RESTRICTIVE vs. obstructive

lung disease

GENERAL PATHOLOGICAL CHARACTERISTICS

- lung expansion is restricted
- primarily due to decreased lung or chest wall compliance or muscular dysfunction
- primarily affects deep **inspiration**
- difficulty getting air **in**

- increased airway obstruction/resistance
- increased work of breathing
  ↳ hyperventilation
- decreased **expiratory** flow
- difficulty getting air **out**

CLINICAL MANIFESTATIONS

- decreased lung volumes/capacities
- dyspnea
- tachypnea
- increased work of breathing → fatigue
- impaired gas exchange

- hyperinflated lungs & flattened diaphragm
- dyspnea on exertion
- wheezing
- increased work of breathing → paradoxical
- chronic cough & expectoration of mucus

VOLUMES, CAPACITIES, & SPIROMETRY

- ↓ IRV, TV, ERV
- ↓ VC, RV
- ↓ TLC
- ↓ FEV_1
- ↓ FVC
- ↑ FEV_1/FVC (%)

I:E ratio → 1:1

- ↓ ERV, VC
- ↑ TV, RV
- ↑ TLC
- ↓ FEV_1
- ↓ FVC
- ↓ FEV_1/FVC (%)

I:E ratio → 1:3 or 1:4

CAUSES

PULMONARY

- interstitial pulmonary fibrosis
- pneumonia
- TB
- Tumors
- Atelectasis
- Pleural effusion
- Pneumothorax
- Pulmonary emboli
- Pulmonary edema
- acute respiratory distress syndrome

EXTRAPULMONARY

- chest wall trauma/surgery
- NM disorders
- pectus carinatum
- scoliosis
- ankylosing spondylosis
- diaphragmatic paralysis
- obesity

- inflammation of airway
- airway thickening over time
- increased mucus
- constriction of the bronchiole walls (bronchospasms)

Study with an SPT

PATHOLOGIES

INTERSTITIAL PULMONARY FIBROSIS
- affects alveoli, capillaries, & connective tissue
- may be idiopathic, viral, genetic, or immune system related
- **pathology:** chronic inflammation injuries tissue → normal tissue is now fibrous → the spaces in alveoli are thickening → loss of space in alveoli
- **symptoms:** fatigue, dyspnea on exertion, tachypnea, cough
- **signs:** impaired PFT's & blood gases (hypoxemia)
- dx with CT scans, chest x-rays, lung biopsy
- **treatment:**
  - ↳ meds → O_2, glucocorticosteroids, anti-inflammatories
  - ↳ mechanical ventilation
  - ↳ lung transplant
  - ↳ physical therapy: want to decrease the progression
    - breathing techniques
    - OOB mobilization
    - walking program w/ O_2
    - strength training
    - inspiratory muscle training

ATELECTASIS
- alveolar collapse causes lung to collapse
- **causes:** airway obstruction, restrictive conditions
- **kinds:** compression, contraction, resorption
- **treatment:**
  - ↳ OOB mobilization
  - ↳ incentive spirometry (often)
  - ↳ splinted coughing
  - ↳ breathing techniques

PNEUMONIA
- inflammatory process of lung parenchyma
- **causes:** bacteria, virus, fungus, aspiration
- **pathology:** usually localized in a segment/lobe
  - ↳ alveolar edema & congestion
  - ↳ alveolar consolidation (from inflammation & mucus)
  - ↳ decreased lung compliance
- **signs & symptoms:** dyspnea, cough, pleuritic chest pain, fever, hypoxemia
- **treatment:** meds, incentive spirometry, early mobilization, airway clearance & breathing techniques

CHRONIC BRONCHITIS (COPD)
- productive cough condition that lasts ≥3 months for at least 2 consecutive years
- **causes:** (response to chronic irritation) smoking, pollution, occupational exposure
- **signs & symptoms:** productive cough, exertional dyspnea, barrel-shaped chest, wheezes, LE edema, blue bloaters, cor pulmonale, prone to pulmonary infections, ↑ symptoms with irritants (cold / damp weather, etc.)
- **pathology:** hypertrophy of mucus glands → ↑ mucus secretion → mucosal edema → bronchospasm & air trapping → cilia unable to clear secretions → chronic infections

EMPHYSEMA (COPD)
- enlargement & destruction of alveoli
- **causes:** disruption of elastic fiber network of lungs
  - ↳ 95% from chronic bronchitis, smoking, or air pollutants
  - ↳ 5% from genetic disorder (α-1 anti-trypsin)
- **types:** * defined by anatomical location
  - ↳ **centrilobular emphysema:** inflammation causes destruction in the terminal bronchioles
    - most common type
    - alveolar sac intact but enlarged
  - ↳ **panlobular emphysema:** destroys air spaces of entire alveoli
    - bronchioles might be okay / not as inflamed
  - ↳ **paraseptal emphysema:** destroys alveoli along lung periphery
    - can cause spontaneous pneumothorax
    - around alveoli, NOT inside
- **signs & symptoms:** progressive & exertional dyspnea, cough (variable productiveness), barrel-shaped chest, hypertrophied accessory muscles, purse-lipped breathing, ↓ FEV, & ↑ TLC, pink puffers, thin, cachetic, ↑ symptoms w/ acute respiratory infection, digital clubbing, postures that stabilize UE's.

ASTHMA
- airway hyper-reactivity to various external/internal stimuli
- recurrent episodes of intermittent, reversible airway obstruction

PNEUMOTHORAX

- accumulation of air/gas in pleural space
  - ↳ can lead to atelectasis (but atelectasis CAN'T cause a pneumothorax)
- **causes:** defect in visceral/parietal pleura (see types)
- causes the affected lung to collapse
- **types:**
  - ↳ **primary spontaneous:** no underlying cause
    - usually young, tall, thin men
  - ↳ **secondary spontaneous:** due to COPD, blebs, or bullae
    - most common type
  - ↳ **traumatic:** due to central line (iatrogenic), gun shot, knife wound, rib fracture
  - ↳ **tension:** air enters pleural space but can't escape
    - medical emergency
- **signs & symptoms:** acute dyspnea, pleuritic pain, hypoxemia, absent/diminished breath sounds, hyper-resonant breath sounds, tracheal deviation
- **treatment:** O_2, chest tube drainage, incentive spirometry

PULMONARY EDEMA

- pulmonary congestion that restricts airflow
- **causes:** L-sided heart failure, ARD's, high altitude sickness
- **signs & symptoms:** severe dyspnea, anxiety, tachypnea, crackles, coughing, hypoxemia
- **treatment:** diuretics, oxygen, upright positioning

PULMONARY EMBOLUS

- embolus causing occlusion of blood flow through the pulmonary A
- **causes:** R side of the heart, DVT, non-thrombotic material
- **characteristics:** ↓ pulmonary blood flow, ↑ pulmonary vascular resistance
- **signs & symptoms:** rapid onset dyspnea, pleuritic chest pain, anxiety, restlessness, apprehension, tachypnea, hypoxemia, ↓ PFT's
- **diagnostic tests:** V/Q scan, pulmonary angiography, D-dimer blood test (most common)
- **treatments:** prevention of DVT's, meds, surgery

ACUTE RESPIRATORY DISTRESS SYNDROME

- acute/rapid onset of respiratory failure
- **causes:** acute extensive lung inflammation (trauma, sepsis, drug overdose, blood transfusions, pneumonia)
- **characteristics:** hypoxemia, pulmonary edema, atelectasis, ↓ surfactant, ↓ compliance
- **treatment:** ICU monitoring, mechanical ventilation, meds, positioning

- inflammation on bronchiole walls
- **signs & symptoms:** recurrent, paroxysmal coughing attacks, chest tightness, difficulty breathing, & wheezing, symptom-free between attacks, ↓ FEV_1, & ↑ TLC

* not all asthma are obstructive (can also be restrictive)

BRONCHIECTASIS

- permanent abnormal dilation & distortion of one or more medium sized bronchi/bronchioles
- **causes:** destruction of elastic & muscular components of the bronchiole wall, usually because of another pathology
- **pathology:** necrotizing infection → abnormal bronchial dilation & spasms → destruction/fragmentation of the bronchial wall
  - ↳ usually in L lower lobe
- **signs & symptoms:** productive cough, purulent sputum, hemoptysis, crackles, wheezes, dullness to percussion, ↓ breath sounds, digital clubbing, dyspnea, ↓ FEV_1, ↑ RV, hypoxemia, hypercapnia, acidosis, pulmonary HTN, cor pulmonale, R CHF

CYSTIC FIBROSIS

- genetic disorder → dysfunction of exocrine glands
  - ↳ autosomal recessive disorder
  - ↳ multi-organ involvement → "salty disease"
    - pancreas → steatorrhea
    - liver → obstructive jaundice, gallstones
    - GI tract → fecal impaction, intussusception
    - reproductive organs → difficulty w/ pregnancy, vas deferens obstruction
- most common fatal genetic disease of caucasians
- **pathology:** thick secretions plug airways → bacterial lung infections → small airway inflammation → larger airways → hyperplasia of mucus-secreting cells
- **signs & symptoms:** thick, tenacious mucus, increased sputum, chronic cough, increased RR & WOB, crackles, wheezes, digital clubbing, hyperinflation of lungs, ↑ RV, ↓ FEV_1, V/Q mismatching, pulmonary HTN → cor pulmonale, hypercapnia, respiratory acidosis

PT Management for All Obstructive Diseases:
- postural drainage & ACBT
- breathing control training
- effective huff/cough
- improve thoracic mobility & exercise tolerance
- patient education (self-management, relaxation)