

# PATHOPHYSIOLOGY OF COMMON RESPIRATORY DISORDERS

Lois E Brenneman, MSN, ANP, FNP, C

## RESPIRATORY INFECTIONS

### INFLUENZA

- Influenza remains in top 10 causes of death in US.
- 90% in persons > 65 years (10,000-40,000 deaths per year).

#### PATHOPHYSIOLOGY:

- Viral etiology - cold, dry weather (and crowding) favors spread
- Virus replicates exponentially w/ respiratory tract. (**abrupt onset** within 24-48h)
- Influenzae can be lethal - victims contract pneumonia esp elderly or frail
- Widespread lethality in epidemics at turn of century
- Peak flu season: December - March

#### S/S:

- Sore throat; dry nonproductive cough; high fevers with chills
- Severe, diffuse myalgias; headache
- Elderly esp in nursing home present confusing picture concomitant COPD.

### IMMUNIZATION

- CDC indicates that not once in past 10 years has even 1/3 population at risk been immunized.
- Virus is killed - cannot transmit influenzae - safe for immunocompromised persons
- Vaccine must be reformulated yearly - can not readminister previous year's vaccine
  - Influenza A has more frequent major and minor structural changes
  - Each years vaccine must be reformulated according to strains which were prevalent in May, June and July which usually represent the follow winter's most likely strains.
- Requires immunization prior to outbreak in community. (Oct or Nov)
  - Too early immunization will result in vulnerability in late winter early spring
  - Too late immunization will result in no protection during late fall early winter
  - Immunity gradually wanes therefore mid-November is ideal but October is reasonable

## UPPER RESPIRATORY INFECTION (URI)

- Common cold of viral etiology; 30% pharyngitis chlamydial; 5-10% mycoplasma and group A strep.
- Rhinoviruses most common: 110 antigenic serotypes; no cross immunity; reinfection w another serotype right after a recent cold is common.

### TRANSMISSION:

- Aerosolization of virus-laden respiratory secretions and direct mucus membrane contact
- Contaminated hands, skin surfaces, counter tops, etc.
- Similar clinical picture with numerous viral agents:
  - Rhinovirus, respiratory syncytial virus
  - Adenovirus, influenza virus, parainfluenza virus.

### PATHOPHYSIOLOGY:

- Incubation 1-5 days, virus shedding to 2 weeks.
- S/S:
  - Coryza, pharyngitis, laryngitis, H/A, malaise, fever
  - Ear/sinus discomfort secondary to mucosal edema vs acute viral infection
  - Resolve w 1 week, symptoms may linger several weeks
  - Rarely progress into pneumonia.

### PREVENTION:

- Avoid aerosol exposure
- Wash hands, avoid hand contact with oral/nasal/ocular mucus membranes.
- Gargling w antiseptic not effective
- Inhaled alpha-interferon experimental
- High-dose Vitamin C or zinc lozenges not demonstrated in controlled studies

## COUGH

- Number one cause of visits to primary care providers.
- Generally seek medical attention for cough out of fear of underlying problems or presence of secondary symptoms (insomnia, exhaustion, hoarseness, dizziness).
- 1994: 53 million Rx for cough; \$526 million to relieve symptoms.

### PATHOPHYSIOLOGY:

- Defense mech to expel foreign bodies, secretions, inhaled irritants.
- Voluntary component; involuntary component,
- Vagally mediated (efferent and afferent pathways of NS)
- Sequence of Coughing
  - Stimulus → stimulate medulla to initiate deep inspiration → glottic closure via laryngeal nerve → relaxation diaphragm and contraction of intercostal and abdominal muscles → thoracic pressure increases → glottis reopens → air/foreign material expelled.
- Sometimes cough may serve no useful purpose and debilitate patient and family.

## DIFFERENTIAL DIAGNOSIS:

### INFECTIOUS ETIOLOGY

- Symptoms which suggest infectious cause of cough:
  - Rhinitis, sinusitis, pharyngitis, otitis, headache
  - Myalgia, fever, pleuritic chest pain.
- PND may coexist with other causative factors for cough
- Respiratory infection, pneumonia, bronchitis, TB, non-infective cough-inducing conditions
- Viral cough: noisy and prod minimal sputum
- Bacterial/mycoplasma: severe and can last months after other symptoms disappear.

### NON-INFECTIOUS ETIOLOGY:

Asthma, environmental allergies, inhaled agents, tumors, congestive heart failure, pulmonary edema, chronic bronchitis, granulomatous disease, GERD.

#### Cough equivalent asthma

- Cause may be only symptom of asthma; especially if cough worsens at night.
- Determine if cough is exacerbated by exercise or exposure to allergens (dust, pollen, pets, mold)

#### Foreign body aspiration:

Cough w wheezing or stridor may suggest foreign body aspiration especially in very young and elderly.

#### Post viral bronchospasm:

Prolonged duration cough after cold/flu suggests chronic bronchitis (esp if smoke) or post viral bronchospasm

#### Cancer:

Smoker w change in persistent cough: suspect CA (persistent dry cough no other symptoms may be caused by malignancy which irritates the cough receptors in lungs, trachea or mediastinal structures)

GERD: increasingly recognized cause of cough: sour taste, retrosternal burning.

#### Productive vs nonproductive cough:

- Non-productive re sputa: asthma, GERD, allergies.
- Productive: infection; COPD, pulmonary edema (frothy pink/white)

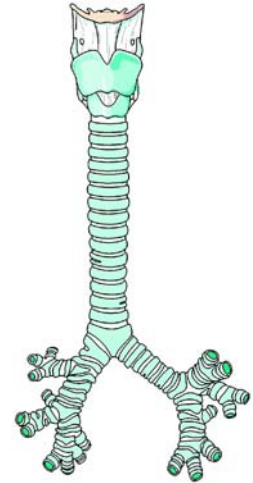
## ACUTE BRONCHITIS

### EPIDEMIOLOGY ACUTE BRONCHITIS (AB)

- One of most freq dx in primary care
- 7 million episodes annually among non-institutionalized adults - 4 per 100
- RX antibiotics 50-70% of time - 16 million RX outpatients

### DEFINITION AND DIAGNOSIS

- No universally accepted definition exists
- Diagnosis is a function of history and physical
- **Transient inflammation of tracheobronchial tree**
- No pathologic diagnostic gold standard
- Majority of causative agents self-limiting and non-treatment
  
- **Hallmark is productive cough**
- Etiology: usually infectious
- Non-infectious causes:
  - Toxins
  - Irritants
  - Noxious fumes
  - Secondary to certain drugs e.g. ACE inhibitors
  
- From clinicians perspective most important distinction is to **R/O pneumonia**
  
- Sinusitis may be confused w bronchitis
  - Both prod productive cough
  - Can co-exist w bronchitis
- Abnormal lung sounds (except stridor) localizes process to below carina
- Normal lung findings does not r/o acute bronchitis - no gold standard for dx



CAUSES: little known re etiology. - viral, bacterial, toxins

- **Viruses** (most common cause of acute bronchitis)
- Bordetella pertussis:
  - Recent evidence for chronic cough adults
  - Minority of cases of AB
- **Mycoplasma pneumoniae**: widespread - common
  - Less common cause than viral
  - Very common with shared quarters: dorms, barracks, etc.
- **Chlamydia pneumoniae**: newly ID pathogen
- Classic pathogens of **pyogenic pneumonia** : uncertain as to what extent they cause AB
  - **Streptococcus pneumoniae**
  - **Haemophilus influenzae**
- Non-infectious irritants
- Misdiagnosed asthma: rhonchi can be present vs wheezes

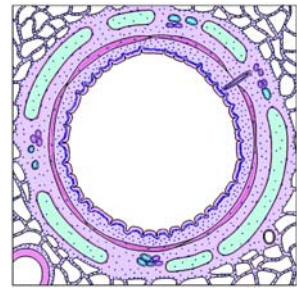
#### VIRUSES CAUSING BRONCHITIS

- Influenza A and B
- Adenovirus
- Parainfluenza virus
- Coronavirus
- Respiratory Syncytial virus
- Coxsackie virus A21
- Miscellaneous (measles, rubella, etc.)

Illustrations: **LifeART**  
William and Wilkins

## PATHOPHYSIOLOGY

- Decent into lower respiratory tract (LRT) of virus or other organism
  - Causes epithelial inflammation
  - Irritation of cough receptors
- Injury to mucus membranes lining tracheobronchial tree
  - Triggers complex series cellular/molecular events
    - Hyperemia and inflammation of bronchus
    - Infiltration of mucosa w leukocytes
    - Secretion of mucopurulent exudates
    - Ciliated cells usually damaged
    - Phagocyte and lymphocyte function impaired
  - Results:
    - Decreased host defenses
    - Bacteria cross mucosa cause further damage

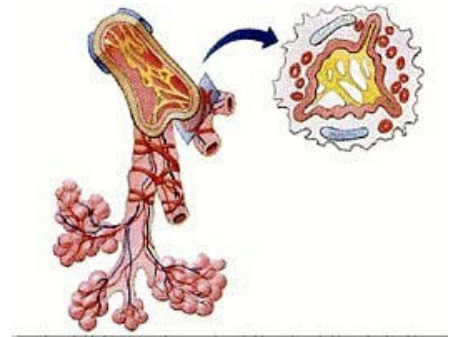


Above: Bronchus histology  
Below:: Secretions in bronchioles

## CLUES IN HISTORY AND PHYSICAL

### HISTORY

- How long has episode coughing persisted?
- Out of work/school or had high fever?
- Was cough preceded by URI?
- Did it begin abruptly without antecedent symptoms?
- Underlying chronic respiratory condition?
- If productive, what is color/nature of sputa?



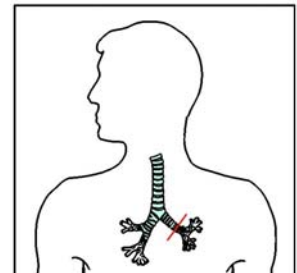
### PHYSICAL EXAM

- White or mucoid sputum suggests bacterial etiology
- Colored sputa or fever suggests bacterial superinfection - specialists doubt such is common
- Transition from productive to dry, hacking cough
- Hacking cough suggests hyperactive airways not necessarily infective process
- Symptoms typical of acute bronchitis
  - **Cough, sputum production, low-grade fever**
  - **Sometimes wheezes and diffuse rhonchi**
- **Focal findings are absent** which distinguishes acute bronchitis from pneumonia

Illustrations: **LifeART**  
William and Wilkins

## WHEN TO ORDER TESTING

- CXR: matter of judgement based on history
- Rarely necessary if history of URI with sore throat or coryza
- Probably unnecessary unless focal findings
- CXR is advisable when
  - Signs or symptoms persist more than 2 weeks
  - Another aspect of history or PE suggests pneumonia
    - High fever, focal findings
    - Profound dyspnea
  - Co-morbid medical disorders vs a healthy patient



- Usefulness of gram stain is debated
  - Uninformative in most patients with acute bronchitis
  - Contaminated with oral secretions
  - Some feel that it identifies predominant organism to guide treatment
  - Particularly useless in children
    - Most can't produce sputa specimen
    - Throat culture rarely informative re: cough
- WBC and differential offer little useful info

## LIKELY PATHOGENS

- Current trend is away from antibiotic treatment in pt with AB
  - Even those with bacterial infections
  - Importance of ID etiologic agent is diminishing with current thinking
- Typical pathogens
  - **Viruses** - most common cause
  - Streptococcus pneumoniae - extent not known
  - Haemophilus influenzae - extent not known
  - Atypical organisms
    - Chlamydia pneumoniae, Mycoplasma pneumoniae
    - Common in general pop esp younger pts
    - Many mild/asymptomatic; can be more serious
    - Associated with bronchial obstruction and wheezing
    - Can precipitate asthmatic bronchitis or adult-onset asthma
  - Bordetella pertussis: cough with whooping or vomiting
    - Increasing in children and elderly
    - Younger adults more frequently than previously realized

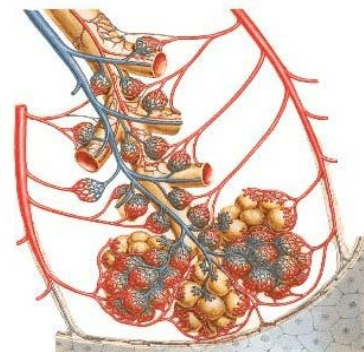
## PNEUMONIA

### DEFINITION:

- Inflammation of peripheral lung and terminal airways
- Usually due to infection
- Classified re: site, etiology, host, clinical course

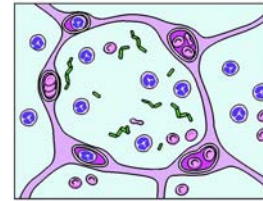
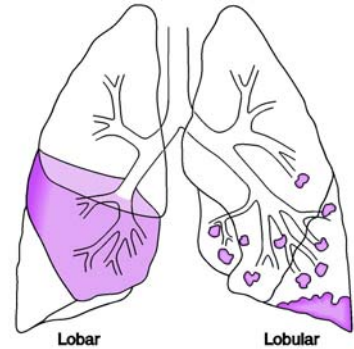
### EPIDEMIOLOGY

- 6th leading cause of death in US
- One of leading causes of infection-related mortality
- Affects 4 million people annually
- 50 yrs ago: all cases were S. pneumoniae
- Today only 25% cases S. pneumoniae
- Empiric therapy
  - Usually successful but most make choice judiciously
  - Factors: age, living conditions, gen health, season, local resistance patterns



## PATHOPHYSIOLOGY:

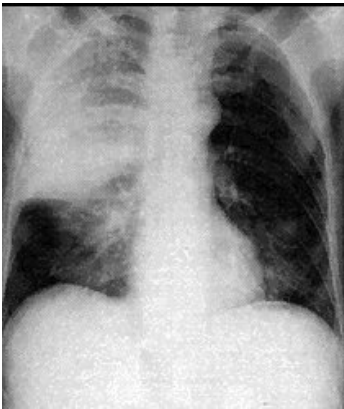
- Colonization of oropharynx followed by aspiration of organism into lower airway
- Host defense vs virulence of pathogen determine whether develop pneumonia
- Greater virulence and greater quantity of organism the more likely to be pathogenic
- Host defenses
  - Tissue macrophages
  - White cells, granulocytes
  - Cilia in mucociliary tract
- Glottis (UR tract) prevents aspiration large volume fluids
- Modes of transmission
  - Most due to aspiration of nasopharyngeal flora
  - Also via infected aerosols: influenza, TB, RSV
  - Hematogenous seeding of lung usually *S. aureus*
- Conditions which increase risk
  - Airway obstruction
    - Decreases mucociliary transport
    - Increases alveolar hypoxia
  - Altered consciousness - incr risk aspiration: CVA, ETOH abuse, seizure
  - Compromised immune system
    - Impaired phagocytosis, opsonization
    - HIV, CA chemotherapy, hypogammaglobulinemia
  - Recent viral infection
    - Enhance mucosal adherence of bacteria
    - Impair mucociliary transport



## DIAGNOSIS AND INITIAL WORKUP

- Differentiating from bronchitis is first step
  - Bronchitis:
    - Diffuse rhonchi and wheezing suggest diagnosis
    - Especially suggestive if low-grade temp and only moderately ill
  - Pneumonia:
    - Focal chest sounds: **Inspiratory crepitant rales and dullness to percussion**
    - Classic signs: **fever, pleurisy, cough, sputa production, rapid pulse and respiration**
    - Other s/s: **Chest retractions, nasal flaring, cyanosis lips, tongue, nail beds and conjunctiva**

- Elderly: s/s esp fever may be absent or subtle in the elderly
- Infants/children: s/s are subtle
  - Cough, rapid/diff breathing, wheezing, recent URI, poor feeding
  - Temperature may not be helpful: above or below normal
  - Chest auscultation: typical focal abnormalities
  - Small crackles to fingertips chest/back (assessment straightforward)
  - Struggling toddlers: assessment is more difficult
  
- Extrapulmonary findings suggests atypical pneumonia (40% accurate)
  - H/A, bullous myringitis, mental confusion, erythema multiform
  - Much overlap exists - extrapulmonary s/s may be unreliable to diagnose atypical
    - Elderly (vs young patients) may have extrapulmonary signs with *S. pneumoniae*
    - Concurrent illness may present with extrapulmonary symptoms
  
- CXR (AP/Lateral) required when suspect pneumonia in an adult
  - Confirms diagnosis or suggests other diagnosis (abscess, tumor, TB)
  - Indicates severity of pneumonia
  - Not diagnostic of causative organism: only 50% ID cause organism for pneumonia
  - Children treated without CXR based on s/s and auscultation
    - Rarity of other conditions: tumors, abscess, etc.
    - CXR is still recommended



Above: Rust colored sputa  
 Left : Upper right lobe pneumonia  
 Right: Mycoplasma pneumonia



## LIKELY ORGANISMS

- Except for aspiration CAP virtually always single agent
- S. pneumoniae is leading "typical"
- H. influenzae
  - HIB vaccine for children
  - H. influenzae (b conjugate) drastically decreased incidence in infants and children
  - Most adults remain susceptible
  - Smokers and patients with COPD particularly susceptible
- M. catarrhalis common
- S. aureus rare in community acquired pneumonia except as sequel to influenza or DM
- Gm negative community-acquired pneumonia: nursing homes and debilitated elderly
- Aerobe organisms in CAP: strong possibility if patient is alcoholic as is K. pneumoniae
  
- Viral pneumonias
  - Influenza A and B (preventable w vaccine): winter
  - Respiratory syncytial virus (RSV): winter - also prominent pathogen in young children
  - Parainfluenza: late summer, fall - majority of lower respiratory infections in infants
  - Varicella zoster: pt of all ages
  
- HIV population: S. pneumoniae is most common
  - More common than PCP (Pneumocystis carinii pneumonia)
  - Lower the CD4 count -> greater the risk



## "ATYPICAL" PNEUMONIAS

- Term fallen out of favor in some quarters
- Non-zoonotic pneumonias
  - Legionella pneumophila
  - Chlamydia pneumoniae
  - Mycoplasma pneumoniae
  
- Zoonotic (from animals)
  - Q fever: Coxiella burnetii (sheep)
  - Tularemia: Francisella tularensis (rabbits)
  - Psittacosis: Chlamydia psittaci (birds)
  
- Review history or possibility of zoonotic - risk is minimal except for one of the following
  - Exposure to psittacine birds: psittacosis
    - Parrots, lovebirds, parakeets
    - Some seabirds, poultry, pigeons and pet birds can harbor
  - Sheep, lamb goat or cattle: Q fever
  - Rabbits: tularemia: lab workers, hunters, butchers, rabbit handlers
  
- Pulse-temperature deficit
  - Not present w tularemia
  - Occasionally present w Q fever
  - Always present with psittacosis
  
- C. pneumoniae or M pneumoniae
  - Occurs with up to 25% CAP
  - Consider even where no history of exposure

Pneumococcal pneumonia

### PNEUMONIA

- 80% have fever
- 80% have crackles
- Respiratory rate >20 per minute

- No data to support belief that atypical are less virulent than typical (widely held belief)
- Epidemiology of atypical pneumonia
  - Legionnaires rare in children
  - Chlamydial pneumonia common in children (more than generally believed)
  - M. pneumoniae: adolescents and young adults (most common in this population)

### CLINICAL PRESENTATION OF ATYPICAL INFECTIONS

<b>L. pneumophila:</b>	<b>M. pneumoniae</b>	<b>C. pneumoniae</b>
<ul style="list-style-type: none"> <li>- Relative bradycardia</li> <li>- High fever</li> <li>- Mental status changes</li> <li>- Diarrhea (not related to antibiotic use)</li> <li>- Hypophosphatemia</li> <li>- Renal impairment</li> </ul>	<ul style="list-style-type: none"> <li>- Pharyngitis</li> <li>- Diarrhea</li> <li>- Otitis media and/or bullous myringitis</li> <li>- Arthritis</li> <li>- Erythema multiforme</li> <li>- Wispy lower lobe infiltrates</li> <li>- <b><u>Dry non-productive cough</u></b></li> </ul>	<ul style="list-style-type: none"> <li>- Pharyngitis</li> <li>- Conjunctivitis</li> <li>- Lymphadenopathy</li> <li>- Wispy lower lobe infiltrates</li> <li>- Dry non-productive cough</li> </ul>

### BEYOND THE CXR

- Sputum exam are rarely recommended
    - Patients can't produce proper specimen
    - Contaminated w oral flora
    - Comorbidity w COPD: sputa notoriously uninformative\_\_
  - Routine culture is avoided
    - Atypical organisms do NOT grow in routine culture media
    - False negatives with S pneumoniae and H-flu - very fastidious
    - False positives with COPD - colonized but not infected
  - C/S sputum useful
    - With penicillin-resistant S pneumoniae likely
    - If patient on antibiotic when pneumonia develops
  - Viral culture rarely performed in CAP
  - Serologic treatment during acute and post-6 weeks
    - Confirms diagnosis but not contribute to treatment
    - Not likely approved with HMO
  - ABG (f) severity of illness - most hospitalized patient sick enough to need them
  - CBC, electrolytes, LFT, RFT: provides prognostic not etiologic info
- 
- Blood cultures standard for pneumonia workup
    - Any hosp pt should have pair of blood cultures
    - Only 20-30% positive
    - + culture highly specific and informative re therapy
  - Universal empiric therapy is norm - critics strongly advocate routine blood cultures

## TUBERCULOSIS

### EPIDEMIOLOGY:

- 15 million people infected with **Mycobacterium tuberculosis**
- CDC documented increase since 1985
  - Until 1985 no of cases was declining 5%-8% per year
  - 1985-1993: incidence increase 14%
- Factors causing increase TB
  - Advent of AIDS
  - Aging of population - elderly institutionalized are latent pool
  - Growing number of immigrants from endemic countries
  - Lack of public health funding
  - Incidence of drug-resistant TB

### PATHOPHYSIOLOGY

- Clinical course difficult to detect
- May not manifest s/s for years
- Function of age, immune status
  - Healthy person: lifetime risk progression 5%-15%
  - DM: 3X higher
  - HIV: 100 higher

### SCREENING

- Infected persons at high risk (benefit from therapy)
- Persons with active disease
- Routine screening for persons at high risk - see Groups at High Risk
- **Mantoux test** is standard skin test for M. tuberculosis
- Problems with Mantoux testing
  - Improper administration
  - Misinterpreted results
  - **Anergy**: diminished, absent delayed hypersensitivity

#### FALSE NEGATIVE PPD TESTING

- Inaccurate reading
- Age greater than 45 years
- AIDS
- Alcoholism
- Hematologic or lymphoreticular disease
- Intestinal bypass or gastrectomy
- Malnutrition
- Renal
- Sarcoidosis
- Systemic viral, bacterial, fungal Ix
- Zinc deficiency
- Live virus vaccines-MMR, polio

#### FALSE POSITIVE PPD TESTING

- Error in administering test
- Cross-reaction with non-TB mycobacterium
- Previous bacille Calmette-Guerin vaccine
- Booster phenomenon

#### PPD and Live Vaccines

- PPD not effected if administered simultaneously
- If vaccine given before PPD it may result in false negative for up to 2 months

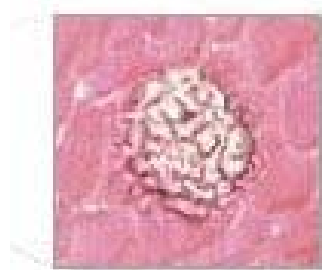
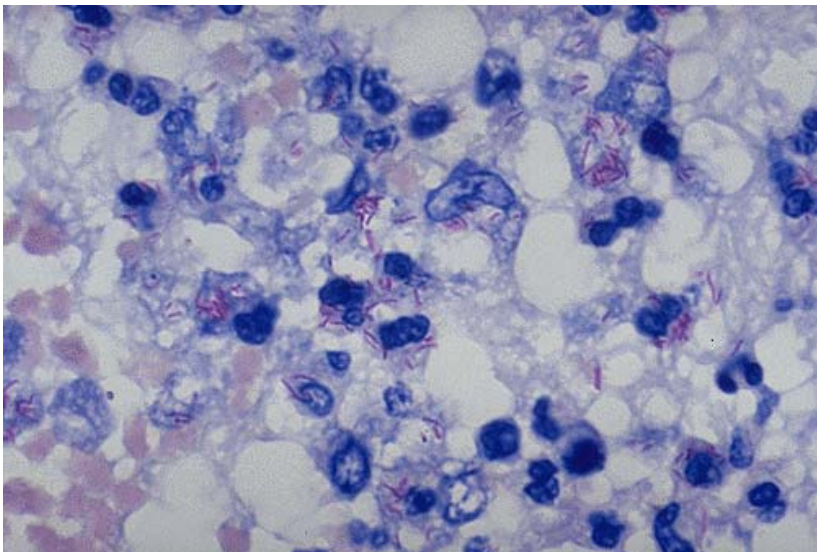
## DIAGNOSING TB

Classic signs and symptoms of pulmonary TB

- **Cough**
- **Fever, sweats, chills**
- **Anorexia and weight loss**
- **Malaise**
  
- Other indicators
  - Upper-zone disease on CXR
  - Fever, night sweats and weight loss
  - CD4 count of less than 200 cells/mm<sup>3</sup> in HIV infected patients
  
- Extra-pulmonary TB
  - Altered mental status (CNS involvement)
  - Back pain (spinal disease)
  - Abdominal pain (peritoneal disease)
  - Most common sites (descending order of frequency)  
Pleural, lymphatic, bone and joint disease, genitourinary tract, miliary disease, meningitis, peritonitis

## DIAGNOSTICS

- **PPD negative in 10-25% of patients with active TB**
- CXR when pulmonary TB is suspected
  - Atelectasis, parenchymal consolidation, lymphadenopathy, pleural effusion, miliary pattern
- **Sputum culture remains gold standard**
  - 81% sensitive; 98.5% specific for active disease
  - M tuberculosis may require 10-14 days to culture
  - Sensitivity may take 15-30 disease
  - Delays limit use of culture in making early treatment decisions
  
- Recent developed rapid sputum tests amplify and detect M tuberculosis
  - Ribosomal RNA or DNA may prove useful adjuncts
- Bronchoscopy considered for patients who cannot produce sputa



Left: mycobacterium \*  
Above: granuloma

\* Seen as red-stained rods

## OTHER CONSIDERATIONS

- Lobe involvement
  - Any lobe may be affected; lower lobe somewhat more common
  - Reactivation has predilection for upper-lobe
- Cavitation in 50% of patients
  - Extrapulmonary involvement common in HIV
  - Lower the CD4 (HIV) more likely TB findings
- Signs and symptoms may be minimal in children and infants until dissemination

### INTERPRETATION OF TB SKIN-TEST RESULTS

**I - 5 mm** - considered positive in persons who

- Have had recent close contact with persons with active TB
- Have or are suspected of having HIV infection
- Have fibrotic changes on CXR consistent with TB
- Have occupational exposure with inadequate precautions

**II - 10 mm** - Considered positive in all persons who do not meet the above criteria but who belong to one or more of the following risk groups

- Injecting drug users (seronegative for HIV)
- Persons with medical factors which increase risk for progression to active TB
- Residents and employees in high-risk congregate settings
- Immigrants from countries where TB is prevalent
- Some medically underserved, low-income populations
- Members of high-risk racial or ethnic minorities
- Children under age 4 yrs and children/adolescents exposed to adults at high risk
- Health care workers who have contact with high-risk patients

**III - 15 mm** Considered positive in anyone who does not meet the above criteria for I and II

**IV** - Recent tuberculin skin test conversion is defined as an increase in induration of 10 mm or more within a two-year period, regardless of age

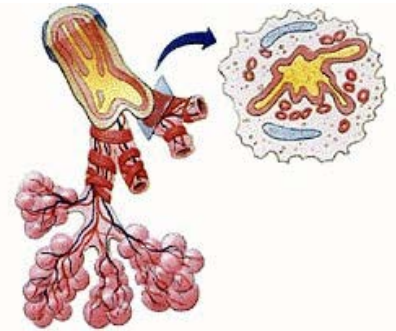
**V** - Health care workers, the recommendations in sections I, II, III generally should be followed. In facilities where TB patients frequently receive care, the optimal cut-off point for health care workers with no other risk factors may be an induration of 10 mm or greater

## OBSTRUCTIVE DISORDERS

### ASTHMA

DEFINITION: obstructive lung disease manifested by recurrent wheezing

- Obstruction secondary to **inflammation**, mucosal edema, mucous hypersensitivity and smooth muscle contraction
- Airways **hyperresponsive** which condition is exacerbated by inflammation

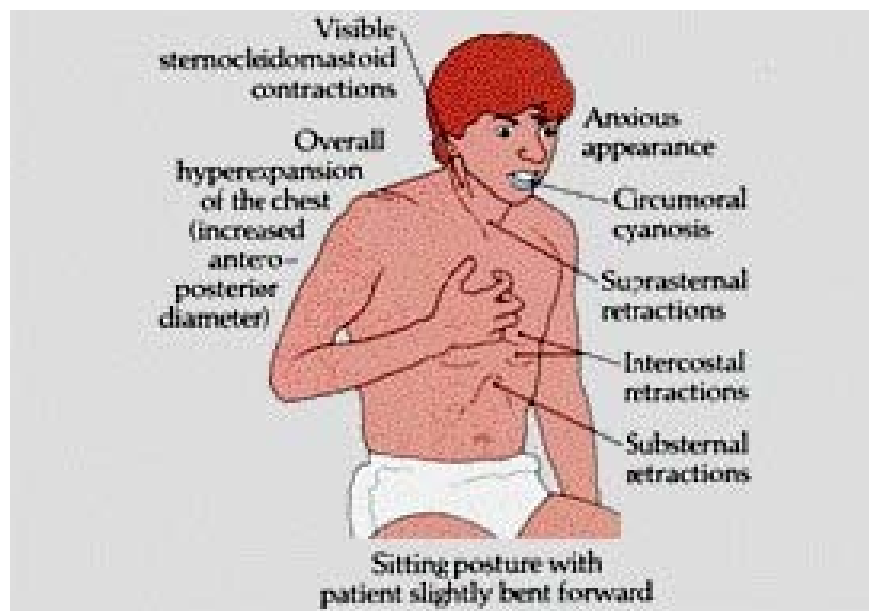


### KEY CONCEPTS

- Acute, reversible episodes of airway obstruction -> wheezing, dyspnea, hyperinflation and productive cough
- Bronchospasm, excessive mucus production, swelling of bronchial mucosa -> obstruction
- Severity variable as (f) degree of airway obstruction (severe hypoxia w extreme narrowing)
- Frequently involves allergic etiology mediated by IgE frequently involved
- Therapy directed at avoiding inflammation, acute attacks and further deterioration of airways

### CLINICAL PRESENTATION

- Dyspnea, chest tightness/pain, cough, decreased exercise tolerance
- **Wheezing**, prolonged expiratory phase, decreased intensity of breath sounds
- Tachypnea, tachycardia, use of accessory muscles
- Very commonly coexists with **allergies**: nasal polyps, eczema, rhinorrhea, PND, dermatitis



## DEFINITION

- Chronic, inflammatory disease of the airways
- The cellular players: T lymphocytes, mast cells, eosinophils, neutrophils and epithelial cells
- Effect on airways: **wheezing, dyspnea, chest tightness, cough**
- Symptoms worse at night and in am.
- Episodes coincide w reversible airflow obstruction
- Airway inflammation increases bronchial hyperresponsiveness to exogenous substances

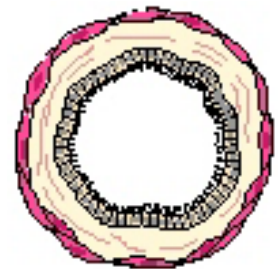


## GOALS

### 1997 GUIDELINES FOR DIAGNOSIS AND MANAGEMENT OF ASTHMA

Issued by National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH). - Updates the 1991 guidelines

- Prevention of chronic and troublesome asthma symptoms
- Maintenance of near-normal pulmonary function
- Maintenance of normal activity levels, including physical activity
- Prevention of asthma exacerbations requiring emergency department (ED) visits and hospitalizations
- Satisfaction of patients and family with asthma care
- Provision of optimal pharmacotherapy with minimal or no adverse reactions



## DIAGNOSIS: 3 components

- Demonstration of episodic symptoms of airflow obstruction
- Evidence: airflow obstruction at least partly reversible
- Exclusion of other conditions from the differential diagnosis



## CATEGORIES (replaces 1991: mild, moderate and severe)

### INTERMITTENT

- Symptoms no more than twice a week
- Nocturnal symptoms no more than twice a month
- Exacerbations are brief (few hours to few days);
- Normal between episodes
- Peak expiratory flow (PEF) is normal
- Forced expiratory volume in 1 second (FEV1) or PEF
  - at least 80% of predicted normal value
  - varies by less than 1 second

#### MILD PERSISTENT

- Symptoms more than twice per week but not every day
- Nocturnal symptoms more than twice per month
- Exacerbations curb pt's daily activities
- FEV1 or PEF is 80% predicted value
- PEF varies by 20-30%

#### MODERATE PERSISTENT

- Daily asthma symptoms are the rule
- Daily use of inhaled, short acting B2 agonist
- Asthma episodes
  - Disrupt pt's activities
  - Occur at least twice a week
  - Continue several days
- Nocturnal symptoms typically occur once per week
- FEV1 or PEF between 80% and 61% of predicted value
- PEF varies by more than 30%

#### SEVERE PERSISTENT

- Symptoms are continual and restrict physical activity
- Exacerbations are frequent
- Nocturnal symptoms frequent
- FEV1 or PEF is no more than 60% predicted value
- PEF varies by more than 30%



## CHRONIC OBSTRUCTIVE PULMONARY DISEASE

### EPIDEMIOLOGY:

- **COPD:** chronic bronchitis/emphysema major cause of total disability
- 2nd only to coronary artery disease.
- Incurable: goal is to preserve function/limit complications.

### TREATMENT OBJECTIVES

- Cessation of smoking
- Immunization against influenza and pneumococcal infection
- Control of bronchospasm and inflammation, mobilization of secretions
- Improvement of exercise tolerance
- Effective treatment of pneumonia and chronic hypoxemia.

### PATHOPHYSIOLOGY

- COPD is subset of obstructive pulmonary diseases: asthma, bronchiectasis, cystic fibrosis
- Characterized by slowing of expiratory flow rate.
- **Reduction in ratio of forced expiratory volume (FEV1) to forced vital capacity (FVC or VC).**
- Earliest manifestation is increase in small airway resistance.

### CLINICAL PRESENTATION

- S/S: any combo of cough, sputum production, wheezing and shortness of breath
- Most patients have mixed picture, although one pathophysiology predominates.

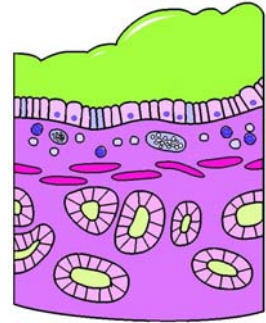
### **EMPHYSEMA** alveolar destruction

#### PATHOPHYSIOLOGY

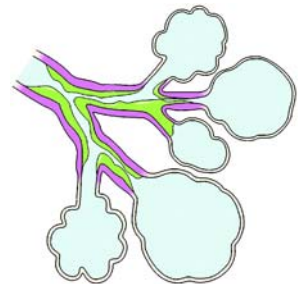
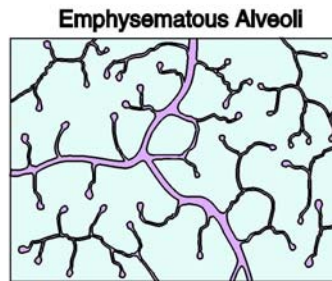
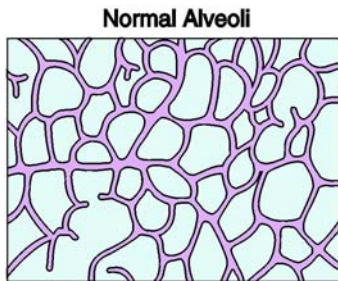
- Pathologic enlargement of airspaces distal to the terminal bronchioles due to destruction of the alveolar walls and its constituent components.
- Alveolar destructive process incompletely understood.
- Cigarette smoking increases the risk of COPD 30X
- Pathologic fragmentation of pulmonary elastic tissue leading to destruction of tissue structure
  - Alveolar architecture structure
  - Capillary bed structure
- Tissue structure destruction results in fall in expiratory flow rates
- Loss of lung's natural elastic recoil; poorly supported airways collapse during expiration
- Inspiratory flow rates are normal because airway caliber is normal.
- Pulmonary compliance increases with decline in elasticity
- Size of pulmonary capillary bed is reduced -> drop in carbon monoxide diffusing capacity
- Reduction in size of vascular bed parallels fall in alveolar surface
  - Ventilation still roughly matches perfusion
  - Significant hypoxemia does NOT ensue.

## CLINICAL PRESENTATION

- Dyspnea is major clinical sign, esp on exertion
- Cough is only a minor component
- Sputa production is scant.
- Patient with advanced disease is thin and tachypneic
- Use of accessory muscle and pursed lip breathing.
  
- Cyanosis is uncommon because PO<sub>2</sub> only minimally reduced.
- Neck veins distended on expiration only.
- Anterior-posterior diameter of chest is increased.
- Percussion note is hyperresonant.
- Breath sounds seem distant.
- No signs of cor pulmonale
- Little CO<sub>2</sub> retention until end stages
- CXR: hyperinflation and hyperlucency



Chronic Bronchitis



**CHRONIC BRONCHITIS:** hyperplasia of mucus glands and narrowing of small airways

### Predominant Pathologic Features

- Inflammation of cells lining the bronchial walls in conjunction
- Hyperplasia of the mucous glands and narrowing of small airways.
  
- Etiology uncertain: chronic infections and airway hyperreactivity important role
- Smoking is major precipitant
- Also prolonged exposure to air pollution and bronchial irritants
- Even withdrawal of irritants, inflammatory process often continues unabated.
- Obstruction to airflow occurs with inspiration as well as with expiration.
  
- Hypoxemia from mismatching ventilation due to widespread narrowing and mucous plugging
- Hypercarbia results from impeded ventilation.

Clubbing

- May lead to pulmonary hypertension and eventually cor pulmonale
- Less parenchymal damage as compared to emphysema
- Not effected: diffusing capacity, lung volumes and compliance.
- Typically colonized w H. influenzae and S. pneumoniae
- Little difference in outcome with prophylactic antibiotic therapy
- Typical patient: smoker who presents w history of chronic, productive cough.

**By definition cough must be present for at least 3 months each year during two consecutive years.**

- At first cough just in winter months but soon year round symptom w frequent exacerbations
- Dyspnea on exertion (DOE): disease well advanced.
- Orthopnea
  - May be manifestation of CHF or secondary to cough/sputa
  - Relieved by expectorating sputa

**Cor pulmonale** and right heart failure may ensue if chronic hypoxemia and pulmonary hypertension.

Distended neck veins, right ventricular heave, right ventricular gallop, peripheral edema.

- Typical patient:
  - Male in 50's, plethoric and cyanotic at end stage
  - Tobacco stains on fingers and teeth common
  - S/S cor pulmonale
- Lungs sound noisy: crackles, wheezes; prolonged expiratory phase.
- Hypoxemia w blood gases. PCO<sub>2</sub> rises as patient's ability to move air effectively declines
- Secondary polycythemia is common
- CXR shows increased bronchovascular markings.

CLINICAL COURSE: generally progressive., although some may reach a plateau if stop smoking

- Presymptomatic stage of small airway disease may be reversible
- Decrease in maximum midexpiratory flow rate; increase in closing volume
- FEV 1 (forced expiratory volume at 1 second) used as measure of obstruction
- Rate of decline can be halted if patient stops smoking
- **Cessation of smoking is critical to improving chances of survival.**

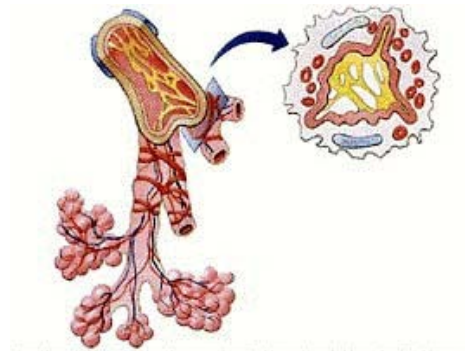
DIAGNOSIS:

History

Physical Exam:

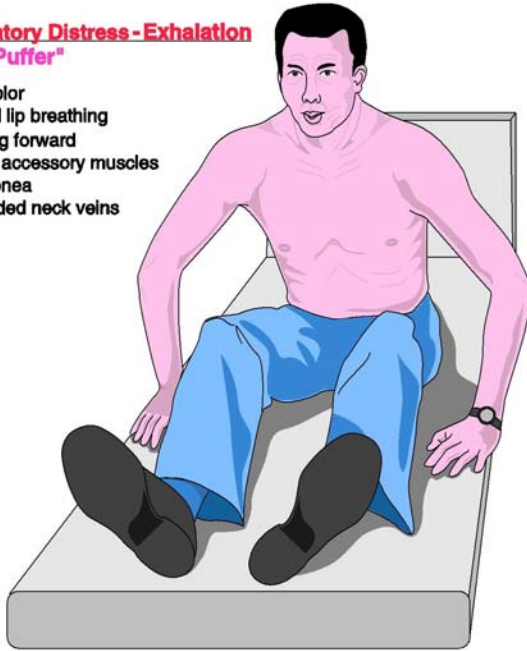
Diagnostics: PFT, CXR, ABG, Hgb/Hct, EKG, sputa exam .

Mucus secretion in bronchioles



**Respiratory Distress - Exhalation**  
**"Pink Puffer"**

- Pink color
- Pursed lip breathing
- Leaning forward
- Use of accessory muscles
- Tachypnea
- Distended neck veins



**Respiratory Distress - Inhalation**  
**"Blue Bloater"**

- Cyanotic
- Sweating
- Leaning forward
- Use of accessory muscles
- Tachypnea
- Distended neck veins

