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Respiratory System

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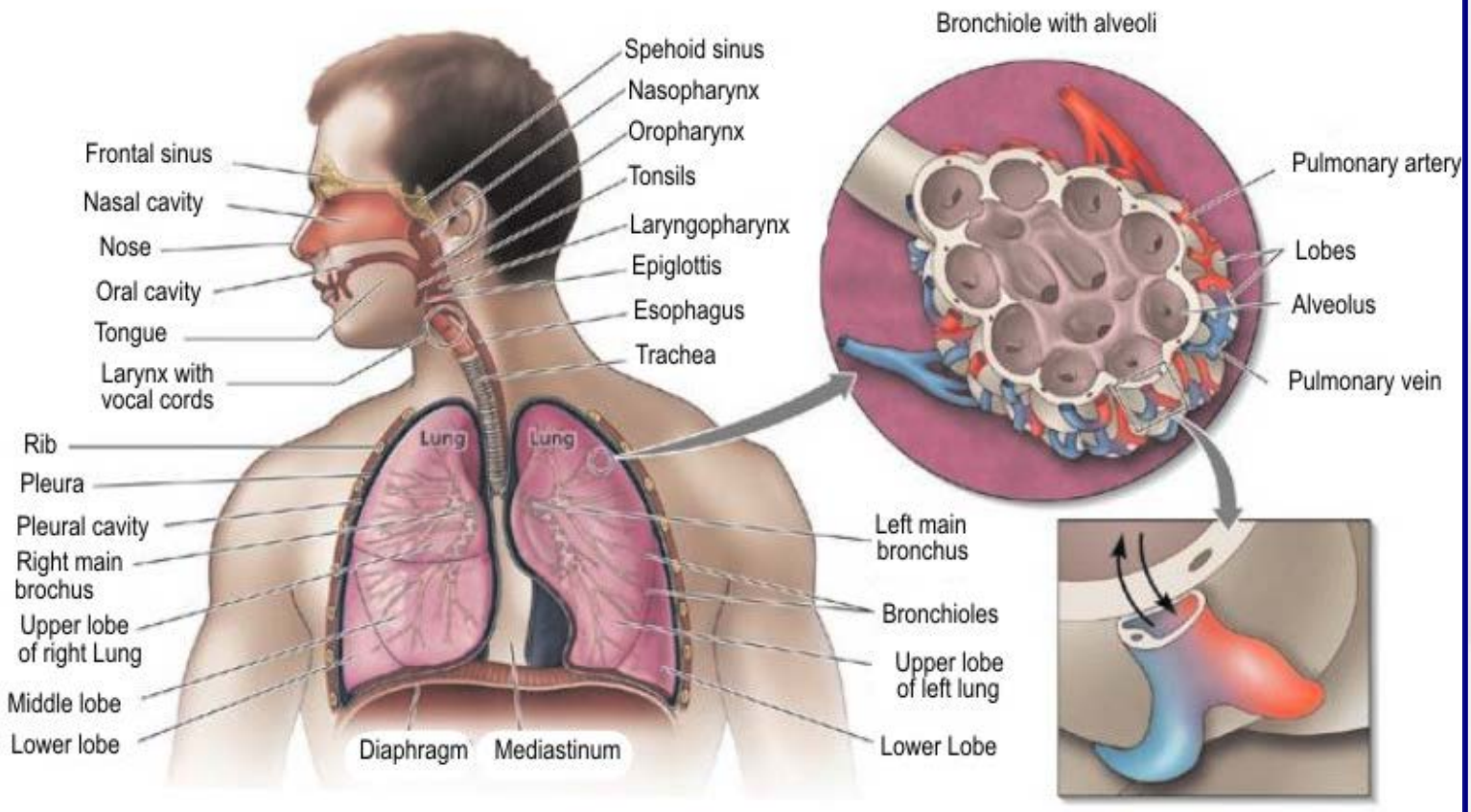
Respiratory System



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Respiratory System

Easiest way to discuss structure of the Respiratory System is to follow a particle of air through it.

Take a Deep Breath

I

Air drawn in the Nose encounters Mucous Membranes

I

Air enters the Pharynx,

I

then Larynx,

I

then Trachea

I

and then Bronchi

Bronchi

Asymmetrical with right bronchus being bigger, wider and straighter. **Right bronchus leads to three lobes**; **Left bronchus is smaller and curves into two lobes**. (If a foreign object is inhales it almost always follows the path of least resistance to the right side.)

Alveoli

Next section of tubing is bronchioles which subdivide 23 times to end in microscopic **alveoli: grape shaped clusters** are like tiny balloons surrounded by blood capillaries. Gaseous exchange occurs between alveoli and capillaries.

Lobes

Have separate segments called **lobules** lined with mucous membrane which traps pathogens and other particles.

Smooth tissue lines all of the tubes

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Function

Air cycles through the lungs 12-20 times per minutes.

Fresh air contains about 21% oxygen

_____

Exhaled air contains about 16% oxygen

_____

Enough surface area in lungs that only 5% of resting energy is needed to supply the whole body with adequate oxygen

Lungs have no muscle tissue to make them fill up or empty; they are limp-walled sacs. They are stretched by pulling on thorax walls and snap back to original shape on exhale.

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Infectious Respiratory System Conditions

Acute Bronchitis

Common cold

Influenza

Pneumonia

Sinusitis

Tuberculosis

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Acute Bronchitis

Self-limiting inflammation of bronchial tree; Usually a complication of cold or flu; Distinguished from chronic bronchitis

Demographics

12 million cases/year

3 million doctor visits

Smokers, workers in polluted environments at risk ; Also, elderly, heart problems, immunosuppressed

Etiology

Irritated bronchi get inflamed: tubes swell, cilia are damaged, mucus produced

Leads to coughing, wheezing

Most are complications of cold or flu:

Virus can attack bronchial mucosa or bacteria can take advantage of a good growth medium

Self-limiting: lasts about 10 days, then heals (*not* chronic bronchitis)

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more Acute Bronchitis

Signs and Symptoms	Diagnosis	Treatment	Massage
Persistent cough Starts dry, becomes productive Wheezing, congestion, headache, fever, muscle aches, chest pain, fatigue If fever goes over 101ºF (38.3ºC) or if mucus becomes thick and opaque, pneumonia is possible	Usually clear Can look like sinusitis, pneumonia, asthma	Rest, fluids, warm humid air Antibiotics only if identified as bacterial infection Bronchodilators/cough suppressants may suppress symptoms; don't speed healing	Circulatory massage contraindicated for acute infection May be appropriate during recovery

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Common Cold

200 viruses that attack upper respiratory system ; Also called upper respiratory tract infection (URTI)

Demographics

An estimated 1 billion infections/year in the United States

Children most at risk: 6–10/year

Adults: 2–4/year

Elderly: <2/year

Etiology

Rhinoviruses (110 subtypes)

Coronaviruses

Adenoviruses

Respiratory syncytial viruses

Viruses enter nose: good growth medium

Access cells in lymphoid tissue of adenoids

Incubation is short: 12 hours

Immune system attacks infected cells; causes most symptoms

Does *being* cold *cause* cold? Maybe

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more Common Cold

Signs and Symptoms	Prevention	Treatment	Massage
Runny nose, sneezing, sore throat, dry coughing, headache, mild fever Less than 2 weeks Bacterial infections of ear, larynx, sinuses May go to lungs: bronchitis, pneumonia Especially if lungs are compromised, e.g., chronic obstructive pulmonary disease (COPD)	Virus can be airborne or picked up by hand from contaminated surfaces Prevent spread by washing hands, disposing of tissues, staying home when sick	No antibiotics! Rest, fluids, humidifier Over-the-counter (OTC) drugs can reduce symptoms, may *increase* communicability Vitamin C, Echinacea, lysine, zinc, licorice root, hydrotherapy	Safest after symptoms have peaked May be more severe if massage occurs early in infection May exacerbate symptoms for a day or so if massage occurs during healing—get permission!

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Influenza

Viral infection of respiratory tract: different from viruses that cause colds

Etiology

Virus gains access (airborne or via hands)

Invade mucus-producing cells in respiratory tract

Immune system kills infected cells, making most symptoms

Incubation 2–3 days; communicable before symptoms appear

Peak of communicability about day 4; continues through recovery

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Type A: most virulent, associated with epidemics, pandemics

Type B, C: stable, less severe

Type A infects other animals (birds, pigs, etc); mutates easily

Demographics

5–20% population has flu 1/year

- Children more at risk than adults

For young, elderly, immunocompromised, can be dangerous

- 200,000 hospitalizations
- 36,000 deaths/year

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more Influenza

Signs and Symptoms	Complications	Treatment	Massage
Looks like a bad cold Respiratory irritation, high fever 3 or more days Muscle, joint pain May last 2 weeks No such thing as stomach flu	Acute bronchitis, pneumonia	No antibiotics Rest, liquids OTC drugs may control symptoms, don't shorten duration Antiviral medications Amantadine, rimantadine, Tamiflu, Relenza Flu vaccine: made several months ahead to predict active virus; must be updated yearly	Circulatory work is contraindicated while acute May exacerbate symptoms during recovery: ask permission! May be contagious during recovery

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Pneumonia

Inflammation of the lungs, usually due to an infectious agent

Demographics

Opportunistic infection: takes advantage of weak immune system

- Combines with flu to be number 7 cause of death in the United States
- 3 million to 5 million cases/year, 500,000+ hospitalizations, 60,000 deaths

Etiology

Alveoli fill with pus, mucus, other fluid

Diffusion of gases is impossible; person drowns

May affect pleura: pleurisy is scarring of pleural layers

Infection of pleural fluid: **empyema**

Causes

May be more than one at a time

Viruses

- About half of cases
- Flu, syncytial viruses most common
- Short-lived, not serious for most

Bacteria

- Staphylococci or streptococci get from throat to lungs; toxins initiate inflammatory response
- Could also be tuberculosis, legionella
- Edema in alveoli
- Responsive to antibiotics

Mycoplasma

- Smallest living infectious agents
- Tiny bacteria: responsive to antibiotics
- Walking pneumonia

Fungi

- Several species are endemic to certain areas
- PCP: Pneumocystis carinii pneumonia in immunosuppressed people

Forms of pneumonia

Primary pneumonia: rare attack directly on lungs

Secondary pneumonia: more common, complication of other problems; may be classified by location

Bronchopneumonia: patchy pattern all over the lungs

Lobar pneumonia: Restricted to one lobe; may spread to whole lung

Double pneumonia: affects both lungs

Source of the infectious agent

Community acquired pneumonia

Nosocomial, or hospital-acquired, pneumonia

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more Pneumonia

Signs and Symptoms	Diagnosis	Treatment	Massage
Vary with agent, virulence, health of patient Coughing, high fever, chills, sweating, delirium, chest pain, cyanosis, thick sputum, shortness of breath, muscle aches, pleurisy Sudden or gradual onset; looks like flu but gets progressively worse	Clinical examination and description of symptoms Viral, bacterial often have fast onset Mycobacterium has slower onset, less severe symptoms Radiography, computed tomography (CT), arterial blood gas study	Depends on type Antibiotics for bacteria, mycoplasma Humidifier, fluids, rest, oxygen Surgery to drain pleural space if necessary **Prevention** Flu vaccine Pneumovax for pneumococcus **Prognosis** Usually reversible if treated Untreated: 30% mortality rate; may complicate to meningitis, respiratory failure, blood poisoning Fibrosis, scar tissue may accumulate Raises risk of future infections	Contraindicated for circulatory massage while acute Post acute stage can benefit from percussive massage on back, chest

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Sinusitis

Inflammation of mucous membranes in nose, sinuses ; Can be from infection or allergies

Demographics

37 million infections/year in the United States

Etiology

Cilia in sinuses break down in response to infection, pollutants

Causes

Noninfectious sinusitis: allergic rhinitis: sinuses are inflamed without infection; may increase risk of infection

Infectious sinusitis:

Acute (complication of viral infection, lasts 6–8 weeks)

Chronic (less severe, longer-lasting symptoms)

Infectious agents

Viruses and bacteria: cold, flu, Streptococcus pneumoniae, Haemophilus influenzae, bacteria freed by dental work

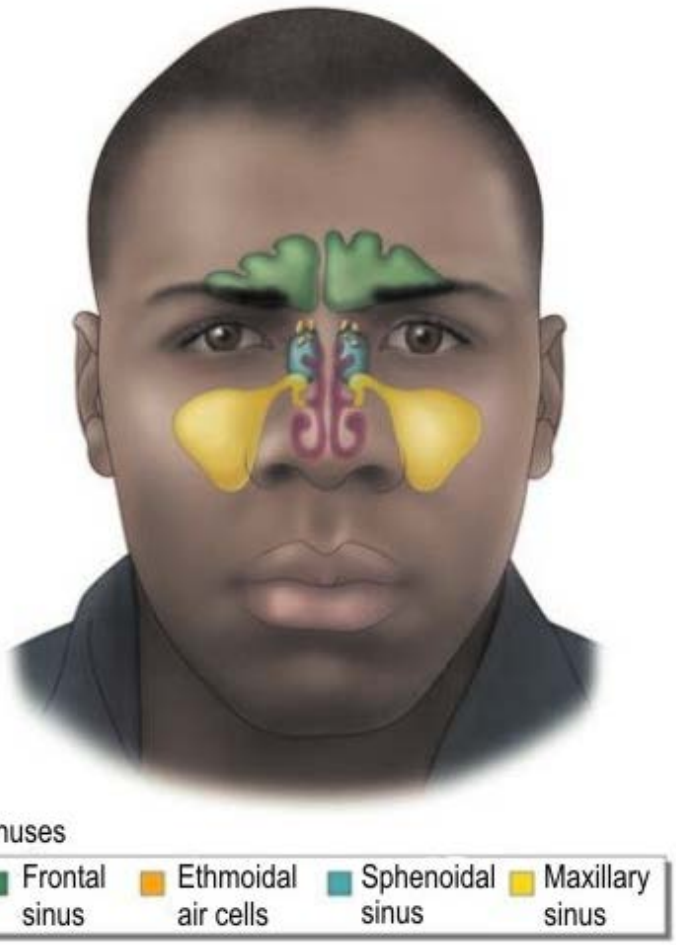
Fungi and bacteria: Colonies of fungi may create growth medium for bacteria as well

Other causes of infectious sinusitis

Structural problems: Deviated septum, nasal polyps

Environmental irritants: cigarette smoke, indoor and outdoor pollutants, cocaine, other irritants

Other conditions: severe cavities, asthma



more Sinusitis

Signs and Symptoms	Treatment	Massage
Depends on cause Severe headache, worse with bending over Local pain, edema Fever, chills with acute infection Sore throat, coughing (postnasal drip) Mucus clear with allergies; streaked or opaque with infection	Humid air, fluids, saline wash of sinuses Drugs: antibiotics for bacterial infection; short-term decongestants; steroid spray Surgery to correct structural anomalies	Indicated for allergies if client is comfortable on table (may require some adjustment in position or duration) Circulatory massage is contraindicated for acute, untreated infection

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Tuberculosis

Tubercle = *bump* ; TB is a bacterial infection leading to pus-filled bumps in lungs and other areas

Etiology

Airborne bacterium: *Mycobacterium tuberculosis*

Spore gives it environmental resistance

Usually takes prolonged, repeated exposure to spread; can go more quickly

Progression

Two phases

Primary phase

Inhaled bacteria travel to alveoli, engulfed by macrophages (doesn't work)

Set up small colony

Body builds protective wall around them: tubercle

This is exposure—not active disease; stays stable for 90%

Secondary phase

Bacteria escape capsule and spread through lung to other tissues

Scarring, pleurisy

Happens to about 10% of infected, usually within first year

Inside large capsules tissue is infected, dead

Risk Factors

Long-term exposure to a person with active disease

Travelers to areas with high infection rates

Most likely to → active infection if poor, unhealthy, drug user, alcoholic, HIV+

HIV and tuberculosis

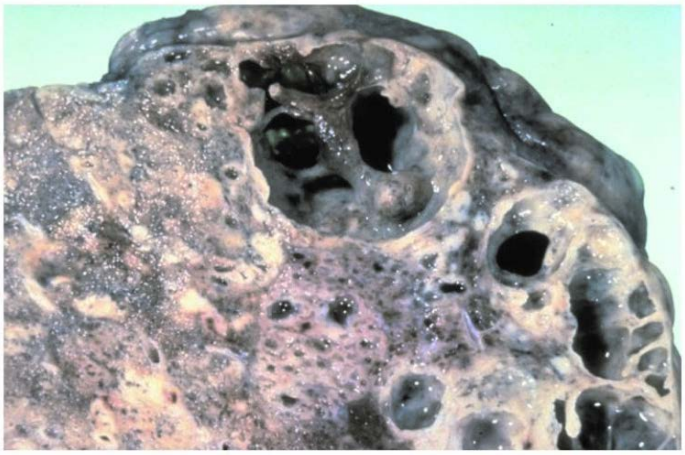
Demographics

Worldwide:

- 2 billion people exposed
- 8 million new infections/year
- 9 million develop infection in active form
- 2 million to 3 million deaths/year: >AIDS + malaria + all tropical diseases combined

United States

- 10 million to 15 million exposed
- 14,000 in active form
- Mostly in poor, indigent, limited access to health care



Coinfection with HIV and TB increases risk of TB becoming active

HIV+ can interfere with accurate diagnosis

Worldwide one-third who are HIV+ are also TB+

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more Tuberculosis

Signs and Symptoms	Diagnosis	Treatment	Massage
Primary phase: may be silent or look like mild flu Active phase: fever, sweating, weight loss, exhaustion, chest pain, shortness of breath Cough with phlegm that may become bloody Other organs: bone pain, hematuria, CNS symptoms	Within weeks of exposure a skin test is positive Coinfection with HIV can alter test Vaccination with bacille Calmette-Guérin (BCG) can alter test Harder to catch active infection: looks like cold, flu, pneumonia, fungal infections of lungs	Previously: sanatoria Now: antibiotics (INH = isoniazid) 6–12 months, several side effects, especially with alcohol Low compliance leads to drug-resistant TB **Drug-Resistant TB** MDR-TB $250,000 to treat; 18–24 months of medications; same mortality as untreated regular TB; spreads as MDR-TB Worldwide: 1% have MDR-TB; 47 states and DC in the United States XDR-TB Virtually no treatment works 74 deaths in the United States since 1993 Most common in the former Soviet Union, Asia, in HIV+ in South Africa	Safe if infection is latent 2 weeks of antibiotic treatment cuts communicability risk to near 0 Contraindicated with active infection

Chronic Obstructive Pulmonary Diseases

Asthma

Chronic bronchitis

Emphysema

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Asthma

Sympathetic/parasympathetic swing in bronchioles ; Triggered by irritant, stress ; Sometimes classified as COPD; doesn't usually cause irreversible lung damage

Demographics

20 million in United States; 9 million < 18 years old

12.7 million doctor visits; 2 million emergency department visits, 5,000 deaths/year

Statistics continue to climb; up 160% between 1980-1994

Highest among African Americans

Etiology

Hyperreactive bronchioles

- Chronic inflammation, waiting for trigger
- Dilation (sympathetic) followed by constriction (parasympathetic)
- Membranes swell, secrete excessive mucus

Breathing, especially exhalation, becomes labored

Triggers: pet allergens, cockroach waste, cigarette smoke, dust mites, viral infections, breathing cold dry air, exercise

Mild, intermittent asthma

Episodes < twice/week; little impact on activity

Mild, persistent asthma

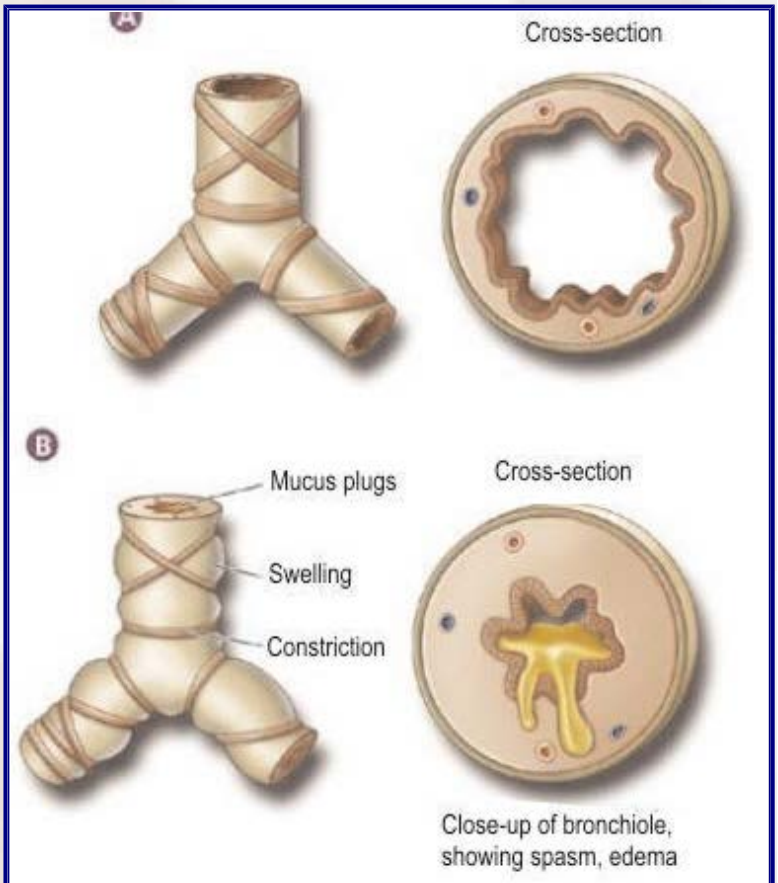
>Once/week; up to 1/day; impacts activity

Moderate, persistent asthma

At least 1/day, plus nighttime episodes 1+/week

Severe, persistent asthma

Episodes most days and nights; activity severely limited



more Asthma

Signs and Symptoms	Diagnosis	Treatment	Massage
Dyspnea, wheezing, coughing Hardest to expel air Bronchial asthma: tight bronchioles with excess mucus Exercise induced: with exertion Silent: no transition, just sudden shortness of breath Cough variant: coughing is only symptom During episode: panic symptoms, cyanosis	Rule out other lung disorders Spirometry	Manage exposure to stimuli Recognize warning signs of attack Short term: beta-agonist inhalers Long term: inhaled or oral steroids Allergy shots	Contraindicated during episode; otherwise can be helpful for breathing efficiency Be careful about triggers in massage setting: essential oils, hyperallergenic oil, perfume, etc.

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Chronic Bronchitis

Part of COPD ; Long-term irritation of the bronchi and bronchioles, with or without infection ; Progressive and irreversible ; Precursor to emphysema

Demographics

9 million people in the United States

- Men > women
- Whites > other groups

Leading risk factor is smoking

- Others: occupational irritants, air pollution, history of respiratory infections

Etiology

Long-term irritation to bronchial tubes

- Inflammation: destruction of cilia, elastin and overgrowth of mucus-producing cells

Increased resistance to air movement in lungs

Damage becomes permanent

With increasing resistance

Heart works harder

Red blood cell production increases (blood becomes thicker)

Acidosis → vasoconstriction in pulmonary arteries

Right-sided heart failure, edema in extremities

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more Chronic Bronchitis

Signs and Symptoms	Diagnosis	Treatment	Massage
Slow onset Cough follows respiratory infection, lingers Produces thick, clear sputum for weeks to 3 months Repeats several times within 2 years Frequent throat clearing Shortness of breath gets worse Vulnerable to respiratory infections, pneumonia Cyanosis **Complications** High risk of infection, heart failure	Patient history, examination, pulmonary function tests Chest radiography, CT to rule out other damage	Aggressively treat infections Vaccinate for flu, pneumococcus Limit progression of damage, quit smoking, avoid polluted air Bronchodilators with anti-inflammatories for best function	May be indicated if circulatory system is strong Clients in advanced stage may not tolerate laying flat, strong challenges to circulatory system Adjust for positioning

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Emphysema

Part of COPD ; Blown up, inflated

Etiology

Normal exhalation is passive: elastin in alveoli and bronchioles pulls lungs back to neutral

300 million alveoli in lungs, each with capillary bed for gaseous exchange, coated with alpha-1 antitrypsin (AAT)

With chronic exposure to irritants

- AAT doesn't work to protect alveoli
- Elastin degenerates; lungs don't rebound
- Alveoli fuse into bullae
- Reduces surface area for gas exchange
- More effort to breathe, to exhale
- Respiration rate slows → acidosis, high carbon dioxide, spasm of pulmonary arteries
- Right-sided heart failure: can't pump adequate blood through resistant pulmonary circuit
- Respiratory/circulatory collapse

Demographics

3.6 million people in the United States

- Most have smoked 20/day, 20 years+

Other irritants: coal dust, quarries, grain dust, etc.

- <5% have genetic problem: lacking alpha-1 antitrypsin

Other Respiratory Disorders

Cystic Fibrosis

Lung Cancer

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Cystic Fibrosis

Autosomal recessive genetic disorder ; Causes production of thick, viscous exocrine secretions ; Respiratory tract and digestive, integumentary, reproductive system

Demographics

CF is the most common lethal inherited disease of whites

- 1:3,000 births in the United States
- 12 million may have gene (many don't know)
- 30,000 people in the United States have CF

Life expectancy is improving: patients who make it through childhood make it to about 35

- 40% of patients > 18 years

Etiology

Genetic mutations → transmembrane conductance regulator gene (CFTR) is altered so that cell membranes can't conduct chloride

Leads to thick, sticky secretions

Respiratory system:

Mucus is thick, gluey, difficult to dislodge

Growth medium for infections; chronic inflammation

Also, growth of nasal polyps, chronic rhinitis

Digestive system

Gastrointestinal (GI) tract and accessory organs

Babies may be born with intestinal obstruction: intestines don't move well

Poor absorption → failure to thrive

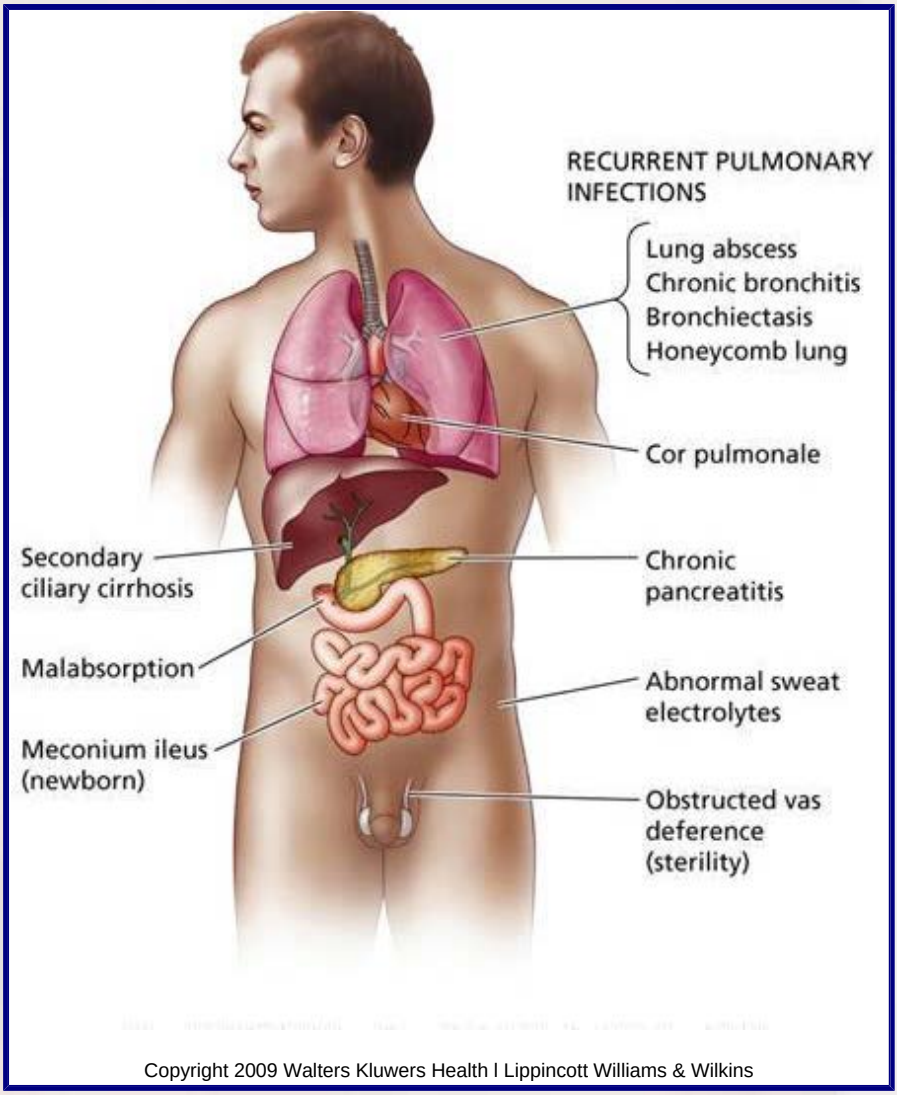
Abnormal production of bile → splenomegaly, gallstones, portal hypertension

Abnormal pancreatic secretions → pancreatitis, peptic ulcers

Integumentary system

Thick, salty sweat

Risk of heat stroke, salt depletion



Reproductive system

Men usually sterile: epididymis can't secrete normally or incomplete vas deferens

Women usually have normal repro tract, successful pregnancies

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more Cystic Fibrosis

Signs and Symptoms	Diagnosis	Treatment	Massage
Vary, depending on system Respiratory symptoms are most common: dry or productive cough, dyspnea, wheezing, chest pain, cyanosis, clubbing of fingers	Skin test to analyze for abnormal sweat Look for defect in CFTR gene Look for changes in upper respiratory tract **Complications** Related to the exocrine gland dysfunction of the affected system (Chronic intractable bacterial infection; bronchiectasis, resistance in the pulmonary circuit, pnuemothorax, risk of right-sided heart failure Cirrhosis, gallstones, duodenal ulcers, intestinal obstruction with or without rectal prolapse, risk of pancreatitis or diabetes from a damaged pancreas, and vitamin and mineral deficiencies from poor absorption Heat stroke, salt depletion Sterility in men	Minimize symptoms, complications Break up congestion in lungs, breathing exercises Supplement enzymes, vitamins Bronchodilators, mucolytics, antibiotics to fight infection, anti-inflammatories Surgery: lung transplant	Guided by health, resilience of client Therapy on lungs can include massage

Lung Cancer

Growth of malignant cells in the lungs

Demographics

180,000 new diagnoses/year

160,000 deaths/year

Number 1 cause of death by cancer (more deaths from breast and colorectal and prostate cancers)

Etiology

85–90% related to tobacco exposure

Other factors: radon, asbestos, uranium, arsenic, air pollution, other carcinogens

Orderly pattern of death and repair in epithelial cells of lungs is disrupted

Abnormal cells accumulate in patches

Lots of circulatory and lymph vessels allow cells to travel before a significant tumor forms

- Mediastinal lymph nodes, liver, bone, skin, adrenal glands, brain

Types of lung cancer

Small cell lung cancer (SCLC):

- Also called oat cell carcinoma
- 15–25% of all lung cancers
- Grows fast, spreads quickly, usually inoperable

Non–small cell lung cancer

- 75–85% of all lung cancers
- Includes squamous cell carcinoma, adenocarcinoma, large cell carcinoma, others (Fig. 7.7)
- Grow more slowly than SCLC, still hard to detect early

Other types of lung malignancies

- Carcinoid tumors, adenoid cystic carcinoma, sarcomas, mesothelioma

Risk Factors

Smoking

Exposure to asbestos, coal miners, toxic chemicals

15,000 deaths/year in people who never smoked

Exposure to other cigarette smoke, genetic predisposition

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more Lung Cancer

Signs and Symptoms	Diagnosis	Treatment	Massage
No early signs Smoker's cough, bloodstained phlegm, chest pain, wheezing, and possibly shortness of breath Tumor may put pressure on other structures: brachial plexus, vena cava esophagus, larynx, phrenic nerve	Radiography, CT, MRI Sputum analysis is inconsistent No accurate, noninvasive early detection methods Usually metastasizes before detection	Surgery, radiation, chemotherapy Photodynamic therapy may become practical; other biological therapies in development	Useful to deal with challenges of cancer treatment; respect limitations of client and risks associated with treatment protocols

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