Introduction

The mouth cavity is bounded by the alveolar arch and teeth in front, the hard and soft palate above, the anterior two-thirds of the tongue and the reflection of its mucosa forward onto the mandible below, and the oropharyngeal isthmus behind.

The function or respiration is to ensure the needs of the tissues for oxygen and for removal of CO_2. The Process of respiration can be divided into four major mechanistic events:

Pulmonary ventilation: Which means the inflow and outflow of air between the atmosphere and lung alveoli.

Diffusion: Diffusion of oxygen and carbon dioxide between the alveoli and the blood.

Pulmonary perfusion: The volume of blood Pumped by the right ventricle to the lungs is 5L/min.

Gas transport function of the blood: The transport of oxygen and carbon dioxide by blood is mainly in chemical combination. The Process of pulmonary ventilation is regulated by respiratory centers present in the brain stem according to cellular needs.

Compliance refers to the ease with which the lungs and thoracic wall can be expanded. High compliance means that the lungs and thoracic wall expanded easily. Low compliance means that they resist expansion. Compliance is related to two principal factors: elasticity and surface tension. Presence of elastic fibers in lung tissue results in high compliance. If surface tension within lung tissue were high, the tissues would resist expansion, but surfactant lowers surface tension and thus increases compliance. Compliance is a ratio between change in volume and change in distending pressure $\frac{\Delta V}{\Delta P}$ (volume change per unit pressure change) because a lung may be considered as an elastic sac, its volume

depends on the pressure difference between its inside and outside surface, the transmural pressure. Transmural pressure = Distending pressure.
= pressure inside–pressure outside or =Alveolar pressure–pleural pressure
Compliance is a measure of expandability (Dispensability) and not mere elasticity. (Sade, et al. 1970).

In normal range (expanding pressure about -2 to -10 Cm water) the lung is remarkably dispensable or compliant.

The compliance is 0.22 liters per Cm H_2O pressure.

Diffusion is transfere of gas across the blood gas barrier. This process occurs by diffusion. Respiratory membrane or alveolo-capillary membrane separates the alveolar gases from blood.

$$\mathbf{D} \alpha \frac{\textbf{pressure gradient} \times \textbf{Surface area} \times \textbf{Solubility}}{\textbf{thickness of membrane} \times \sqrt{\textbf{MW.}}}$$

The bronchial circulation is the main supply to the bronchi and intralobular bronchioles and is a division of systemic circulation.

Shunt refers to blood which enters the arterial system without going through ventilated areas of lung.

The heart is irregularly conical in shape, and it is placed obliquely in the middle mediastinum. The right border is formed entirely by the right atrium, the left border partly by the auricular appendage of the left atrium but mainly by the left ventricle, and the inferior border chiefly by the right ventricle but also by the lower part of the right atrium and the apex of the left ventricle.

The arterial supply to the cardiac musculature is derived from the right and left coronary arteries.

The right coronary artery arises from the anterior aortic sinus and passes forwards between the pulmonary trunk and the right atrium to descend in the right part of the atrio-ventricular groove. At the inferior border of the heart it continues along the atrio-ventricular groove to

anastomose with the left coronary at the inferior interventricular groove. It gives off a marginal branch along the lower border of the heart and an interventricular branch which runs forward in the inferior interventricular groove to anastomose near the apex of the heart with the corresponding branch of the left coronary artery.

The cardiac output (co) is quantity of blood pumped by pumped by each ventricle into the circulation (greater or lesser) per minute.
The co is responsible for the transport of substances to and from the tissues.

When the exercise begins, these processes continua and arm augmented by the accumulation of metabolites resulting from the muscular contraction, The efficient return to the heart of the larger quantities of blood flowing through the muscles is by the pumping action of respiration and of the muscles themselves. This and the other factors previously described lead to an increase in the cardiac output and in the circulation through the muscles which enables adequate supplies of oxygen to reach them, and ensures the removal of waste products.

When large amounts of blood flow into the ventricles during diastole, their end–diastolic volume can be as great as 200 to 250 ml. When the heart contracts strongly, the end systolic volume can fall as little as 10 to 30 ml, by both increasing end–diastolic volume and decreasing the end systolic volume, the stroke volume can be increased twice or three times its normal volume e.g. 200 ml, If venous return rises more than 15 litres / min. the heart will not pump it without cardiac stimulation, Stimulation of the heart by the sympathetic system increases the cardiac output to about normal, This effect comes out by autonomic increase in heart rate and force of contraction, In heavy exercise cardiac output is increased to 20-25 litres /ml. (Sharp, et al. 1970).

Pressure Gradient: The pressure gradient for venous return is the difference between the mean systemic filling pressure and the right atrial pressure. Normally the mean systemic filling pressure is 7 mm. Hg. The normal right atrial pressure is about 0 mm. Hg. The greater the difference between the mean systemic filling pressure and the right atrial pressure, the greater becomes the venous return.

After load: One of the most important features of the Frank-Starling's law of the heart is that, within limits, changes in the arterial blood pressure load, against which the heart pumps, have no effect on cardiac output, When the arterial blood pressure is increased, the heart puts out less blood than it receives for several beats. Blood accumulates in the ventricles, and the size of the heart increases. The distended heart, beats more forcefully and the output returns to its previous level.

The arterial blood pressure depends primarily upon two factors the cardiac output and peripheral resistance but it is also affected by the elasticity of the large arteries and by the changes in the blood volume

Normal resting rate is 65-85 beats per minute.

Tonic reflex stimulation of cardio-vagal discharge when the blood pressure drops carotid and aortic baroceptor discharge decreases. Sympathetic discharge is reflexly increased, and vagal activity is reflexly lessened. Both these responses serve to minimize the fall of blood pressure. Hypoxia and Hypercapnia: Hypoxia and hypercapnia both stimulate the medullary cardiovascular centers directly inducing vasoconstriction and tachycardia.

The most important muscles of inspiration are: Diaphragm and External intercostals, Diaphragm consist of a thin, dome-shaped sheet or muscle which is inserted into the lower ribs. When it contracts the abdominal contents are forced downward and forward and the vertical dimension of chest cavity is increased. In addition, the rib margins are

lifted and moved out, causing an increase in transverse diameter of the thorax. So, descent, of diaphragm increases the vertical dimension of the chest.

Trams-airway pressure gradient = (10-20 cm H_2O): It is a pressure difference between the atmosphere and alveoli. This is the pressure gradient that will result in movement of gas into or out of the pulmonary system it is also called driving pressure or inflation pressure. The expiratory driving pressure is the result of the elastic recoil of the lung tending to return the lung to its resting state producing a transairway pressure the rate of expiratory flow will be affected by airway resistance lung compliance and chest wall compliance. Elastic forces create an increased pressure within alveoli and alveolar pressures become positive during expiration. At end of expiration there is a period of absent flow (expiratory pause).

Negative pressure ventilators, create a negative thoraco-abdominal pressure, thus expanding the thorax and lowering pleural (extrathoracic) pressure to more negative levels. Air flows from the mouth to the alveolus. Expiration occurs when the negative thoraco-abdominal pressure exerted by the ventilator ceases allowing the pleural pressure to rise, alveolar pressure becomes above atmospheric and reversing mouth alveolar pressure gradient. (Robartson, et al. 1969).

Continuous mandatory ventilation "CMV" previously termed intermittent positive pressure ventilation (IPPV), controlled ventilation is defined as the patient taking no role in the ventilatory cycle the machine initiates inspiration, rate of ventilatoion and tidal volume.

Augmented ventilation is defined as both the patient and machine being involved. Patients maintained on augmented mode have a better survival rate than those maintained on control mode because patients who are maintained on augmented ventilation have reasonable cardio-vascular

reserves while most patients requiring CMV are severely suffering from unstable cardio-vascular system.

This mode of mechanical ventilation allows the patient to breathe spontaneously through the ventilator circuit, it is used as a weaning technique, and as a maintenance mode IMV is more efficient, and safer, the ventilator can be adjusted to the patient without any sedation or even muscle relaxants, other advantages of IMV are the reduced risk of incidents caused by disconnection and the fact that the combination of ventilation and spontaneous breathing improves auto-regulation of the acid-base balance. IMV trains the inspiratory muscles and decrease severity of disorders of breathing co-ordination, IMV reduces the mean intrathoracic pressure that leads to positive effect on circulatory system.

Three forms of HFV are available. High–frequency positive–pressure ventilation involves delivering small "conventional" tidal volume at a rate of 60 – 120 breaths/min. High–frequency jet ventilation (HFJV) utilizes a small cannula at or in the airway through which gas is injected 80-300 times/min; gas entrainment (Bernoulli effect) may augment tidal volume. (Rosenhanex, et al. 1971).

Expiration retard aims at slowing down exhalation, This tends to hold collapsing alveoli and airways open for longer, In most cases of severe obstruction, expiratory flow will be markedly improved when retard is applied, it can be useful in asthma.

PEEP implies positive airway pressure at end expiration and throughout the expiratory phase of the respiratory cycle. Other terms that are used more or less interchangeably are CPPB, CPPV, CPAP, and PEPP.

The effects of PEEP on blood gases, pulmonary function, and hemodynamics are thoroughly documented and reasonably well understood. A much more controversial issue, despite considerable

investigation in recent years, concerns whether or not PEEP actually affects the amount of pulmonary edema fluid in patients with adult respiratory distress syndrome or heart failure. (Achloerb, et al. 1970).

Hazards of PEEP include (1) decreased cardiac out-put, (2) pulmonary barotrauma, (3) increased extravascular lung water, (4) redistribution of pulmonary blood flow: (5) Hazards of humidification, (6) Hypocapnia and alkalaemia, (7) Gastro-intestinal complications, (8) Renal malfunction, (9) Mechanical malfunction and (10) Psychological trauma. (Birger, et al. 1975).