

HNN325 - COMPREHENSIVE NURSING PRACTICE INTENDED LEARNING OUTCOMES

WEEK 1 – Respiratory Dysfunction & Respiratory Trauma

- State normal arterial blood gas levels

Arterial blood gases analysis provides valuable information about respiratory and acid-base status of the patient.

Type:	Normal levels:
Partial pressure of oxygen (PaO ₂)	75-100mmHg
Partial pressure of carbon dioxide (PaCO ₂)	38-42mmHg
Arterial blood pH	7.38 – 7.42
Oxygen Saturation (SaO ₂)	94-100%
Bicarbonate – (HCO ₃)	22-28 mEq/L

- Define blunt and penetrating trauma to the thoracic cavity

Blunt thoracic trauma: the type of trauma that occurs when there is no communication from the damaged tissues to the outside environment. It is a chest/lung injury sustained from blunt force mechanism such as: fall, motor vehicle accident, vehicle-pedestrian impact or crush injury, inhalation injury such as smoke or near drowning.

Penetrating thoracic trauma: Occurs when a foreign object enters the thoracic cavity causing damage to the structure and function of the thoracic cavity such as from a stab or gunshot wound.

- Describe the major effects that injuries such as flail chest, pulmonary contusion and cardiac tamponade have on the respiratory systems

Flail chest: Free floating segment of the chest wall, resulting from two or more consecutive ribs fractured in multiple places

- Physiological function of the chest wall is impaired as the flail segment is sucked inward during inhalation and moves outwards during exhalation (paradoxical movement)
- Flail chest can significantly affect ventilation and, consequently, gas exchange.
- Lung expansion is impaired and the work of breathing increases
- Flail chest is frequently associated with underlying pulmonary contusion, which may lead to respiratory failure.
- Flail chest indicates the presence of an underlying pulmonary contusion

Manifestations: Flail chest causes dyspnea and pain, especially on inspiration. Chest expansion is unequal. Breath sounds are diminished and crackles may be heard on auscultation

Pulmonary contusion:

- Pulmonary contusion, or lung tissue injury is frequently associated with flail chest and other blunt chest trauma resulting from abrupt chest compression followed by sudden decompression – MVA, fall or crush injury
- It may occur unilaterally or bilaterally
- Alveoli and pulmonary arterioles rupture, causing intra-alveolar haemorrhage and interstitial and bronchial oedema
- Oedema can be localised to damaged lung tissue or more generalised and results from the inflammatory response and increased capillary permeability

- Inflammation and oedema impair the production of surfactant within the alveoli, decreasing compliance - pulmonary vascular resistance increases and blood flow decrease.
- Airway obstruction, atelectasis (collapse of lung tissue) and impaired gaseous diffusion result
- Associated chest wall injury impairs the ability to clear secretions effectively and the work of breathing is significantly increased.

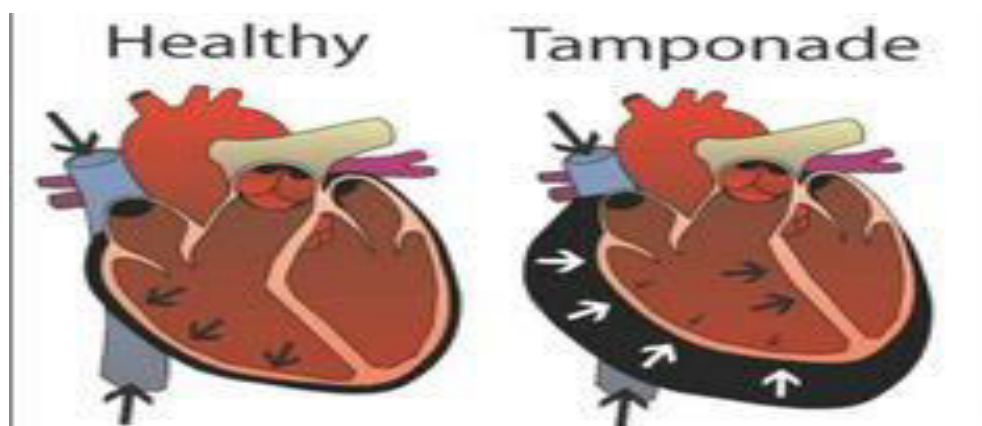
Manifestations:

Early signs - increasing SOB, restlessness, apprehension and chest pain, copious sputum (possibly blood tinged)

Later signs – tachycardia, tachypnoea, dyspnoea and cyanosis

Cardiac Tamponade: compression of the heart due to pericardial effusion, trauma, cardiac rupture or haemorrhage

- Pericardial effusion is an abnormal collection of fluid between the pericardial layers of the heart and threatens normal cardiac function
- Rapid collection of fluid in the pericardial sac interferes with ventricular filling and pumping, critically reducing cardiac output
- Manifestations result from rising intracardiac pressures and decreased diastolic filling and cardiac output
- Paradoxical pulse occurs (pulse decreases in amplitude during inspiration) due to fluid in the pericardial sac and distended right ventricle (occurs during inspiration from decrease intrathoracic pressure and increase venous return to R heart) restricting the filling of the left ventricle and cardiac output.



- Define traumatic, tension and spontaneous pneumothorax
- Describe the pathophysiology of a pneumothorax and haemothorax
- Describe the effects a pneumothorax and haemothorax have on the cardiovascular and respiratory system

Pneumothorax: Accumulation/collection of air between the visceral and parietal pleural (pleural space) due to a breach of either the visceral or parietal pleura

- Can occur spontaneously without apparent cause, as a complication of pre-existing lung disease, as a result of blunt or penetrating trauma to the chest
- Pressure in the pleural space is normally negative in relation to atmospheric pressure and is vital to the process of lung expansion and breathing.
- When either visceral or parietal pleura is breached, air enters the pleural space, equalising the pressure
- Lung expansion is impaired and the natural recoil tendency of the lung causes it to collapse

Spontaneous Pneumothorax: develops when an air filled bleb, or blister, on the surface of the lung ruptures. Rupture allows air from the airway to enter the pleural space.

- Air accumulates until pressures are equalised or until collapse of the involved lung section seals the leak
- Primary spontaneous – affects previously healthy people. Air filled blebs tend to form on the apices of the lungs. Some activities increase the likelihood such as high altitude flying or scuba diving
- Secondary spontaneous – affects people with underlying or pre-existing lung disease. Are generally caused by over-distention and rupture of an alveolus, is more serious and potentially life-threatening

Manifestations: Abrupt onset, pleuritic chest pain, dyspnoea and SOB, tachypnoea, tachycardia, unequal lung excursion, decreased breath sounds

Traumatic Pneumothorax: Blunt or penetrating trauma of the chest wall and pleura can cause pneumothorax

- Closed pneumothorax: Air moves between the lungs and the pleural space and can be caused by blunt force trauma and fractured ribs penetrating the pleura
- Open pneumothorax: air moves between the pleural space and the atmosphere through a penetrating wound such as a gunshot or stab wound. Pressure on the affected side equalises with the atmosphere and the lungs collapse rapidly = significant hypoventilation
- Iatrogenic pneumothorax: puncture or laceration of the visceral pleura during central line placement or lung biopsy. Alveoli can also become distended and rupture during anaesthesia, CPR or mechanical ventilation

Manifestations: Pain, dyspnoea, tachypnoea, tachycardia, decreased respiratory excursion, absent breath sounds in affected area, air movement through an open wound

Tension Pneumothorax: develops when injury to the chest wall or lungs allows air to enter the pleural space but prevents it from escaping.

- Pressure in the pleural space becomes positive in relation to atmospheric pressure as air rapidly accumulates with each breath
- Affected lung collapses and pressure causes thoracic organs to shift to the unaffected side of the chest, placing pressure on the other lung
- Ventilation is severely compromised and venous return to the heart is impaired

Manifestations: hypotension, shock, distended neck veins, severe dyspnoea, tachypnoea, tachycardia, decreased respiratory excursion, absent breath sounds on affected sides, tracheal deviation towards unaffected side

Haemothorax: Blood in the pleural space

- Usually occurs as a result of chest trauma, surgery or diagnostic procedures
- Usually due to laceration of the lung, an intercostal vessel or the internal mammary artery. If a major thoracic vessel is disrupted, haemorrhage can be massive.
- Causes also include tumour, pulmonary infarction and infections such as TB
- When blood collects in the pleural spaces, pressure on the affected lung impairs ventilation and gas exchange. With significant haemorrhage, a risk of shock exists