

Westmead Intensive Care Unit



Respiratory and Mechanical Ventilation Learning Package

Aim of the Package

To provide the registered nurse with the opportunity to acquire the level of knowledge, through self directed learning, on which to base the nursing skills necessary for safe practice.

Objectives of the Package

1. Identify the relevant gross anatomy of the respiratory tract
2. Discuss the pathophysiology of breathing including terms such as gas exchange, compliance, resistance, ventilation, and perfusion
3. Outline the factors contributing to respiratory failure
4. Understand the indications for and complications of intubation
5. Describe different modes of basic ventilation and troubleshoot basic problems with ventilation.

What to do with the package

1. Attempt all questions
2. You will need to exceed 80% correct answers to pass the package, if this is not achieved you will need to repeat the package
3. Your package will reviewed by a CNE and then you will be provided with the package answers to allow further review

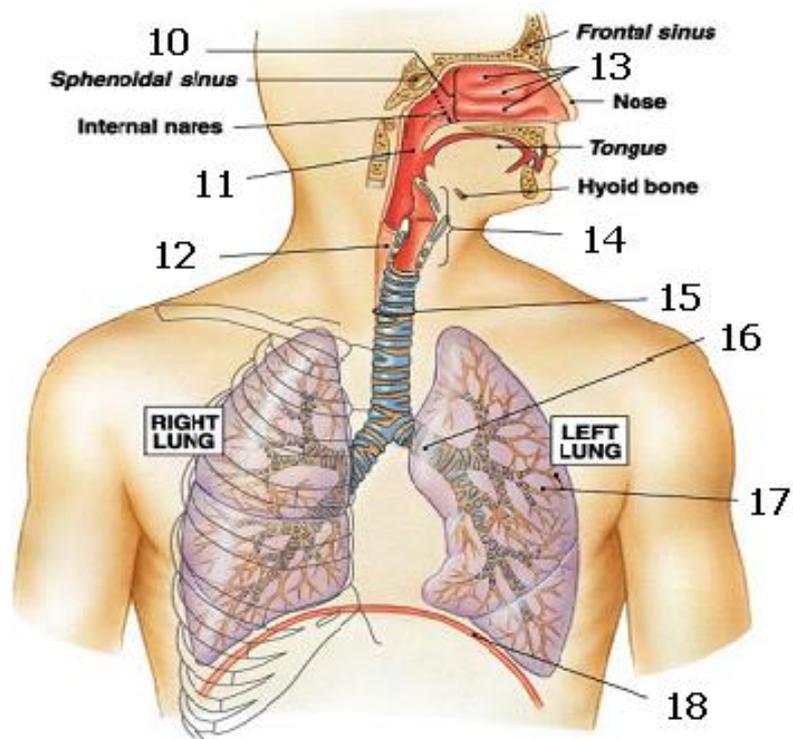
Useful Resources

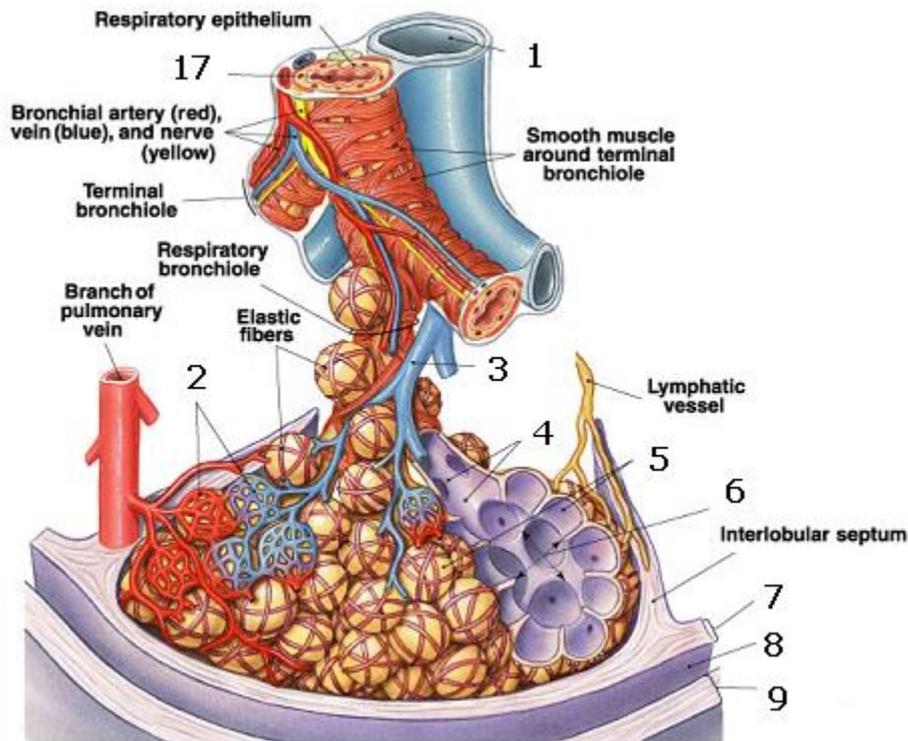
- References found in this package will provide a guide for answering questions. This list is by no means exhaustive and if you wish to do your own research, please do so.
- Textbooks are available in the CNE nook
- CIAP can be access on all the computers through the intranet site.

Respiratory Anatomy

1. Label the following two diagrams choosing from the list below.

Alveolar Duct	Nasal cavity	Visceral Pleura
Alveolar Sac	Trachea	Parietal Pleura
Alveoli	Diaphragm	Pleura space
Arteriole	Bronchus	Capillary Beds
Bronchiole	Oesophagus	Nasal Conchae
Larynx	Pharynx	
Branch of the Pulmonary Artery		





1) For each the structures you have labelled describe the function or functions for each.

Ref. Tortora, G., Derrickson, B., "Principles of Anatomy and Physiology." Ed. 11. John Wiley & sons, Inc.

2) Explain the physiological mechanisms that control breathing.

- 3) Define the terms
- a) Tidal Volume
 - b) Minute Volume
 - c) Functional residual capacity
 - d) Total lung capacity
 - e) Work of breathing

- 4) Describe how Oxygen and Carbon Dioxide are transported
- a) Between the lungs and the pulmonary blood supply
 - b) In the blood
 - c) Between the blood supply and the cells

The relationship between ventilation and perfusion.

The key function of the lungs is gas exchange. The capillaries in association with the alveoli allow this process. Alveoli ventilation (V) is about 4L/min whilst pulmonary capillary perfusion is about 5L/min, so the normal V/Q ratio is 0.8. Additionally, pressure in the pulmonary circulation is low in relation to systemic pressure. It is also influenced by gravity/hydrostatic pressure. In relation to patient position – upright, apices less perfusion than the bases Supine – Apices and bases similar but the posterior receives more perfusion than the anterior. Ventilation is also uneven, with the bases receiving more ventilation than the apices.

Pressures within the surrounding alveoli also influence blood flow through the capillary network. The pressure gradients between arterial and venous ends of a capillary network normally determine blood flow. Alveoli pressure can sometimes be greater than arterial or venous pressures, thus can influence blood flow and gas exchange.

In the upright position.

Zone 1 (upper area of the lungs) – alveoli pressure (PA) > arterial pressure (Pa) and venous capillary pressure (Pv). Blood flow is reduced leading to alveolar deadspace. (Alveoli are ventilated but not adequately perfused.) [PA>Pa>Pv]

Zone 2 (middle portion of the lungs) – Perfusion and gas exchange are more influenced by the pressure differences between arterial and alveoli. With a normal V/Q ratio. [Pa>PA>Pv]

Zone 3 (lung bases) – alveolar pressure is lower than both arterial and venous pressures and ventilation is reduced leading to intrapulmonary shunting (alveoli perfused but not adequately ventilated) [Pa>Pv>PA]

Ref. Elliot, D., Aitkin, L., Chaboyer, W., ACCN'S "Critical Care Nursing"

- 5) Give three examples of reasons that cause ventilation/perfusion mismatch.
- 6) What information can we interpret from the oxygen dissociation curve in different physiological states? When do shifts to the left and right occur?
- 7) Define the terms airway resistance and compliance, and give examples of conditions that may cause:
 - a) Increased resistance
 - b) Decreased compliance
- 8) Define the differences between Type I and Type II respiratory failure.
- 9) List 4 reasons why a patient may require intubation and mechanical ventilation.
- 10) In terms of ventilation strategies what is CPAP and BiPAP and for what reasons may each of them be used?

- 1) List 4 immediate complications to intubation (first few hours).
- 2) List 4 long-term complications to intubation/mechanical ventilation.
- 3) Give 4 examples of patients that may require active humidification.
- 4) List 4 reasons why there maybe air leaking around the ETT or Trachy cuff and describe how you would rectify each.
- 5) What are the indications for suctioning (tracheal aspiration) of ETT or tracheostomies and list 5 complications that may occur?
- 6) Name the parameters and values on an Arterial Blood Gas that will identify
 - a) Respiratory Acidosis
 - b) Respiratory Alkalosis
 - c) Metabolic Acidosis
 - d) Metabolic Alkalosis
- 7) The Peak Airway Pressure alarm setting on the ventilator has a major function. What is it? And at what level should this alarm be set?
- 8) What are 4 causes of increased airway pressures? For each of these what nursing interventions could rectify the situation?
- 9) If your patient self-extubates, what are your immediate actions?
- 10) When should tapes be changed on a ETT or Tracheostomy?
- 11) Complete the following table identifying whether the variables, Pressure and Volume, are set, or dependent on resistance and compliance, and the Flow is constant, or decelerating for each mode of ventilation.

	Flow	Pressure	Volume
Volume Control			
Pressure Control			
Pressure Regulated Volume Control			

Pressure Support			
Volume Support			

12) In what clinical situations could the above 5 modes of ventilation be used?

13) Describe your understanding of what the Synchronised Intermittent Mandatory Ventilation provides for the patient.

14) Why is oral care essential in the intubated patient and describe how you would perform oral care.

References

Maquet Critical Care. *Servo-I: Modes of Ventilation*. Getinge

Oh, T. (1997) *Intensive Care Manual*. Butterworth's, Syd

Oczenski.W., Werba, A., Andel, H., *Breathing & Mechanical Support*. Blackwell Science, Berlin.