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LECTURER

ICON

S N O	SPECIFIC OBJECTIVE S	TIM E	CONTENT	TEACHER 'S ACTIVITY	LEARNER 'S ACTIVITY	EVALUATI ON
1	Review the anatomy & physiology of the respiratory system	10 min	<p>ANATOMY & PHYSIOLOGY OF THE RESPIRATORY SYSTEM:</p> <p>The respiratory system is situated in the thorax, and is responsible for gaseous exchange between the circulatory system and the outside world. Air is taken in via the upper airways (the nasal cavity, pharynx and larynx) through the lower airways (trachea, primary bronchi and bronchial tree) and into the small bronchioles and alveoli within the lung tissue.</p> <p>The lungs are divided into <i>lobes</i>; The left lung is composed of the upper lobe, the lower lobe and the lingula (a small remnant next to the apex of the heart), the right lung is composed of the upper, the middle and the lower lobes.</p> <p>Mechanics of Breathing</p> <p>To take a breath in, the <i>external intercostals muscles</i> contract, moving the ribcage up and out. The <i>diaphragm</i> moves down at the same time, creating negative pressure within the thorax. The lungs are held to the thoracic wall by the <i>pleural membranes</i>, and so expand outwards as well. This creates negative pressure within the lungs, and so air rushes in through the upper and</p>	explain the anatomy & physiology of the respiratory system with use of LCD	Listening	List out the functions of respiratory system

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lower airways.

Expiration is mainly due to the natural elasticity of the lungs, which tend to collapse if they are not held against the thoracic wall. This is the mechanism behind lung collapse if there is air in the pleural space (*pneumothorax*).

Physiology of Gas Exchange

Each branch of the bronchial tree eventually sub-divides to form very narrow terminal bronchioles, which terminate in the alveoli. There are many millions of alveoli in each lung, and these are the areas responsible for gaseous exchange, presenting a massive surface area for exchange to occur over.

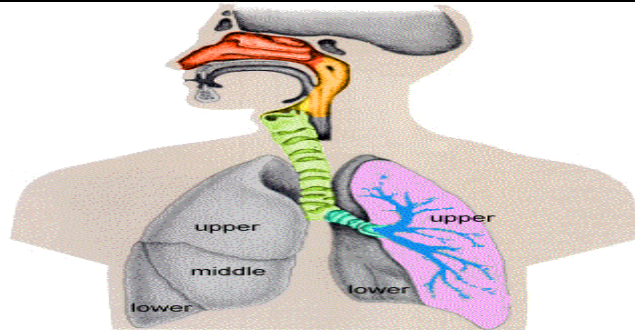
Each alveolus is very closely associated with a network of capillaries containing deoxygenated blood from the pulmonary artery. The capillary and alveolar walls are very thin, allowing rapid exchange of gases by *passive diffusion along concentration gradients*. CO₂ moves *into* the alveolus as the concentration is much lower in the alveolus than in the blood, and O₂ moves *out of* the alveolus as the continuous flow of blood through the capillaries prevents saturation of the blood with O₂ and allows maximal transfer across the membrane.

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The heart is the pump responsible for maintaining adequate circulation of oxygenated blood around the vascular network of the body. It is a four-chamber pump, with the right side receiving deoxygenated blood from the body at low pressure and pumping it *to* the lungs (the pulmonary circulation) and the left side receiving oxygenated blood *from* the lungs and pumping it at high pressure around the body (the systemic circulation).

The myocardium (cardiac muscle) is a specialised form of muscle, consisting of individual cells joined by electrical connections. The contraction of each cell is produced by a rise in intracellular calcium concentration leading to spontaneous depolarisation, and as each cell is electrically connected to its neighbour, contraction of one cell leads to a wave of depolarization and

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contraction across the myocardium.

This depolarization and contraction of the heart is controlled by a specialized group of cells localised in the sino-atrial node in the right atrium- the *pacemaker cells*.

1. These cells generate a rhythmical depolarization, which then spreads out over the atria to the atrio-ventricular node.
2. The atria then contract, pushing blood into the ventricles.
3. The electrical conduction passes via the Atrio-ventricular node to the bundle of His, which divides into right and left branches and then spreads out from the base of the ventricles across the myocardium.
4. This leads to a 'bottom-up' contraction of the ventricles, forcing blood up and out into the pulmonary artery (right) and aorta (left).
5. The atria then re-fill as the myocardium relaxes.

The 'squeeze' is called **systole** and normally lasts for about 250ms. The relaxation period, when the atria and ventricles re-fill, is called **diastole**; the time given for diastole depends on the heart rate.

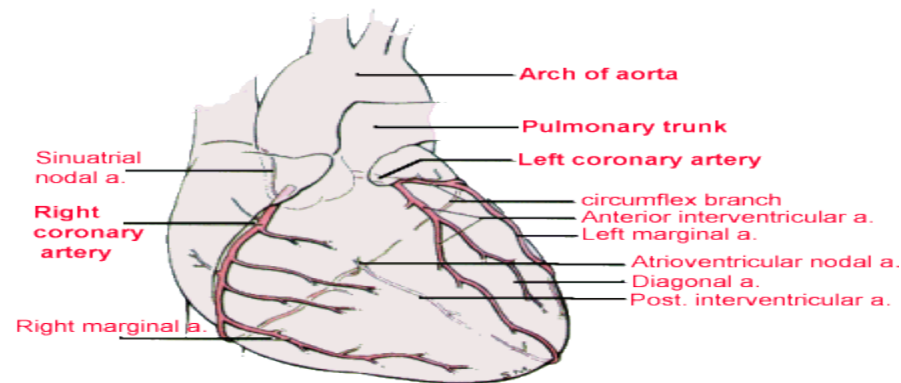
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The Coronary Circulation



The heart needs its own reliable blood supply in order to keep beating- the coronary circulation. There are two main coronary arteries, the left and right coronary arteries, and these branch further to form several major branches. The coronary arteries lie in grooves (sulci) running over the surface of the myocardium, covered over by the epicardium, and have many branches which terminate in arterioles supplying the vast capillary network of the myocardium. Even though these vessels have multiple anastomoses, significant obstruction to one or other of the main branches will lead to ischaemia in the area supplied by that branch.

DEFINITION:

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			Oxygenation is the delivery of oxygen to the body tissues and cells.			
2	Define oxygenation	1min	FACTORS AFFECTING OXYGENATION: Adequate oxygenation is influenced by many factors including: age, environmental and life style factors and disease process•		Listening	Define the oxygenation
3	list out the factors affecting oxygenation	5min	<ol style="list-style-type: none">1. Physiological factors Decreased oxygen carrying capacity-anemia Hypovolaemia-shock and sever dehydration Decreased oxygen carrying capacity Increased metabolic rate Conditions affecting chest wall movements Pregnancy Obesity Musculoskeletal abnormalities Trauma, neuromuscular diseases2. Age(developmental factors): older adults may exhibit a barrel chest and require increased effort to expand the lungs. Older adults are also more susceptible to respiratory infections because of decreased activity of cilia which normally are effective defense mechanism.3. Environmental and lifestyle factors:	explain the definition with use of black board explain the factors affecting oxygenation with use of chart	Listening and asking doubts	list out the some factors affecting oxygenation

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4	enlist the alteration in oxygenation	5min	<p>Environmental and lifestyle factors can significantly affect clients oxygenation status. Clients who are exposed to dust, animal dander, chemicals in the home or workplace are at increased risk for alteration in oxygen</p> <p>Individuals who experience significant physical or emotional stress or who are obese or underweight are also subject to changes in oxygenation status</p> <p>Disease process: Diseases that may affect oxygenation include: obstructive pulmonary disease, atherosclerosis heart failure, anaemia</p> <p>Alteration in respiratory function: Hypoventilation-inadequate alveolar ventilation Hyperventilation- more alveolar ventilation Hypoxia-inadequate tissue oxygenation at cellular level</p> <p>Alteration in cardiac function: Disturbances in conduction Altered cardiac output-left or right side heart failure Impaired valvular function Myocardial ischemia and myocardial infraction</p> <p>ALTERATION IN OXYGENATION: Anemia: Hemoglobin transports 99% of oxygen to tissues Decreased Hb</p>	explain the alteration in oxygenation with use of black board	Listening	Say some alteration in oxygenation
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5	enumerate the indication for oxygen therapy	5min	<p>production, increased RBC destruction, blood loss</p> <p>Toxic inhalation: decreased binding sites</p> <p>Carbon monoxide: Increased Metabolic Rate, increased oxygen demand</p> <p>-Exercise, pregnancy, fever(Prolonged or high fever)</p> <p>Aging: Structural changes chest wall compliance, elastic recoil, functioning alveoli. Defense mechanisms, cilia function, cough force, immunity</p> <p>OTHER RESPIRATORY RISK FACTORS:</p> <ul style="list-style-type: none">•Increased age•Nutrition's•Cigarette smoking•Substance abuse•Exercise•Environmental pollution•Stress/anxiety <p>Assessment of the patients</p> <ol style="list-style-type: none">1. Identify the recurrent and assessment of signs and symptoms	explain the indication for oxygen therapy with use of poster	Listening and asking doubts	List out few important indication for oxygen therapy
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6	list out the types of oxygen therapy	10 Min	<p>associated with impaired oxygenation</p> <ol style="list-style-type: none">2. Determine the risk factors3. Check the eyes4. Pain5. Fatigue6. Dyspnoea, Cough, wheezing7. Environmental exposure8. Smoking9. Respiratory infection10. Allergies11. Health risks and medications12. Physical examination <p>Inspection-head to toe observation Palpation-tenderness, tactile fremitus, thrills, quality of pulse, temperature, capillary refilling, edema Percussion- abnormal fluid or air Auscultation-heart and lung sounds</p> <p>OXYGEN THERAPY:</p> <p>A method by which oxygen is supplemented at higher percentage than what is available in atmospheric air</p> <p>Purpose</p> <ol style="list-style-type: none">1. To relieve dyspnea2. To reduce or prevent hypoxia or hypoxemia3. To alleviate anxiety associated with struggle to breath	explain the types of oxygen therapy with LCD	Listening	list out the various types of oxygen therapy
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7	explain the various methods of oxygen administration	15 min	<p>Sources of oxygenation</p> <ol style="list-style-type: none">1. Central supply2. Oxygen cylinder <p>INDICATION FOR OXYGEN THERAPY:</p> <p>Any individual with one or more of the following:</p> <ul style="list-style-type: none">• Peri and post cardiac or respiratory arrest• Hypoxia - diminished blood oxygen levels (oxygen saturation levels of <92%)• Acute and chronic hypoxemia ($\text{PaO}_2 < 65\text{mmHg}$, $\text{SaO}_2 < 92\%$) signs and symptoms of shock• Low cardiac output and metabolic acidosis ($\text{HCO}_3 < 18\text{mmol/l}$)• Chronic type two respiratory failure (hypoxia and hypercapnia)• Despite a lack of supportive data, oxygen is also administered in the following conditions:<ul style="list-style-type: none">• Dyspnoea without hypoxemia• Post-operatively, dependent on instruction from surgical team• Treatment of pneumothorax• Assessment process - difficulty to obtain arterial blood samples• Clinical conditions in infancy are exclusive although overlaps exist in adolescents	explain the various methods of oxygen administration with LCD	Listening	Explain any one methods of oxygen administration
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TYPES OF OXYGEN THERAPY:

High concentration oxygen therapy

Up to 60 per cent oxygen results in the reduced risk of hypoventilation and retention of carbon dioxide. High concentration oxygen therapy can have detrimental effects on the respiratory system,

Complication: particularly after prolonged usage, and can lead to respiratory distress due to absorption atelectasis (collapse of alveolus due to blockage).

Low concentration oxygen therapy (controlled oxygen therapy)

Used to correct hypoxaemia by using an accurate amount of oxygen.

Long term oxygen therapy (LTOT)

The provision of continuous oxygen therapy for patients with chronic hypoxaemia. Requirements vary between 24-hour dependency and dependency during periods of sleep. Principally aims to improve symptoms and prevent harm from chronic hypoxaemia.

Chronic hypoxaemia include those with:

- Chronic lung disease
- Congenital heart disease with pulmonary hypertension
- Pulmonary hypertension secondary to respiratory disease
- Interstitial lung disease
- Bronchiolitis

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- Cystic fibrosis and other causes of severe bronchiectasis
- Obstructive sleep apnoea and other sleep related disorders

Assessment:

Wherever possible, a set of baseline observations should always be obtained. This should be documented appropriately on relevant.

METHODS OF OXYGEN ADMINISTRATION:

The selection of an appropriate oxygen delivery system must take into account clinical condition, the patient's size, needs and therapeutic goals

- High concentration oxygen is usually delivered via incubator or humidified head box
- For concentrations below 50 per cent, oxygen can be delivered via nasal cannula
- Face masks
- Re-breathe mask
- Humidified oxygen
- wafting
- via nebulisation

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- tracheostomy
- nasal cannula
- via a ventilation circuit

Face mask:

Supplied in child sizes, but has been found that children do not always tolerate them. There are two types of face masks dependant on the condition of the child

1. Simple oxygen mask (variable flow masks)

Vents in the mask allow for the dilution of oxygen. High concentrations of oxygen can be safely administered. If low concentration of oxygen (below four litres) required, then there is a risk of a carbon dioxide build up .

2. High concentration oxygen masks

Used for emergency situations due to a large reservoir that allows oxygen only to be breathed in by the patients. This prevents the inhalation of mixed gases. The approximate oxygen received is 99 per cent

Humidified:

This can be delivered via a face mask or head box, dependent upon patients age/co-operation. Humidified oxygen should be utilised when high percentages of oxygen are required for prolonged periods, and in those with chronic respiratory illness, to prevent drying of the mucosa and secretions.

Nasal cannula oxygen does not need to be humidified

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Wafting:

When conventional delivery methods are not tolerated, wafting of oxygen via a face mask has been shown to deliver concentrations of 30-40 per cent with 10 litres oxygen per minute, to an area of 35x32cm from top of the mask.

Wafting via green oxygen tubing has been assessed as appropriate for short term use only, ie whilst feeding.

Via nebulisation:

If the patients is oxygen dependant, nebulisers should be delivered via oxygen and not air.

Tracheostomy:

Oxygen can be delivered via a tracheostomy mask, Swedish nose or headbox. Consider patients individual needs.

Nasal cannula:

Can be used for long-term oxygen use, whilst allowing the patients to vocalise and eat. The concentration is often not controlled, resulting in a low inspiratory oxygen concentration.

Nasal cannula oxygen does not need to be humidified

Via a ventilation circuit:

Accurate measurement of inspired oxygen is difficult and pulse oximetry must be maintained. Can be delivered at various points throughout the ventilation circuit but always before the humidification unit as oxygen is a

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cold gas that needs to be warmed and humidified.

Via an T piece – open ended bag:

Used frequently by anaesthetists and experience gives a reliable impression of the state of the lungs. This technique allows manual application of PEEP (positive end-expiratory pressure). It is completely reliant on an effective oxygen source

Bag valve mask:

Comes in three sizes: 250mls, 500mls and 1,500mls. The smallest one is ineffective even at birth. Two smallest bags have a pressure limiting valve set at 4.41kPa (45cm H₂O) to protect the lungs from barotrauma (damage caused to tissues by a change in pressure inside and outside the body).

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Subject : Nursing Foundation II
Unit : X
Topic : oxygenation
Hours : 1 hour
Group : B Sc (Nursing) II Semester
Venue : Lecture Hall I, ICON.
Methods of teaching : Lecture cum discussion and demonstration
AV Aids : Black board, Chart, Posters, LCD.

GENERAL OBJECTIVE:

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Help the students to acquire adequate knowledge about oxygenation and develop desirable skills and attitude towards various methods oxygenation used in all health care settings and their day to day nursing practice.

SPECIFIC OBJECTIVES:

At the end of the class, the students are able to

- 1) review the anatomy & physiology of the respiratory system
- 2) define oxygenation
- 3) list out the factors affecting oxygenation
- 4) enlist the alteration in oxygenation
- 5) enumerate the indication for oxygen therapy
- 6) list out the types of oxygen therapy

- 7) explain the various methods of oxygen administration

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2. Taylor Lillis (2012), “ Fundamentals of Nursing, The art and science of Nursing care”, seventh edition, LWW Publication,558-613.

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