Since each hemoglobin molecule can bind to 4 molecules of oxygen, it may bind with 1 to 4 molecules of oxygen. However, hemoglobin is stable only when bound to 4 molecules of oxygen or when not bound to any oxygen. It is very unstable when bound to 1 to 3 molecules of oxygen. Therefore, as shown in the above figure, hemoglobin exists in the body in the form of deoxygenated hemoglobin (Hb) with no oxygen bound, or as oxygenated hemoglobin with 4 molecules of oxygen. Oxygen saturation can be assessed by SaO2 or SpO2. SaO2 is oxygen saturation of arterial blood, while SpO2 is oxygen saturation as detected by the pulse oximetry. They are called arterial blood oxygen saturation and percutaneous oxygen saturation, respectively.

## Relation of PaO2 to SpO2

The amount of oxygen dissolved in the blood is proportional to the partial pressure of oxygen. The amount of oxygen bound to hemoglobin will increase as the partial pressure of oxygen increases. The partial pressure of oxygen is expressed as PO2, and the partial pressure of arterial blood is expressed as PaO2. In contrast, the amount of oxygen bound to hemoglobin does not increase in proportion to the partial pressure of oxygen.

## Purpose/ uses of the pulse oximetry:

- Determining the severity of a disease
- Deciding whether to perform blood gas analysis in order to better understand the patient's condition.
- Deciding on hospitalization of patients with chronic diseases when in acute phase
- Home oxygen therapy, prescribing oxygen, and educating patients receiving home oxygen therapy
- Starting noninvasive ventilator with chronic respiratory failure
- Assessment and risk management of rehabilitation and exercise therapy
- SpO2 is the fifth vital sign after body temperature, blood pressure, and respiration.
- Screening for sleep apnea syndrome
- The pulse oximetry is used as a part of monitoring of patients with dysphagia when they are observed while eating.
- The oxygen saturation may decrease in patients with pulmonary diseases such as COPD, sleep apnea syndrome, cardiac disorders such as valvulopathy, as well as persons living at high altitudes. In these cases, the bone marrow is stimulated to produce more red blood cells and consequently polycythemia (secondary polycythemia). The pulse oximetry may be used to measure SpO2 and determine causes of polycythemia.
- Monitoring during examinations such as endoscopy



## How does the pulse oximetry work?

Pulse oximetry measure the absorption of specific wavelengths of light in oxygenated hemoglobin as compared with that of reduced hemoglobin. Arterial oxygenated blood is red due to the quality of oxyhaemoglobin it contains, causing it to absorb light of certain wavelengths. The oximetry probe has two light-emitting diodes (LEDs), one red and one infrared, located on one side of the probe. The probe is placed on a suitable part of the body, usually a fingertip or ear lobe, and the LEDs transmit light wavelengths through pulsating arterial blood to a photo detector on the other side of the probe. Infrared light is absorbed by the oxyhaemoglobin; red light by the reduced hemoglobin. Pulsatile arterial blood during systole causes an influx of oxyhaemoglobin to the tissue, absorbing more infrared light, and

This will rapidly reverse hypoventilation due to drugs or a high spinal and cause a collapsed lung to re-expand. The lower airway should be suctioned with suction catheters to remove any secretions. A nasogastric tube should be passed to relieve stomach distension.

A pneumothorax may occur following trauma, central line insertion or a supraclavicular brachial plexus block. It should be suspected if there is reduced air entry on the affected side. In thin patients a hollow note on percussion may also be detected. A chest X-ray is diagnostic. A chest drain should be inserted to prevent the pneumothorax from worsening. When there is associated hypotension (tension pneumothorax), the pneumothorax should be treated by emergency needle decompression through the 2nd intercostal space in the mid-clavicle line without waiting for an X-ray. A definitive chest drain should be inserted later. Always maintain a high index of suspicion in trauma cases.

**C -** Is the circulation normal?

• Feel for a pulse and look for signs of life, including active bleeding from the surgical wound
• Check the blood pressure
• Check the peripheral perfusion and capillary refill time.
• Observe for signs of excessive blood loss in the suction bottles or wound swabs
• Is anesthesia too deep? Is there a high spinal block?
• Is venous return impaired by compression of the vena cava (gravid uterus, surgical compression)
• Is the patient in septic or cardiogenic shock?

An inadequate circulation may be revealed by the pulse oximeter as a loss or reduction of pulsatile waveform or difficulty obtaining a pulse signal.

**Action**

• If the blood pressure is low, correct it
• Check for hypovolemia
• Give IV fluids as appropriate (normal saline or blood as indicated)
• Consider head down or leg up position, or in the pregnant mother, left lateral positioning.
• Consider a vasoconstrictor such as ephedrine or phenylephrine
• If the patient has suffered cardiac arrest, commence cardiopulmonary resuscitation (CPR) and consider reversible causes (4 H's, 4T's: Hypotension, Hypovolemia, Hypoxia, and Hypothermia; Tension pneumothorax, Tamponade (cardiac), Toxic effects (deep anesthesia, sepsis, drugs), Thromboembolic (pulmonary embolism).



**D – Drug effects**

Check that all anesthesia drugs are being given correctly.

• Excessive halothane (or other volatile agent) causes cardiac depression.
• Muscle relaxants will depress the ability to breathe if not reversed adequately at the end of surgery.
• Opioids and other sedatives may depress breathing.
• Anaphylaxis causes cardiovascular collapse, often with bronchospasm and skin flushing (rash).

This may occur if the patient is given a drug, blood or artificial colloid solution that he/she is allergic to. Some patients are allergic to latex rubber.

**Action**

• Look for an adverse drug effect and treat as appropriate.
• In anaphylaxis, stop administering the causative agent, ventilate with 100% oxygen, give intravenous saline starting with a bolus of 10ml/kg, administer adrenaline and consider giving steroids, bronchodilators and an antihistamine.

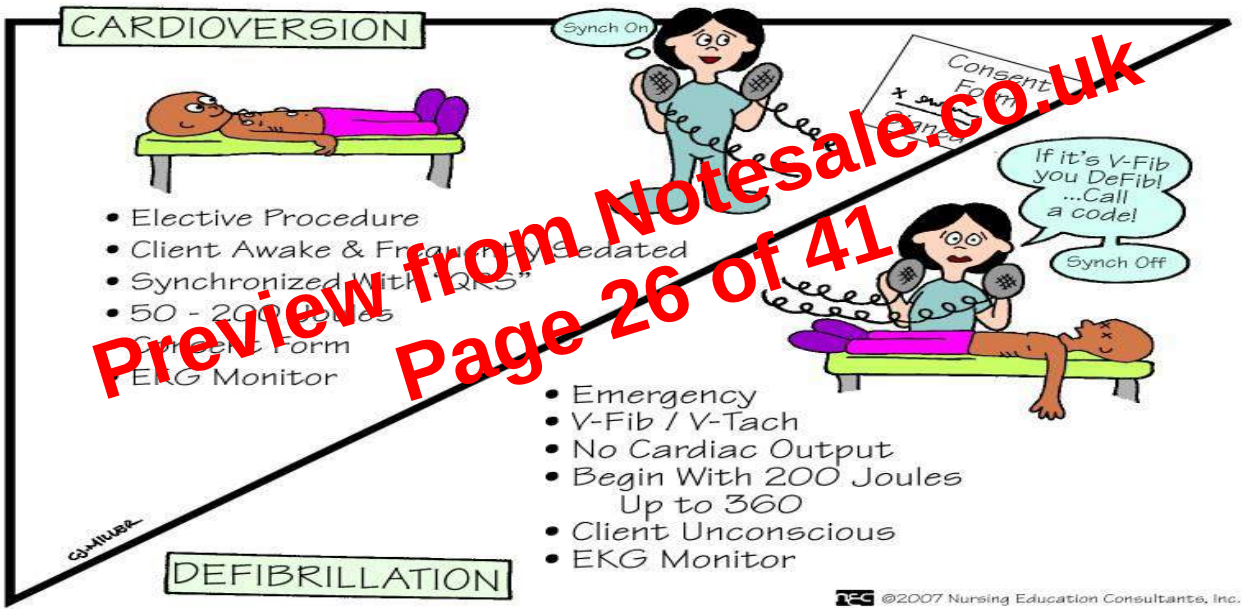
**E - Is the equipment working properly?**

• Is there a problem with the oxygen delivery system to the patient?
• Does the oximeter show an adequate pulse signal?

- The patient is instructed not to eat or drink for at least 8 hours before the procedure.
- Before cardioversion patient receive intravenous sedation as well as an analgesic medication.
- Respiration then supported with supplemental oxygen.
- The amount of voltage used varies from 50-200 joules.
- Indications of a successful responses are conversion to sinus rhythm, adequate peripheral pulses, and adequate blood pressure.
- Because of sedation airway patency must be maintained vital signs and oxygen saturation must be monitored regularly
- ECG monitoring is required during and after cardioversion.

## Defibrillation:

- It is used in emergency situations as the treatment of choice for ventricular fibrillation and pulseless VT
- Defibrillation depolarizes a critical mass of myocardial cells at once, when they repolarize, the sinus node usually recaptures its role as the pacemaker.
- The procedure is associated with potential hazards particularly myocardial damage. Higher the amount of energy of shock greater is risk of damage






## Medical uses:

- Defibrillation is often an important step in cardiopulmonary resuscitation (CPR). CPR is an algorithm-based intervention aimed to restore cardiac and pulmonary function.
- Defibrillation is indicated only in certain types of cardiac dysrhythmias, specifically ventricular fibrillation (VF) and pulseless ventricular tachycardia.
- If the heart has completely stopped, as in asystole or pulseless electrical activity (PEA), defibrillation is not indicated. Defibrillation is also not indicated if the patient is conscious or has a pulse. Improperly given electrical shocks can cause dangerous dysrhythmias, such as ventricular fibrillation.

## Functions of Buttons:

- START/STOP – Start/Stop button is use to start/stop the infusion of saline.
- ADULT-MICRO Button – These button is use to set the age of the patient.
- ML MODE – These button is use to set units of infusion i.e. ml or drop.
- SET RATE/SET ml/SET TIME (T) – SET RATE is use for setting the rate of saline i.e. amount of saline in ml/hr. SET ml button is use to set ml. SET T button is used to set the time.
- YES/NO Button – YES Button is use for permitting the command and to increase the numerical value when we are setting rate, ml, time and NO Button is use for declining the command and also for decreasing the numerical value.
- ENTER – ENTER Button is use for access the command.
- KVO [Keep Vein Open] – KVO Button is use to keep vein open.
- Button Is use for going next in the numerical digits when we are setting rate, ml, and time.
- CALL – To call the attendant by alarming.




## Set Rate Factor:

- Formula : ml/hr. * drop factor/60 = drops/min
- Drop Factor :

Drop Factor is nothing but the constant value which is different for every liquid.

1. For Blood – 15 2. For Fluids – 20

- How we use by simplifying it?
- For Blood – ml/hr. * 1/4 (15/60) = drops/min
- For fluids – ml/hr. * 1/3 (20/60) = drops/min

- Don’t store or operate it to the area where the air pressure increases or decreases spontaneously.
- Don’t expose it to the dust or in the presence of corrosive gas in atmosphere.
- Don’t carry it in the area where vibration occurs.
- Don’t expose it at hot place or splashing water

## Advantages for syringe pumps:

- Easy to use and virtually maintenance free
- Ideal for low flow at high pressure
- Excellent pulse-less flow
- Available with accuracy of 0.5%
- Repeatability of 0.2%
- Wide dynamic range, typically 100,000:1

**MAINTAINANCE OF PUMPS:**

- Always place pump and supplies on a clean surface.
- Keep food and drinks away from the area around the pump.
- Monitor children when in the pump area.
- Before touching the pump

➢ wash hands

➢ dry with a clean paper towel

➢ change tubing according to pump’s instructions

➢ Change batteries or recharge the pump as directed by healthcare provider.

➢ **Surroundings**



Radio transmitters (such as cell phones, wireless hand-held computers, two way radios are sources of strong electric and magnetic interference (EMI), such as large electric motors, could affect pump.

Pump users, care givers, and others should use caution and keep electromagnetic sources away from the pump.

## CONCLUSION:

Equipment used in the ICU varies from the general, such as instruments to measure blood pressure, to very specialized devices, such as bedside monitors or ventilators. ICU equipment may be used to monitor the patient and/or help treat their illness. NET brand ICU Equipment have set new standards in intensive care. The ICU equipment we offer include Defibrillator, Patient Monitor, Ventilator, CPAP & BPAP systems etc. so main role of nurse is to maintain these equipment's and use properly to treat patient early as soon as possible.

## SUMMARY:

**This assignment includes the following things:**

**Ventilator:**

- Definitions
- Purposes
- setting up the ventilator
- Mechanical ventilator settings
- uses for mechanical ventilation
- Procedure & *points of emphasis

**Pulse oximetry:**

- Definition
- Oxygen saturation
- Relation of PaO2 to SpO2
- Purpose/ uses of the pulse oximetry
- How does the pulse oximetry work?
- Practical uses
- Maintenance Checklist Pulse Oximetry

**Monitors:**

- Bedside monitor
- Purposes and uses
- Cardiac monitors
- Types of monitors
- Recommendations for cardiac arrhythmia monitoring in the emergency department
- Setting of monitors and maintenance

**Transducers:**

- Introduction & definitions
- Types of ultrasound transducer
- Application of biomedical transducer

**Defibrillators:**

- Cardioversion
- Defibrillator
- Medical uses
- Types of defibrillator
- Principle and uses
- Types of waveforms
- Maintenance of defibrillator
- Role of nurse