Acute Lung Injury (ALI)/ARDS

- Syndrome
- Direct or indirect injury
- Significant inflammatory insult
- Mediator release
- Increased capillary permeability
Disclosures

- Nothing to disclose

Pulmonary

- Acute respiratory failure and acute respiratory distress syndrome (ARDS)
- Acute pulmonary embolism (PE)
- Acute respiratory infections (e.g., pneumonia)
- Air-leak syndromes
- Aspiration and pulmonary fibrosis
- Chronic conditions (e.g., COPD, asthma)
- Failure to wean
- Pulmonary hypertension
- Thoracic surgery and trauma
- Status asthmaticus

Anatomy Review
Ventilation – Moving air into and out of the lungs
Diffusion – Movement of gas from higher concentration to lower concentration
Perfusion – Transporting gases to the body via circulatory system
Definitions

- Dead space ventilation – Alveolar ventilation with no perfusion
- Pulmonary embolism (PE)
- Intrapulmonary shunting – Perfusion with no ventilation
- Atelectasis

Oxyhemoglobin Dissociation Curve

- Shift to the Left
  - ↑ pH
  - ↓ PaCO₂
  - ↓ Temperature
  - ↓ 2,3–DPG
  - ↓ PO₄
- Shift to the Right
  - ↓ pH
  - ↑ PaCO₂
  - ↑ Temperature
  - ↑ 2,3–DPG

Basic Assessment, Respiratory Monitoring, and Acid–Base Balance

- Arterial blood gases (ABGs)
### Normal Values for ABGs

<table>
<thead>
<tr>
<th>ABG</th>
<th>Normal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO2</td>
<td>80-100</td>
</tr>
<tr>
<td>pH</td>
<td>7.35-7.45</td>
</tr>
<tr>
<td>PaCO2</td>
<td>35-45</td>
</tr>
<tr>
<td>HCO₃⁻</td>
<td>22-26</td>
</tr>
<tr>
<td>SaO₂</td>
<td>95%-100%</td>
</tr>
<tr>
<td>Base excess</td>
<td>+/- 2</td>
</tr>
</tbody>
</table>

### Respiratory Regulation
- Ventilation and diffusion → PaCO₂
- Blowing off PaCO₂
- Retaining PaCO₂
- Changes in acid-base (A-B) balance can occur very quickly

### Metabolic Regulation
- Normal HCO₃⁻: 22-26 mEq/L
- Base excess: -2 – +2
- Kidneys function as buffer
- Retain or excrete acid (hydrogen ion [H⁺]) or base (HCO₃⁻)
- Does not happen quickly
Pulmonary Review Questions

Question 1
Renal failure presents most commonly with which of the following acid-base imbalance patterns?

A. pH 7.51, PaCO2 32, HCO3 23
B. pH 7.31, PaCO2 49, HCO3 28
C. pH 7.29, PaCO2 37, HCO3 17
D. pH 7.55, PaCO2 40, HCO3 29

Question 1—Rationale
Renal failure presents most commonly with which of the following acid-base imbalance patterns?

C. pH 7.29, PaCO2 37, HCO3 17
  - pH 7.51, PaCO2 32, HCO3 23—Respiratory alkalosis
  - pH 7.31, PaCO2 49, HCO3 28—Respiratory acidosis with partial met compensation
  - pH 7.55, PaCO2 40, HCO3 29—Metabolic alkalosis
Question 2

Which of the following clinical situations correlates with ABG results of pH 7.22, HCO₃⁻ 23 mEq/L, PaCO₂ 65 mmHg, PaO₂ 56 mmHg?

A. Acute tracheal obstruction
B. Anxiety-induced hyperventilation
C. Chronic obstructive pulmonary disease
D. Diarrhea for 36 hours in a debilitated patient

Question 2—Rationale

Which of the following clinical situations correlates with ABG results of pH 7.22, HCO₃⁻ 23 mEq/L, PaCO₂ 65 mmHg, and PaO₂ 56 mmHg?

A. Acute tracheal obstruction—Hypoxia respiratory acidosis correlates because the O₂ cannot get in or CO₂ out
   • Anxiety-induced hyperventilation—Respiratory alkalosis
   • Chronic obstructive pulmonary disease—Respiratory acidosis and hypoxia with partial metabolic compensation
   • Diarrhea for 36 hours in a debilitated patient—Metabolic acidosis

Acute Respiratory Failure

- Failure of the pulmonary system to provide adequate oxygenation or ventilation
- Sudden drop in PaO₂ or elevation in PaCO₂
Mechanical Ventilation

- Modes are classified by inspiratory trigger

---

Mechanical Ventilation

- Volume modes
  - Volume is set and pressure is variable

  Compliance → alveoli and chest well
  Resistance → airways

---

Mechanical Ventilation

- Pressure modes
  - Pressure is set and volume is variable

  Compliance → alveoli and chest well
  Resistance → airways
Mechanical Ventilation

- New pressure and combined modes
- Airway pressure release volume
- Bilevel/biphasic positive airway pressure
- Pressure-regulated volume-controlled

  - Primarily used for treating ARDS
  - Allows for spontaneous breathing
  - Does not require sedation or muscle relaxants
  - Less barotrauma and intrinsic positive end-expiratory pressure (auto-PEEP)
  - Has not proven to be superior to earlier modes

Ventilator-associated Events

- VAP → VAC → VAE
- CDC Jan 2015 document revised in April 2015
- Bundles
- Documentation
- Reporting

VAP, ventilator-associated pneumonia; VAC, ventilator-associated complication; VAE, ventilator-associated event

Ventilator-associated Events

- Weaning
- Spontaneous breathing trials (SBT)
- Sedation holiday—“wake up and breathe”
- Progressive mobility (ABCDE bundle)
- Nutrition
- Protocol-driven
Noninvasive Ventilation

- Fewer intubations
- Continuous positive airway pressure (CPAP)
- Bilevel positive airway pressure
- High-flow nasal cannula

Review Questions

Question 3

Which of the following is the most appropriate means of preventing ventilator-associated pneumonia?

A. Prophylactic antibiotics
B. Keeping the head of the bed elevated >30°
C. Decontaminating the room with a bleach mixture
D. Changing the ventilator circuit every 4 hours
Question 3—Rationale

Which of the following is the most appropriate means of preventing ventilator-associated pneumonia?

B. Keep the head of the bed elevated >30⁰—Shown to help decrease risk of VAP
   - Give prophylactic antibiotics—Could increase incidence of resistance development
   - Decontaminate the room with a bleach mixture—Room cleanliness is important, but bleach is not required
   - Change the ventilator circuit every 4 hours—The circuit should not be changed that frequently

Question 4

A patient with a tracheostomy requires frequent suctioning for thick sputum. A nurse finds a colleague instilling saline in the endotracheal tube prior to suctioning. The most appropriate response by the nurse would be to:

A. Report the colleague to the charge nurse or manager
B. Note the practice on the patient’s chart to ensure consistency of suctioning techniques
C. Ask the attending physician to review the suctioning policy
D. Collaborate with the colleague to review the evidence about this practice

Question 4—Rationale

A patient with a tracheostomy requires frequent suctioning for thick sputum. A nurse finds a colleague instilling saline in the endotracheal tube prior to suctioning. The most appropriate response by the nurse would be to:

D. Collaborate with the colleague to review the evidence about this practice—Best practice is not to instill NS; it does not loosen secretions and does harms the patient. The practice should be stopped and communication and education given to the colleague
   - Report the colleague to the charge nurse or manager—Direct communication is more professional and appropriate
   - Note the practice on the patient’s chart to ensure consistency of suctioning techniques—NS instillation is not recommended
   - Ask the attending physician to review the suctioning policy—The policy should reflect current evidence-based practice. The most immediate concern is patient safety
Restrictive Lung Disorders

- Pulmonary disorders that restrict the lung from expanding
- Lung compliance and volumes are decreased

- ARDS
- Infections
- Occupational lung disease
- Sarcoidosis
- Atelectasis

Acute Lung Injury (ALI)/ARDS

- Syndrome
- Direct or indirect injury
- Significant inflammatory insult
- Mediator release
- Increased capillary permeability

ARDS

- Pulmonary edema
- Alveolar collapse
- Lung damage
- Lung failure
- Subsequent death
ARDS
- Exudative 0-4 days
- Proliferative 3-10 days
- Fibrotic 7-14 days

ARDS
- 1994
- Acute onset
- \( \frac{\text{PaO}_2}{\text{FiO}_2} \text{ ratio} < 200 \text{ mmHg} \)
- Bilateral infiltrates
- No evidence of LV failure (PAOP < 18 mmHg)

ARDS
- 1994
- Acute onset
- \( \frac{\text{PaO}_2}{\text{FiO}_2} \text{ ratio} < 200 \text{ mmHg} \)
- Bilateral infiltrates
- No evidence of LV failure (PAOP < 18 mmHg)
ARDS

Timing  Within 1 week of known clinical insult or new or worsening respiratory symptoms

Chest Imaging  Bilateral opacities—not fully explained by effusion, lobar/lung collapse, or nodules

Origin of edema  Respiratory failure not fully explained by cardiac failure or fluid overload

Oxygenation

<table>
<thead>
<tr>
<th>Mild</th>
<th>$200 \text{ mmHg} &lt; \frac{\text{PaO}_2}{\text{FiO}_2} \leq 300 \text{ mmHg}$ w/ PEEP or CPAP $&gt; 5$ cm H$_2$O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>$100 \text{ mmHg} &lt; \frac{\text{PaO}_2}{\text{FiO}_2} \leq 200 \text{ mmHg}$ w/ PEEP $\geq 5$ cm H$_2$O</td>
</tr>
<tr>
<td>Severe</td>
<td>$\frac{\text{PaO}_2}{\text{FiO}_2} &lt; 100 \text{ mmHg}$ w/ PEEP $&gt; 5$ cm H$_2$O</td>
</tr>
</tbody>
</table>

Treatment Options

- Treat underlying cause
- Mechanical vent
- Prevent infection
- Pharmacology
- Patient positioning

Pulmonary Fibrosis

- Primary vs secondary
- Causes
  - Occupational
  - Radiation
  - Medications
  - Medical conditions
- Treatments
  - Supportive
  - Medications
  - Oxygen
  - Rehab
Pulmonary

Inflammatory process of lung parenchyma
Caused by infection that leads to alveolar consolidation

Etiology

- Origin
  - Bacterial = 75%
  - Viral
  - Fungal
  - Aspiration
- Site
- Source
  - Community-acquired pneumonia
  - Hospital-acquired pneumonia
  - VAP

Pathophysiology

- Lower respiratory tract invasion
- Inflammatory reaction
- Increased capillary permeability
- Phagocytic cells migrate to site
- Alveoli fill with exudate
- Impaired gas exchange from shunting
Pneumonia

- Clinical presentation
- Diagnosis
- Treatment

Review Questions

Question 5

A restrictive lung disease is one that is characterized by:

A. Decreased compliance, hypoxemia, rapid shallow breathing
B. Increased compliance, hypercarbia, slow deep respirations
C. Decreased compliance, normal PaO2, shunting
D. Hypoxemia, dead space ventilation, low pH
**Question 5—Rationale**

A restrictive lung disease is one that is characterized by:

- Decreased compliance, hypoxemia, rapid shallow breathing—ARDS and pneumonia are classic restrictive disorders
  - Increased compliance, hypercarbia, slow deep respirations—Decreased compliance occurs in restrictive diseases
  - Decreased compliance, normal PaO₂, shunting—The PaO₂ is typically low
  - Hypoxemia, dead space ventilation, low pH—Shunting is the ventilation/perfusion (V/Q) mismatch in restrictive disease

**Question 6**

Two days after a near-drowning, a patient is dyspneic, using accessory muscles, expectorating large amounts of secretions, and reports feelings of “impending death.” Changes to the assessment data include:

<table>
<thead>
<tr>
<th></th>
<th>Admission</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td>Chest x-ray</td>
<td>Clear</td>
<td>Bilateral diffuse infiltrates</td>
</tr>
<tr>
<td>FIO₂</td>
<td>40%</td>
<td>100% non-rebreather mask</td>
</tr>
<tr>
<td>ABG</td>
<td>pO₂ 120 mm Hg</td>
<td>56 mmHg</td>
</tr>
<tr>
<td></td>
<td>pCO₂ 33 mm Hg</td>
<td>50 mmHg</td>
</tr>
<tr>
<td></td>
<td>pH 7.42</td>
<td>7.35</td>
</tr>
<tr>
<td></td>
<td>HCO₃ 24 mEq/L</td>
<td>27 mEq/L</td>
</tr>
</tbody>
</table>

Which of the following do these changes most likely represent?

A. Aspiration pneumonia  
B. Pulmonary embolism  
C. Interstitial pneumonitis  
D. ARDS

**Question 6—Rationale**

Which of the following do these changes most likely represent?

D. ARDS—Meets ARDS criteria and restrictive lung dis  
- Aspiration pneumonia—Could lead to ARDS  
- Pulmonary embolism—Presents with respiratory alkalosis  
- Interstitial pneumonitis—Could lead to ARDS
Question 7

A patient is admitted with acute respiratory failure, left lobar pneumonia, and COPD. Physical exam reveals severe fatigue, coarse inspiratory crackles, and expiratory wheezing. Data also include:

HR 132 RR 36 T 102.6°F (39.3°C) pH 7.28 pCO₂ 72 pO₂ 48 HCO₃ 36

Based on this info, the nurse should anticipate which of the following additional clinical findings?

A. Purulent sputum
B. Mediastinal shift to the right
C. Bradypnea
D. Intermittent apneic periods

Question 7—Rationale

Which additional clinical findings might the nurse anticipate?

A. Purulent sputum—Pneumonia, crackles, temp, and wheezing
   • Mediastinal shift to the right—Common with pneumothorax
   • Bradypnea—Hypoxia would cause tachycardia
   • Intermittent apneic periods—Hypoxia and acidosis causes hyperventilation

Question 8

Which of the following assessment data would indicate that a patient who is receiving mechanical ventilation is ready for an SBT?

A. He has been on the ventilator for 1 week
B. He is breathing over the set ventilator rate
C. The vasopressor was discontinued yesterday
D. He has been trached for 3 days
Question 8—Rationale

Which of the following assessment data would indicate that a patient who is receiving mechanical ventilation is ready for an SBT?

C. The vasopressor was discontinued yesterday—Hemodynamic stability is an important criteria for weaning
   - He has been on the ventilator for 1 week—Pulmonary and hemodynamic stability are criteria, not time on vent
   - He is breathing over the set ventilator rate—This could be a sign of hypoxia, not always readiness
   - He has been trached for days—Being trached is a positive sign for weaning ability, but not a criteria

Question 9

A freshwater drowning victim is hypothermic and intubated upon arrival. Her ABGs are: PaO₂ 80, PaCO₂ 30, pH 7.51, HCO₃ 24. Which of the following factors are most important to consider when directing her care?

A. Hypothermia, drowning, and acidosis will increase the O₂ unloading at the cellular level
B. Hypothermia and alkalosis will decrease the O₂ unloading at the cellular level
C. Hypothermia and alkalosis will help protect the heart from going in to VfB
D. The hypothermia and hypoxia will need to be resolved before she can be declared dead

Question 9—Rationale

A freshwater drowning victim is hypothermic and intubated upon arrival. Her ABGs are: PaO₂ 80, PaCO₂ 30, pH 7.51, HCO₃ 24. Which of the following factors are most important to consider when directing her care?

B. "Hypothermia and alkalosis will decrease the O₂ unloading at the cellular level"—Hypothermia and alkalosis cause a shift of the oxyhemoglobin dissociation curve to the left and less unloading of O₂
   - Hypothermia, drowning, and acidosis will increase the O₂ unloading at the cellular level—Hypothermia causes a shift to the left and decreased unloading of O₂
   - Hypothermia and alkalosis will help protect the heart from going in to VfB—Not protective abnormalities
   - The hypothermia and hypoxia will need to be resolved before she can be declared dead—Attempts will be made to warm the patient, but this does not answer the question that was asked
Question 10

An intubated post-op patient is beginning to wake up. Vent settings are AC, with a rate of 14, TV 450, FiO2 60%, 5 cm PEEP. Other assessments: RR 36; ABG: PaO₂ 150, PaCO₂ 28, pH 7.52, HCO₃⁻ 24. What changes (if any) should the nurse anticipate to the vent settings?

A. No changes to the vent settings; administer an antianxiety agent
B. Decrease the FiO₂ and consider pain medication
C. Decrease the tidal volume (TV) and increase the PEEP
D. Change the mode to PC and decrease the FiO₂

Question 10—Rationale

An intubated post-op patient is beginning to wake up. Vent settings are AC, with a rate of 14, TV 450, FiO2 60%, 5 cm PEEP. Other assessments: RR 36; ABG: PaO₂ 150, PaCO₂ 28, pH 7.52, HCO₃⁻ 24. What changes (if any) should the nurse anticipate to the vent settings?

B. Decrease the FiO₂ and consider pain medication—Hyperoxegenation and hyperventilation must be treated
   - No changes to the vent settings; administer an antianxiety agent—The Hyperoxegenation must be treated
   - Decrease the TV and increase the PEEP—Increasing PEEP would increase oxygenation
   - Change the mode to PC and decrease the FiO₂—Changing to PC from AC will not treat the hyperoxegenation or hyperventilation

Obstructive Lung Disorders

- Pulmonary disorders in which airway obstruction and gas trapping are the primary problem
Pulmonary

COPD: Etiology

- Bronchitis: inflammatory response to irritant
- Vasodilation, congestion
- Mucosal edema and bronchospasm
- Small and large airways, not alveoli
- Chronic: >3 months for ≥2 years

COPD

COPD: Etiology (cont)

- Emphysema
  - Smoking #1 cause
  - Occupational exposure
  - Alpha-1 antitrypsin disease
COPD: Pathophysiology

- Emphysema
  - Irritation and inflammation of bronchioles → mucus production → obstruction → tissue injury → decrease surfactant → bronchiolar collapse

COPD: Pathophysiology (cont)

- Emphysema
  - Obstruction → air trapping and distention of alveoli → enlargement of air sacs and loss of elastic recoil → multiple alveoli actually fuse to one large one → decreasing surface area for gas exchange

COPD: Pathophysiology (cont)

- Increases in functional residual capacity (FRC)
- Hypoxia
- V/Q mismatch
- Pulmonary hypertension
- Increased right ventricular afterload → right heart failure (cor pulmonale)
COPD: Clinical Presentation

- Dyspnea on exertion → dyspnea at rest
- Productive cough → nonproductive cough
- Tachypnea with small TV
- Dropping FEV₁

COPD: Clinical Presentation (cont)

- Malnutrition/muscle wasting (including diaphragm)
- Increase in anterior-posterior diameter
- Diminished breath sounds in bases

COPD: Clinical Presentation (cont)

- Pulmonary function tests:
  - Increased: FRC, residual volume (RV), total lung capacity
  - Decreased: FEV₁, TV
- ABGs: Hypoxia with respiratory acidosis over time will develop a degree of metabolic compensation
  - Example: PaO₂ 71; PaCO₂ 52; pH 7.29; HCO₃ 34; SaO₂ 72
COPD: Clinical Presentation (cont)
- Chest x-ray
  - Flattened diaphragm
  - Decreased vascular markings
  - Bullae
- Right heart failure
- Chronic multisystem dysfunction related to chronic hypoxemia and hypercapnia

COPD
- Chronic Illness
  - Pneumonia
  - Heart failure
  - Pulmonary emboli
  - Respiratory failure
  - Bronchospasm
  - Spontaneous pneumothorax
  - Noncompliance with pulmonary medical therapies

COPD: Treatment Options
- Treat primary cause of admission
- O₂ administration (with caution)
- Hydration and humidification
- Removal of secretions
COPD: Treatment Options (cont)

- Pharmacology
  - Antibiotics
  - Steroids
  - Beta 2 agonists
  - Anticholinergics
  - Methylxanthines
  - Mucolytics

COPD: Treatment Options (cont)

- Nutritional support
  - High-calorie
  - Low-carbohydrate

Asthma

- Hyperactive airway due to intrinsic or extrinsic factor
“Typical” asthma therapies don’t work:
- Bronchospasm, mucus production, and air trapping continue, potentially to the point where there is no air movement
- Hyperinflation increases intrathoracic pressures, which decreases venous return and increases RV afterload.

Status Asthmaticus

Review Questions

Question 11

A patient arrives from the ED with COPD and pneumonia. Assessment includes unlabored RR 28; HR 112; AFib; BP 168/82; T 37.9°C; coarse breath sounds—diminished in bases. Patient denies SOB or chest pain and is on 1 L O₂ via NC. ABGs: PaO₂ 71; PaCO₂ 55; pH 7.28; HCO₃ 35. The nurse contacts the physician with the ABG results and anticipates the order to be:

A. Call anesthesia to intubate the patient and begin mechanical ventilation
B. Administer the antibiotic for the pneumonia as soon as possible
C. Increase the patient’s O₂ to 4 L
D. Continue to monitor the patient for any respiratory distress
Question 11—Rationale

A patient arrives from the ED with COPD and pneumonia. Assessment includes unlabored RR 28; HR 112; ABP: BP 168/82; T 37.9°C; coarse breath sounds—diminished in bases. Patient denies SOB or chest pain and is on 1 L O₂ via NC. ABGs: PaO₂ 71; PaCO₂ 55; pH 7.38; HCO₃ 35. The nurse contacts the physician with the ABG results and anticipates the order to be:

D. Continue to monitor the patient for any respiratory distress—The assessment and ABG are consistent for a patient with these diagnoses.

Patient denies SOB and chest pain
- Call anesthesia to intubate the patient and begin mechanical ventilation—Patient is stable; no need to intubate
- Administer the antibiotic for the PMA as soon as possible—Patient does need antibiotics; this is not answering the question asked
- Increase the patient’s O₂ to 4 L—Oxygen administration to a COPD patient should be increased slowly

Pulmonary Emboli

- Occlusion in the pulmonary arterial circulation, blocking flow to a region(s) of the lung, and creating dead space ventilation

Pulmonary Emboli: Etiology

- Fat
- Air
- Amniotic fluid
Pulmonary Emboli: Etiology (cont)

- Thromboemboli: 90% deep vein thrombosis
- Virchow’s triad
  - Venous stasis
  - Hypercoagulability
  - Vascular wall damage

Pulmonary Emboli: Pathophysiology

- Continuum
- Pulmonary artery obstruction
- V/Q mismatching: V > Q = dead space initially
- Nonperfused alveoli will collapse secondary to decreased surfactant production → intrapulmonary shunting

Pulmonary Emboli: Pathophysiology (cont)

- Pulmonary infarction
- ↑ pulmonary vascular resistance →
  ↑ afterload on right ventricle
- Right-ventricular failure
Pulmonary Emboli: Clinical Presentation
- Dyspnea and pleuritic chest pain
- Tachypnea
- Refractory hypoxemia
- ABGs: hypoxemia with respiratory alkalosis
  - Example: PaO₂ 71; PaCO₂ 28; pH 7.59; HCO₃ 25; SaO₂ 72
  - Fat emboli: petechiae on thorax, upper extremities

Pulmonary Emboli: Diagnostic Tests
- Chest x-ray
- V/Q scan
- CT
- Pulmonary angiogram
- MRI
- D-dimer
- Lower extremity Doppler studies (not emergent)

Pulmonary Emboli: Treatment Options
- ABCs
  - Airway
  - Breathing
  - Circulation
- Administer 100% O₂
- Intubate if necessary
- Thrombolytics
Pulmonary Emboli: Treatment (cont)
- Embolectomy
- Inferior vena cava filter
- Pain management
- Treat cause
- Future prevention

Chest Trauma
- Mechanism of injury
- Index of suspicion

Air Leak Syndromes
- Air enters the pleural space
- Tear in the pleura
- Trauma
- Iatrogenic
- Lung collapses
Classifications

- Tension
- Simple
- Hemothorax (HTX)
- Hemopneumothorax
- Pneumomediastinum
- Sucking chest wound

Chest X-ray

Air Leak Syndromes: Clinical Presentation—Tension Pneumo

- Respiratory distress
- Tachycardia
- Hypotension
- Diminished breath sounds
- Tension PTX
  - Tracheal deviation
  - Jugular vein distention
- Visualized on x-ray
- Hypoxia on ABGs
Pulmonary

Air Leak Syndromes: Treatment Options

- Emergent needle decompression
- Chest tube placement
- Insert high for PTX
- Insert low for HTX

Air Leak Syndromes: Treatment Options (cont)

- Potential for air leak
- No striping or milking routinely
- \( \text{O}_2 \) and, potentially, intubation
- Sucking chest wound
- Air embolism
  - Trendelenburg position
  - Left side to trap air in heart (right ventricle)
- Surgery may be required

Thoracic Surgery

- Tracheal surgery
- Pneumonectomy
- Lobectomy
- Segmental resection (segmentectomy)
- Wedge resection
- Decortication
Thoracic Surgery (cont)

Nursing care

- Oxygen therapy
- Hemodynamic monitoring: central venous pressure
- Positioning
- Initiating "turn, cough, deep breathe" measures
- Promote abdominal breathing
- Nutrition

Thoracic Surgery

Nursing care

- Chest tube
- Assess subcutaneous air
- Assess air leaks
- Special treatment: pneumonectomy
- Cannot lie on operative side
- Assess midline shift of trachea (tracheal deviation)

Review Questions
Question 12

Ten minutes after having a central line placed, a patient complains of SOB and chest pain. The SpO₂ is falling, and a chest x-ray reveals a tension PTX. A needle decompression is successfully performed. The next action by the nurse should be which of the following?

A. Connect a drainage system to the catheter used for the needle decompression
B. Contact anesthesia to intubate the patient
C. Set up for a pulmonary artery catheter (PAC) insertion
D. Set up the chest tube insertion

Question 12—Rationale

Ten minutes after having a central line placed, a patient complains of SOB and chest pain. The SpO₂ is falling, and a chest x-ray reveals a tension PTX. A needle decompression is successfully performed. The next action by the nurse should be which of the following?

D. Set up the chest tube insertion—A needle decompression is followed by a chest tube insertion. The “real” answer to this question would be to monitor the patient, but that isn’t an option
  • Connect a drainage system to the catheter used for the needle decompression—The needle is removed and a CT catheter would be inserted
  • Contact anesthesia to intubate the patient—Not treating problem
  • Set up for a PAC insertion—No indication for PAC

Question 13

Twelve hours after sustaining a pelvic fracture, a patient reports chest pain, hemoptysis, and severe shortness of breath. RR is 34. ABGs on O₂ at 4 L/min via NC are: pH 7.48, pCO₂ 28, pO₂ 68. The nurse should suspect that the patient has developed:

A. A tension pneumothorax
B. A pulmonary embolism
C. Post extubation
D. Respiratory failure
Question 13—Rationale

The nurse should suspect that the patient has developed:

B. A pulmonary embolism—12-hour post long bone fracture, hypoxia, chest pain and air hunger classic for PE (from fat)
   - A tension pneumothorax—Would have tracheal deviation, absent breath sounds
   - Post extubation laryngeal edema—Would present with strider
   - Respiratory failure—True, but a nonspecific answer