagnosis
Severity of impairment

Underlying or associated condition(s)

Microbiology of the bronchiectatic airway

Additional Tests for Diagnosis of Bronchiectasis

Test/Procedure	Suggestive clinical features	Etiology
Quantitative immunoglobulins (IgG, IgA, IgM)	Concomitant sinus disease, recurrent infection	Common variable immune deficiency
Aspergillous-specific IgG, IgE level, aspergillus skin testing	Asthma, central bronchiectasis, prominent mucus plugging	Allergic bronchopulmonary aspergillosis
IgE level	Eczema, staphylococcal infections, retained primary teeth	Hypergammaglobulinemia E (Job sydrome)
Alpha-1 antitrypsin level	Emphysema	Alpha-1 antitrypsin deficiency
Sweat chloride, nasal potential difference or CF mutation screen	Concominant sinus disease, younger age, upper lobe disease	Cystic fibrosis
Bronchoscopy	Unilateral focal disease	Bronchial obstruction

Metersky M L. *Clin Chest Med* 33 (2012) 211-217.

Additional Tests for Diagnosis of Bronchiectasis (2)

Test/Procedure	Suggestive clinical features	Etiology
Bronchoscopy with mycobacterial cultures	"Tree-in-bud" on HRCT, nodules, cavity, scoliosis, pectus	Nontuberculous mycobacteria and tuberculosis
Ciliary biopsy, ciliary functional testing, nasal nitric oxide	Childhood onset, sinus or ear infections, situs inversus, infertility	Primary ciliary dyskinesia
Swallow evaluation of esophageal pH measurement	M avium disease	Gastroesophageal reflux disease or aspiration
IgG subclass levels, response to immunization, tests for qualitative immune defects	Childhood onset, recurrent infections, dysmorphic features	Congenital immunodeficiency
Serology for autoimmune disease	Arthritis, sicca syndrome	Rheumatoid arthritis, Sjögren syndrome
Serology for HIV infection	Opportunistic infections, recurrent infections	HIV disease

Metersky M L. *Clin Chest Med* 33 (2012) 211-217.

Diagnostic Workup in Bronchiectasis

Mucociliary defects	Cellular/immune defects	Associated conditions
Ciliary biopsy/function test Sweat chloride CF mutation screening	Quantitative immunoglobulins IgG or IgE levels AAT level Serology for HIV	**Serology for CTDs:** ANA, Anti-Sm Anti-Ro, Anti-La etc.

Acute/severe	Repeated/episodic	Chronic/persistent
Measles Influenza pneumonia inhalation injury Radiation injury	Esophageal pH Swallow evaluation	Bronchoscopy Aspergillus IgG/IgE Aspergillus allergy test

Metersky M L. *Clin Chest Med* 33 (2012) 211-217.

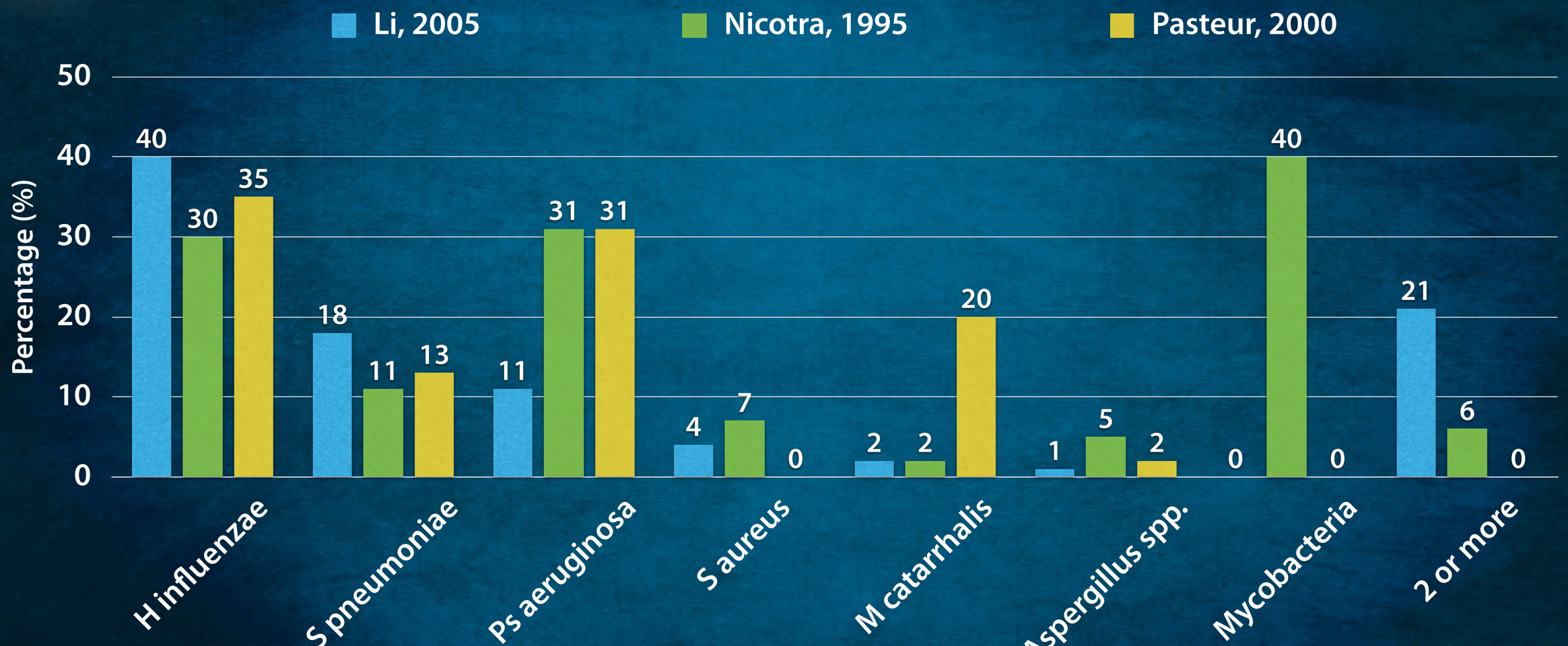
Diagnosis of Bronchiectasis: General Consideration

Definitive diagnosis
Severity of impairment

Underlying or
associated condition(s)

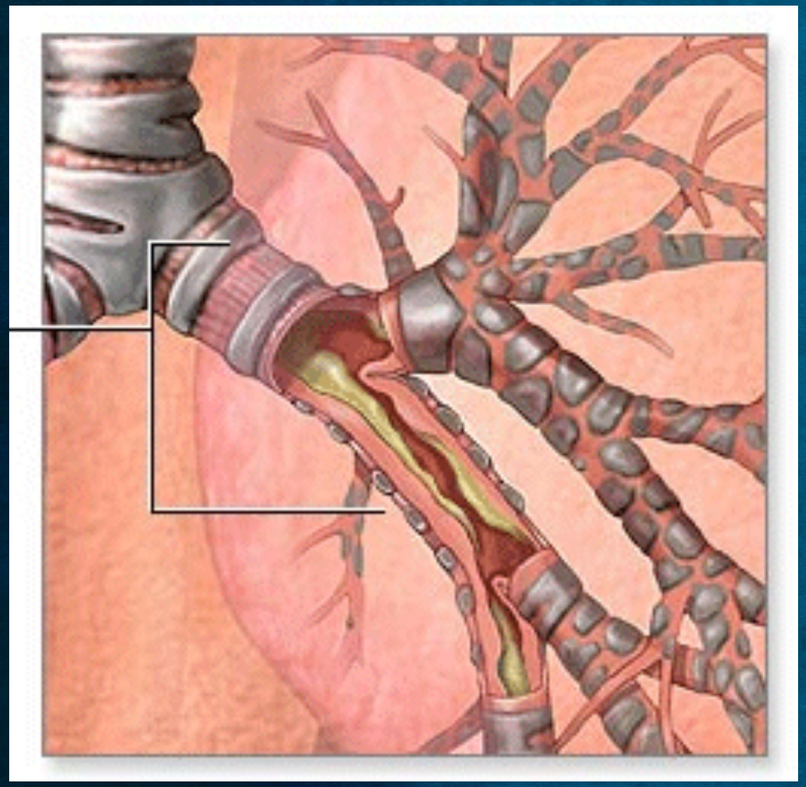
Microbiology of
the affected airways

Microbiology in Bronchiectasis



Barker A F and Ahmed S Y, *Fishman's Pulmonary Diseases and Disorders*, 4th Edition. 2008.

Bronchiectasis: Summary



- Abnormal irreversibly dilated and often thick-walled bronchi
- Pathogenesis related to one or more defects of mucociliary clearance, cellular and immunity defense mechanism or presence of associated conditions
- “The vicious cycle” and *P aeruginosa* contributes progression and severity of disease
- Imaging greatly helps in diagnosis: Tram line, honeycombing, cystic, signet ring sign
- Additional test may be required in specific clinical settings
- Microbiology of the diseased airway may aid proper antimicrobial therapy

Thank you