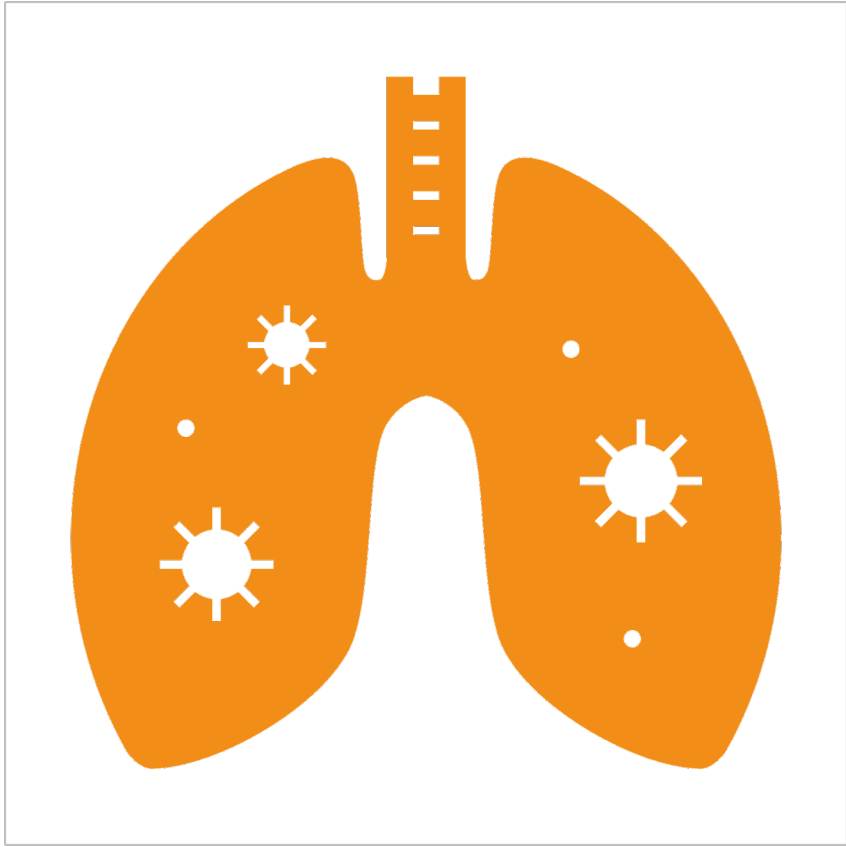




Care of the Critically Ill Patient With Respiratory Dysfunction

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IM 7 2023-2024

RESPIRATORY CONCEPTS

ACID BASE BALANCE	GAS EXCHANGE	PERFUSION
The process of regulating the pH, bicarbonate concentration, and partial pressure of carbon dioxide of the body fluids Regulated through respiratory and renal functions	The process by which oxygen is transported to the cells and carbon dioxide is transported from the cells	The flow of blood through arteries and capillaries delivering nutrients and oxygen to cells and removing cellular wastes

RESPIRATORY TRACT

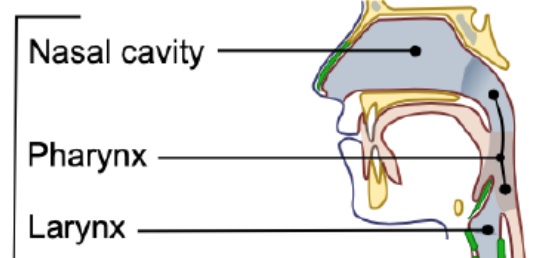
Upper Respiratory Tract

- Nasopharynx
- Oropharynx
- Laryngopharynx

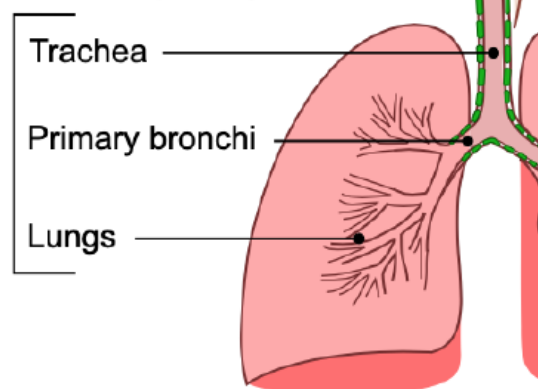
Lower Respiratory Tract

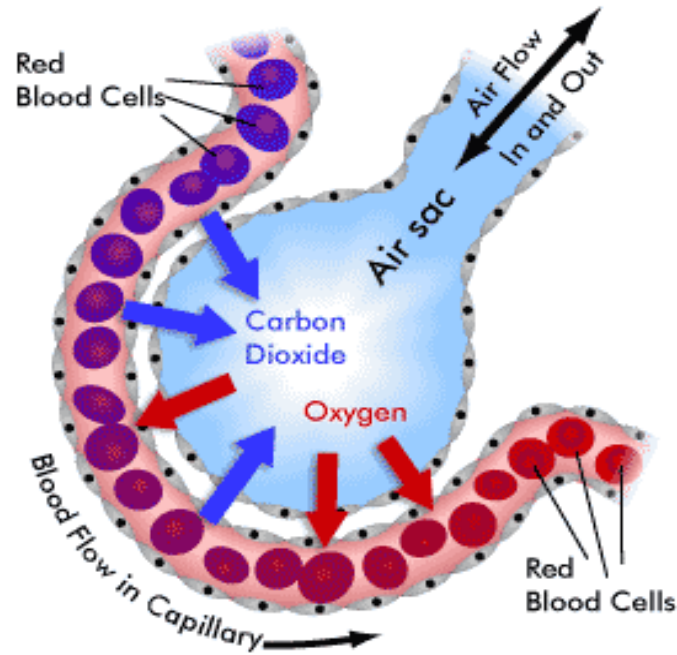
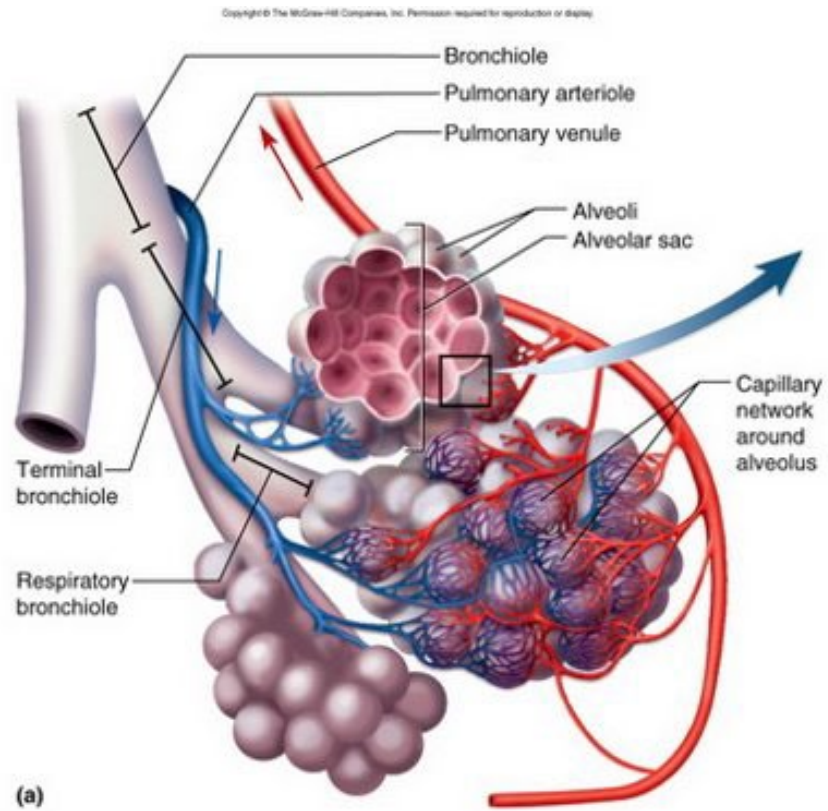
- Bronchioles
- Right & Left lung
 - Alveolar ducts
 - Alveoli

Upper respiratory tract



Lower respiratory tract





GAS EXCHANGE



Respiratory Obstructions

Airway Obstructions

- Blockage from Bronchiole constriction
 - Bronchiole inflammation causing fluid buildup
 - Wheezing, stridor
- Blockage from Alveolar compromise
 - Heart Failure
 - Pulmonary Edema
 - Atelectasis
 - Pneumothorax or Hemothorax
- Inflammation from injury or infection
 - ARDS
 - Pneumonia (community or ventilatory)

Perfusion Obstructions

- Blockage in the blood vessels causing obstruction
 - Pulmonary Embolism



LUNG FUNCTION

Tidal Volume

- Volume of air exchanged with each breath
- 6-8 mL/kg (approx 400-500 mL)

FiO2

- % of Oxygen

MAP

- $SBP + 2 (DBP) / 3$
- >65 mmHg to perfuse organs

ABGs

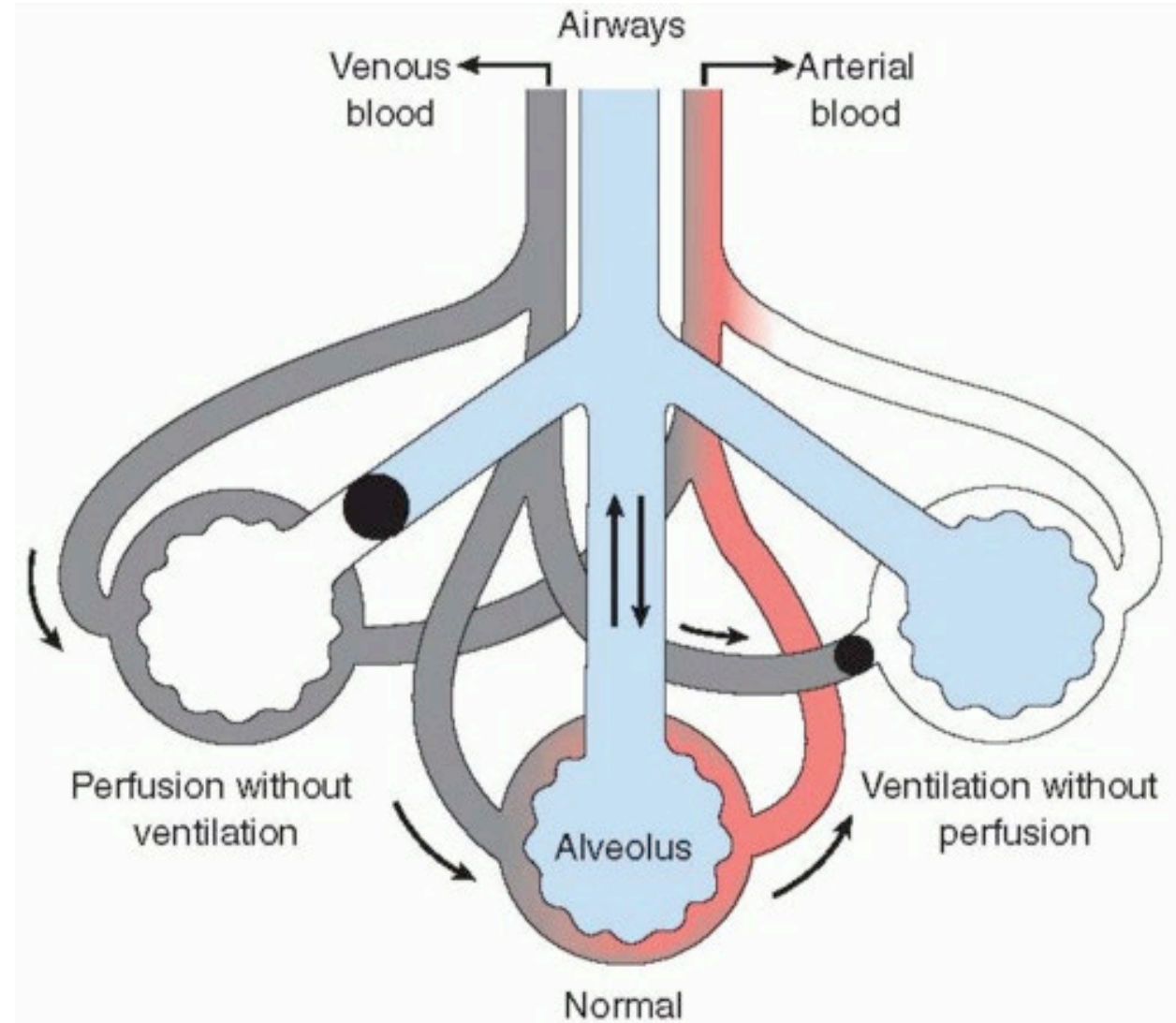
- Maintain homeostasis
- Respiratory (CO₂) or Metabolic (HCO₃)

PaO₂/FiO₂ Ratio

- Determines lung injury
- Normal 300-500
- Acute Lung Injury 200-300
- Significant Lung Injury <200
- High Mortality < 100

Ventilation /Perfusion (V/Q)

- V/Q is the ventilation to perfusion ratio
 - (V) air moving in & out of the lung
 - (Q) blood circulating to areas of the lung
- V/Q -Causes changes in PaO₂ and PaCO₂
 - Normal gas exchange on Room Air
 - No problems with either ventilation or perfusion
 - Hypoxemia on Room Air
 - VQ mismatch or imbalance





HYPOXEMIA

Decreased O₂ gas exchange

Ventilation and/or
perfusion failure

Early:
PaO₂ <80 mmHg

Late:
PaO₂ <60 mmHg



Inadequate alveolar ventilation causing
hypoventilation

Alveolar blockage

- Pulmonary edema
- Pneumonia
- ARDS
- Cystic Fibrosis

Perfusion blockage

- Pulmonary embolism

Airway obstruction

- Asthma
- COPD
- Anaphylaxis
- Atelectasis
- Bronchospasm

Respiratory Depression

- Opioids overdose

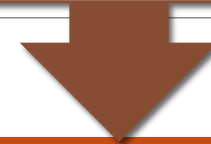
HYPERCAPNIA

Decreased CO₂ removal

Ventilation failure

Early:
PaCO₂ >45 mmHg

Late:
PaCO₂ > 50 mmHg



Inadequate alveolar ventilation causing
hypoventilation and retention of CO₂

CNS conditions

- Spinal cord injury
- Opioid overdose

Neuromuscular conditions

- Multiple sclerosis
- ALS

Chest wall abnormalities

- Barrel chest
- Kyphosis
- Trauma – open thorax wound

Airway or Alveolar blockage

- COPD
- Cystic fibrosis

What's happening?

Hypoventilation caused by:

- Blockage in alveoli
- Airway obstruction
- Perfusion blockage
- Issues with mechanical movement of thorax

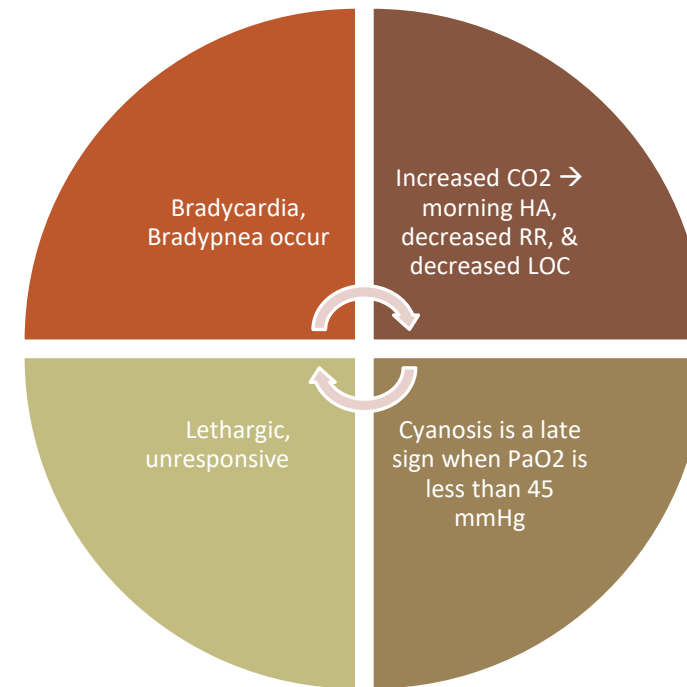
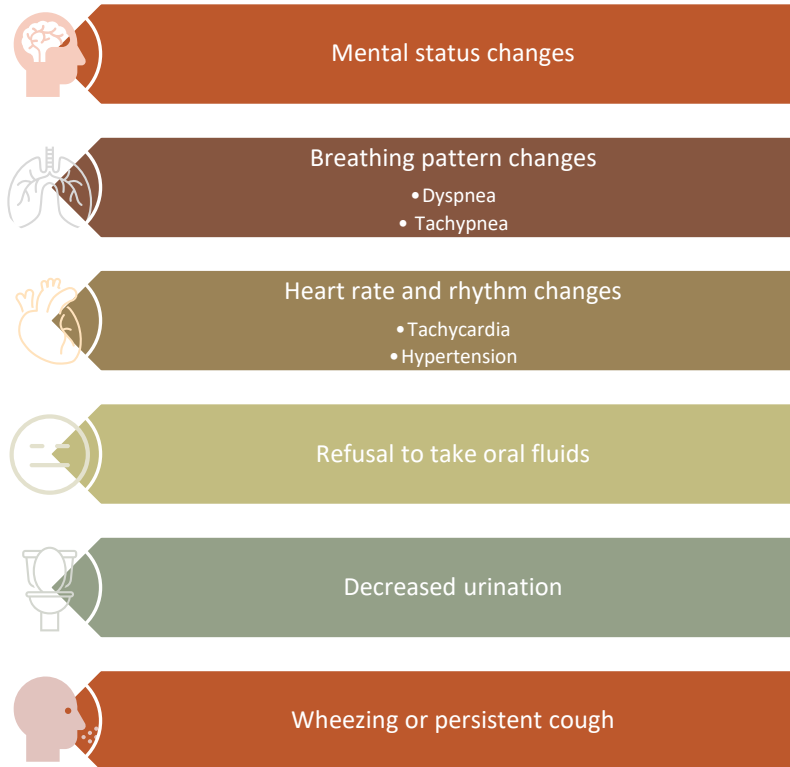
Diffusion limitation

Shunting

Alveolar hypoventilation

SIGNS AND SYMPTOMS OF RESPIRATORY FAILURE

EARLY SIGNS

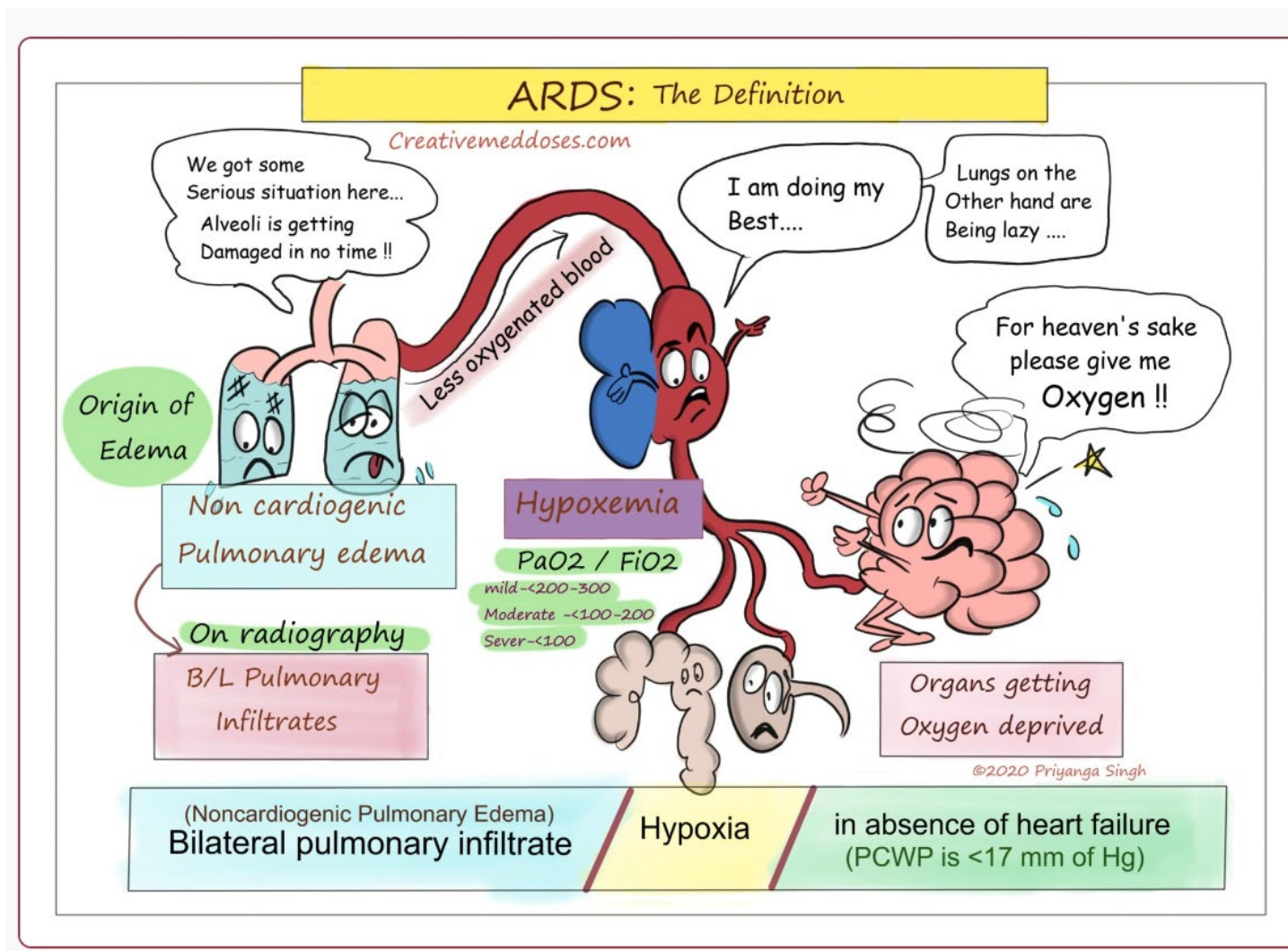


LATE SIGNS

RESPIRATORY FAILURE EXEMPLARS

ARDS, PNEUMOTHORAX, HEMOTHORAX, PULMONARY EMBOLISM





ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS)

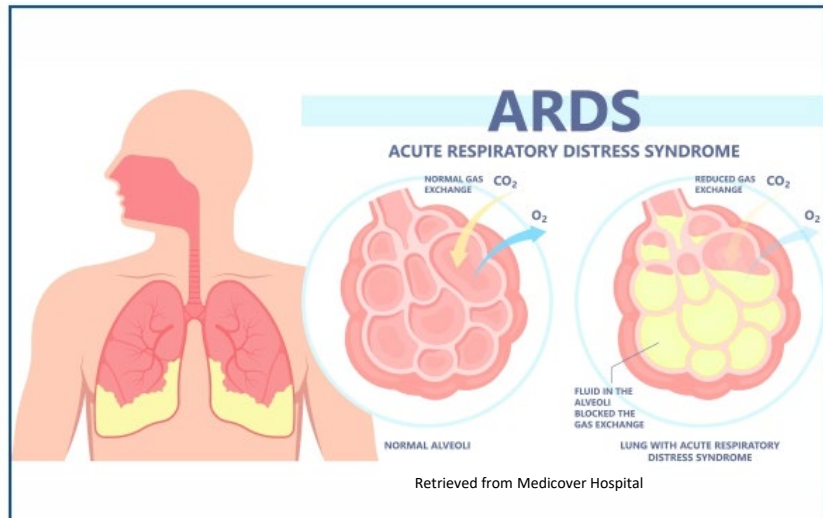
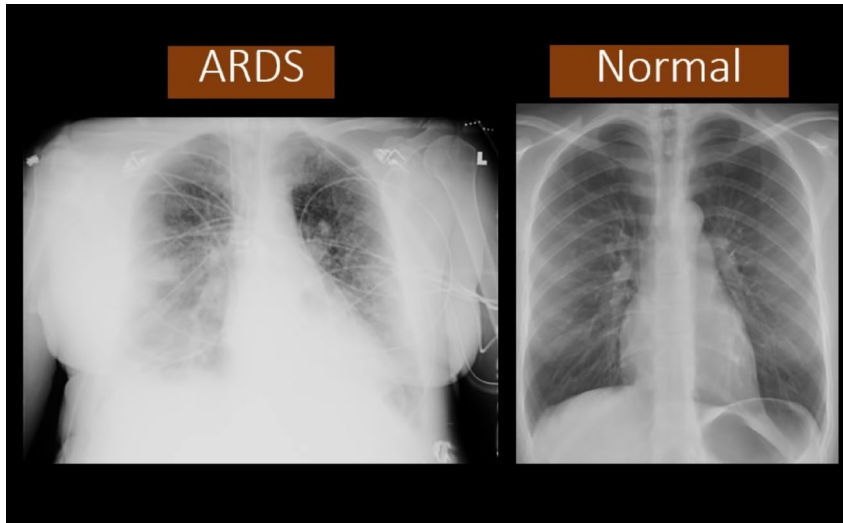
Pulmonary Edema due to trauma or infection

Causes:

- Aspiration of gastric contents
- Near drowning
- MVC
- Chemical Inhalation (paints etc.)
- Sepsis
- Covid-19

Signs and Symptoms:

- § Changes in LOC
- § Severe dyspnea and coughing
- § Tachypnea and shallow
- § Inspiratory crackles
- § Hypoxemia unresponsive to O₂
- § Tachycardia
- § Cyanosis
- § Orthopnea



Nursing A&E: ARDS

Diffuse ventilation issue due to damage to the alveoli

❑ NURSING ACTIONS:

- ❑ Assess respiratory rate, depth, and vitals
- ❑ Administer oxygen
- ❑ Fowler's position
- ❑ Restrict fluid intake
- ❑ Breathing treatments
- ❑ Administer diuretics and/or glucocorticoid steroids
- ❑ Prepare for intubation and mechanical ventilation if the patient declines

ATELECTASIS

Pneumothorax – open/closed wound causing air to enter chest wall

Hemothorax – blood in the pleural space causing atelectasis

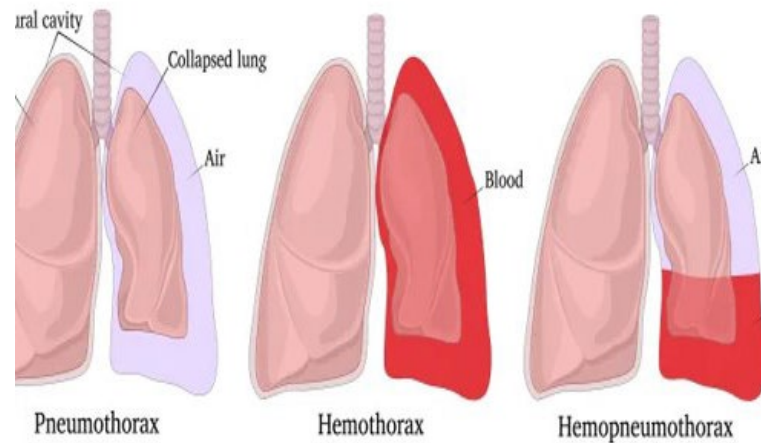
Causes:

- Pneumos: VALI (Ventilator Induced Lung Injury) – high PEEP and/or Tidal Volumes on vents
- Either: Trauma – MVC, gunshot wound

Signs and Symptoms:

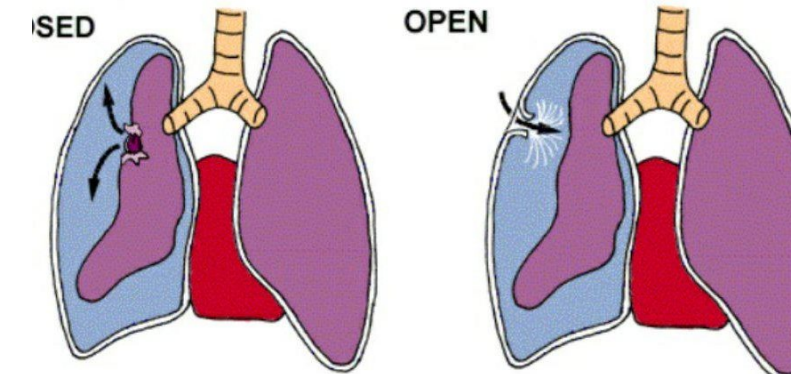
- Tachycardia
- Hypotension
- Tachypnea
- Shallow breathing
- Hypoxia
- Chest pain
- Tension Pneumo = tracheal deviation

Pneumothorax, Hemothorax and Hemopneumothorax



Pneumothorax

The difference between a closed and open pneumothorax depends on the type of trauma that caused either an open wound or a closed wound.



BACKGROUND

- * AIR BUILDS UP in **PLEURAL CAVITY**
 - ~ CAUSED by HOLE in CHEST WALL
- * PUTS PRESSURE on the LUNG
 - ~ CAN LEAD to LUNG COLLAPSE

SYMPTOMS

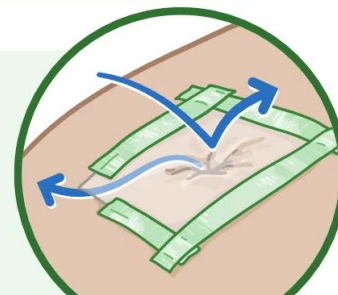
- * SUDDEN CHEST PAIN
- * SHORTNESS of BREATH
- * RAPID & SHALLOW BREATHING
- * FAST HEART RATE
- * HYPOXIA

CAUSES

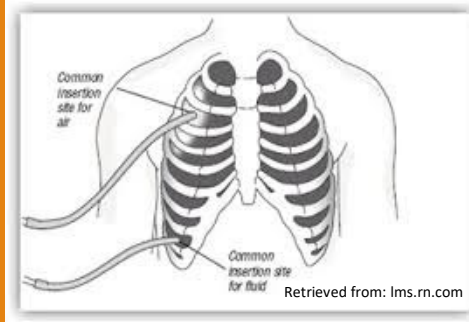
- * TRAUMA
 - ~ BLUNT
 - ~ PENETRATING
- * IATROGENIC
 - ~ TRANSTRACHEAL ASPIRATION
 - ~ LUNG BIOPSY
 - ~ TUBE THORACOSTOMY

TREATMENT

- * THREE-WAY DRESSING
- * CHEST TUBE
- * SURGICAL REPAIR



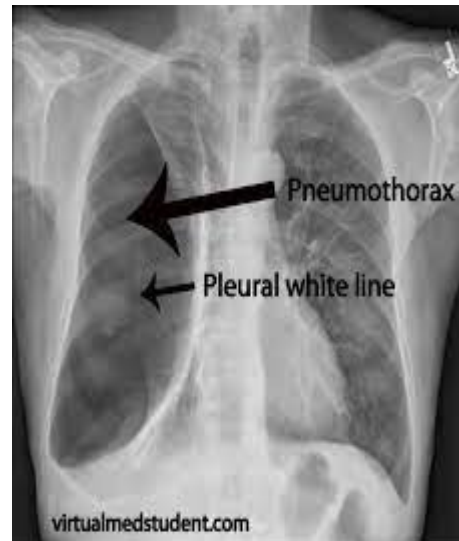
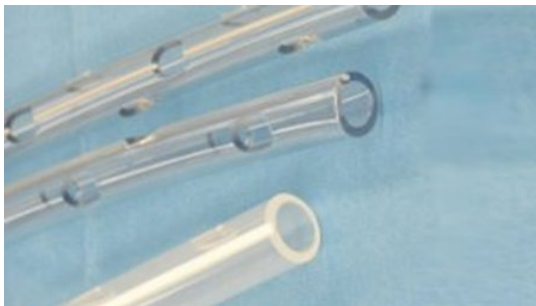
Hemo



Nursing A&E: Atelectasis

❑ Nursing Actions:

- ❑ Assess lung sounds, resp rate/depth, vitals
- ❑ Monitor skin around chest tube insertion site
- ❑ Mobility – ROM, TCDB, Turn frequently
- ❑ Care of chest tube:
 - ❑ Dislodged from patient
 - Sterile dressing over site, taped on 3 sides, and call the physician immediately
 - ❑ System breaks
 - ❑ Insert tube into sterile water or saline
 - ❑ Milking, stripping or clamping
 - ❑ NOT recommended



Pneumo

Chest drain system



Drainage chamber

Suction control

Water seal chamber
(air leak)

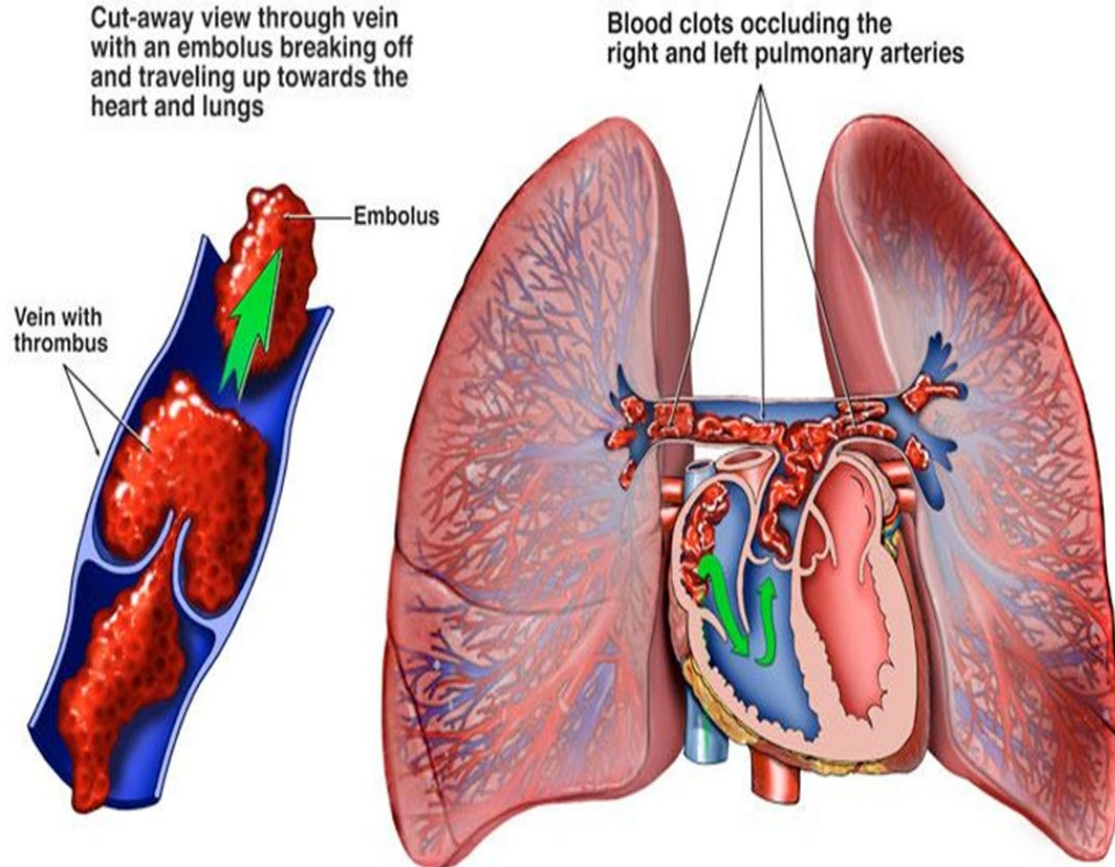
Wet chest tube because the suction control uses water for the pressure.



Dry chest tube because the suction control has a bellows for the pressure.

PULMONARY EMBOLISM

Mechanism of Pulmonary Embolism



PERFUSION ISSUE

- Embolus lodged within the pulmonary system

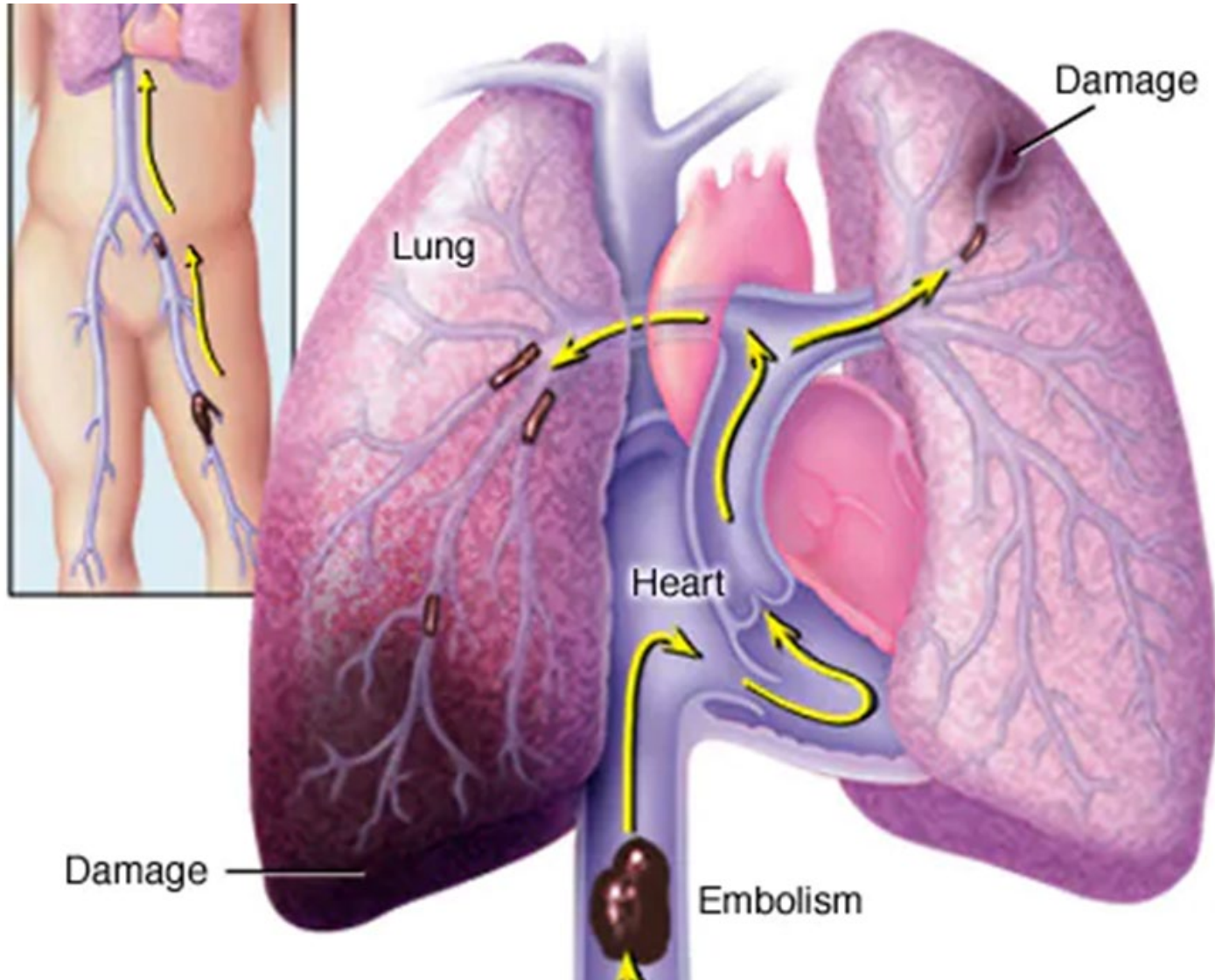
- Causes: DVT (common), cancer, fat emboli

Signs/Symptoms:

- Severe dyspnea, tachypnea
- Hypoxemia unresponsive to oxygen therapy
- Chest pain
- Tachycardia, diaphoresis
- Changes in mental status
- Syncope
- Cyanosis
- Pallor

Diagnostics:

- D Dimer lab – elevated levels from proteins that break down blood clots
- CT Scan

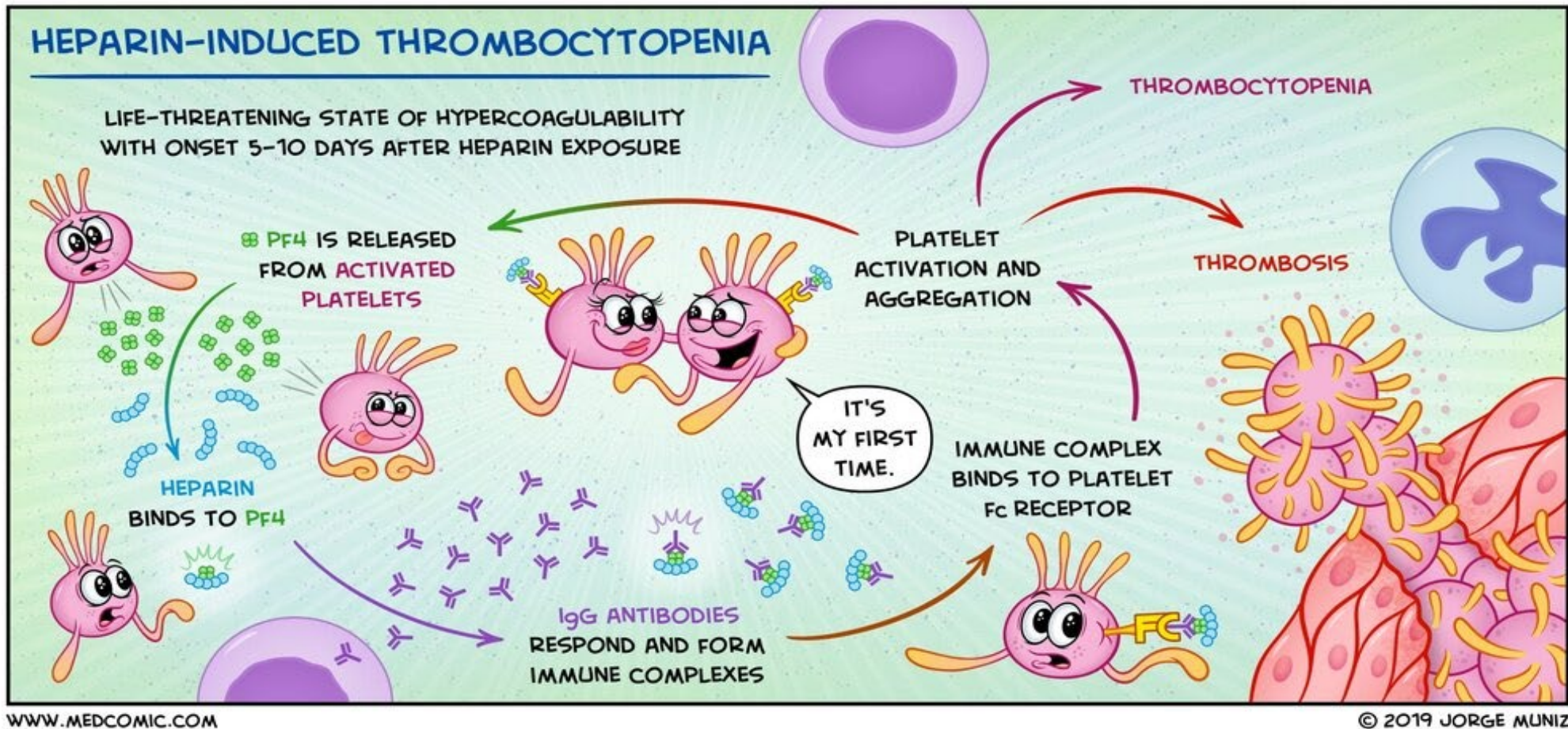


NURSING A&E: PULMONARY EMBOLISM

NURSING ACTIONS:

- ☐ Assess respiratory rate, depth, vitals
- ☐ Elevate head of bed
- ☐ Oxygen
- ☐ Heparin therapy
- ☐ Mobility
- ☐ Nutrition
- ☐ Teaching about anticoagulant therapy

HEPARIN INDUCED THROMBOCYTOPENIA or THROMBOSIS (HITT)





DIAGNOSTICS

- Monitor platelet count
 - Severe Thrombocytopenia
 - Platelets <30,000 microliters

MANAGEMENT

STOP heparin infusion

Monitor aPTT, INR

TREATMENT

Administer direct thrombin inhibitors

☐ argatroban and/or bivalirudin

☐ Transition to oral anticoagulants when therapeutic range is reached

HITT – NURSING ACTIONS



RESPIRATORY NURSING MANAGEMENT



Nursing Assessment and Evaluation



Oxygen therapy



Diagnostics



Pharmacologic therapy



Nutritional therapy



Mobility



Sleep

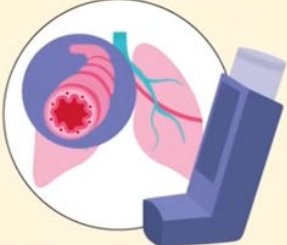


Patient Education



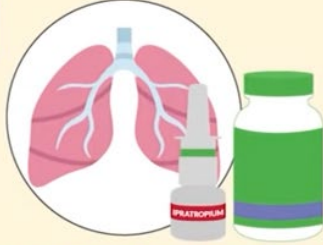
LOWER RESPIRATORY DRUGS

NCLEX NOTES



BRONCHODILATORS

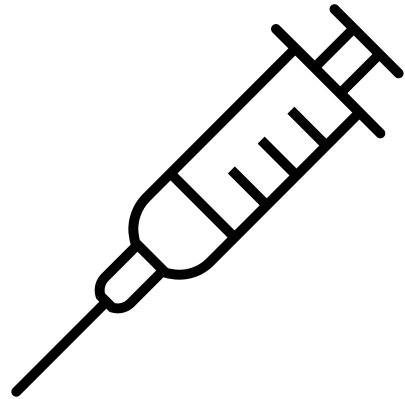
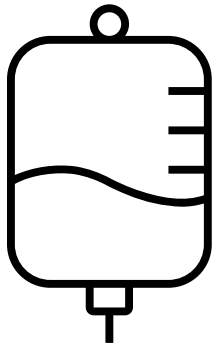
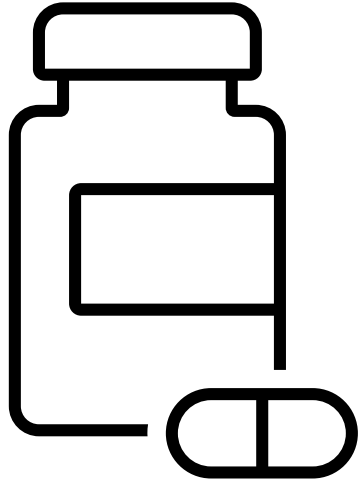
- B** Beta 2 Agonist
Albuterol
- A** Anticholinergics
Ipratropium
- M** Methylxanthines
Theophylline



ANTI-INFLAMMATORY Agents

- S** Steroids
Beclomethasone
- L** Leukotriene Inhibitor
Montelukast
- M** Mast Cell Stabilizers
Cromolyn

PHARMACOLOGIC THERAPY – Respiratory Meds



PHARMACOLOGIC THERAPY - MISC

Diuretics

- furosemide, hydrochlorothiazide, bumetanide
- spironolactone

Anti-coagulant

- Injection: heparin, enoxaparin
- Oral: warfarin, apixaban, rivaroxaban

Anti-inflammatory

Corticoid Steroids or Glucocorticoids:

- Oral: prednisone
- Oral or injection: methylprednisolone, dexamethasone, betamethasone
- Inhaled: beclomethasone, fluticasone



Patient with severe asthma presents to the ER with the following vital signs: HR 120 BPM, RR 32 BPM, O2 Sat 90% on room air and a Peak Expiratory flow of <40%. What medication would you give? Select all that apply

- A. Inhaled salmeterol
- B. Albuterol inhaler
- C. Nebulizer ipratropium
- D. IV Methamphetamines
- E. IV Methylprednisolone



The emergency department nurse is assessing a client who has sustained a blunt injury to the chest wall. Which finding would indicate the presence of a pneumothorax in this client?

1. A low respiratory rate
2. Diminished breath sounds
3. The presence of a barrel chest
4. A sucking sound at the site of injury



The nurse instructs a client to use the pursed-lip method of breathing and the client asks the nurse about the purpose of this type of breathing. The nurse responds, knowing that the primary purpose of pursed-lip breathing is to promote which outcome?

1. Promote oxygen intake
2. Strengthen the diaphragm
3. Strengthen the intercostal muscles
4. Promote carbon dioxide elimination



The nurse is assessing a client with multiple trauma who is at risk for developing acute respiratory distress syndrome. The nurse should assess for which early sign of acute respiratory distress syndrome?

1. Bilateral wheezing
2. Inspiratory crackles
3. Intercostal retractions
4. Increased respiratory rate



A client has experienced pulmonary embolism. The nurse should assess for which symptom?

1. Hot, flushed feeling
2. Sudden chills and fever
3. Chest pain that occurs suddenly
4. Dyspnea when deep breaths are taken