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OXYGEN THERAPY IN ICU

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Intensive care unit

An intensive care unit (ICU), also known as an intensive therapy unit (ITU)

a unit in a hospital providing intensive care for critically ill or injured patients that is staffed by specially trained medical personnel and has equipment that allows for continuous monitoring and life support, Intensive care units cater to patients with severe and life threatening illness or injuries, which require constant, close monitoring and support from specialist equipment and medications in order to ensure normal bodily function.

ICUs are also distinguished from normal hospital wards by a higher staff-to-patient ratio and access to advanced medical resources and equipment that is not routinely available elsewhere. Patients may be transferred directly to an intensive care unit from an emergency department if required, or from a ward if they rapidly deteriorate, or immediately after surgery if the surgery is very invasive and the patient is at high risk of complications.

Types of ICU:

Hospitals may have ICUs that cater to specific medical specialties or patients, such as those listed below:

1) Neonatal intensive care unit (NICU).
2) Pediatric intensive care unit (PICU).
3) Coronary care unit (CCU).
4) Neurological intensive care unit (NICU).
5) Trauma intensive care unit (Trauma ICU).
6) Post-anesthesia care unit (PACU).
7) Surgical Intensive Care Unit (SICU).
8) High dependency unit (HDU).
9) Psychiatric intensive care unit (PICU).
10) Respiratory care unit (RCU).

WORKING IN ICU:

1) Every staff member works for 5 days and has 2 off days (5 working days, 8hr/day).
2) There must be someone present who is responsible for the unit.
3) The total nurse members should be fairly high one nurse per two patients, or three patients in stable cases, and two nurses per one patient in emergency case.

SPECIAL ESTABLISHMENT:

1) The bed capacity should be at least 4% of the total beds in the hospital.
2) The unit should be near to the theater and cut off from the normal rout of visitors.

3) In adult ICUs at least 20m2 of floor area is required for each bed space in an open area exclusive of service areas and circulation space. Single rooms should be at least 25 m2. Pediatric and neonatal ICUs may use less than 20m2 when using cots rather than beds.
4) The beds should be arranged to allow observation of each one.
5) There should be good separation between septic and aseptic patients.

Generally, visitors should not be admitted except with the permission of the officer in charge of the unit, if visitor admitted they must be wear special gowns provided by the hospital.

EQUIPMENT INCLUDES:

1) Patient monitoring equipment, including: ECG, respiratory rate, blood pressure, pulse rate, body temperature, cardiac output, amount of oxygen and carbon dioxide in blood.
2) Life support and emergency resuscitation equipment, including: ventilator, infusion pump, suction apparatus, portable crash cart (resuscitation cart) containing emergency resuscitation equipment such as defibrillator, airways, tracheal intubation kit, self-inflating bag (ambu- bag), masks and medication box.
3) Diagnosis equipment, including: mobile x-ray units and portable clinical laboratory devices.

المحاضرة الثانية

Post-anesthesia care unit (PACU)

A post-anesthesia care unit, also called “post-anesthesia recovery unit” or “recovery room”.

It is the area designated for the monitoring and care of patients who are recovering from the physiological derangements produced by anesthesia and surgery.

The goals of post-anesthesia care unit are:

1) Full return of consciousness.

2) Full return of protective airway reflexes.

3) Full return of skeletal muscles power.

4) Resumption of cardiovascular stability.

5) Resumption of good respiration.

6) Monitoring for bleeding, nausea, hypo and hyperthermia, fluid or electrolytes disturbances… etc. and management of any complication of them.

7) Pain relief.

Standards for PACU:

1) All patients who have received general or regional anesthesia should receive post-anesthesia management in PACU.

2) The patient should be transported to the PACU by a member of the anesthesia team that is knowledgeable about the patient’s condition.

3) Upon arrival in the PACU, the patient should be re-evaluated and verbal report should be provided to the nurse.

4) The patient should be re-evaluated continuously in the PACU.

5) An anesthesiologist should be responsible for discharge of the patient.

Requirements of PACU:

A) Space:

1) Should be located closed to the operating theatres.
2) Should have 1.5 PACU beds per operating theatre used.
3) 40 m2 per patient.
4) Minimum 2 m away between one bed and another.

B) Personnel:

1) Central nursing station.
2) 1:1 ratio for stable case and 3:1 ratio for unstable case.

C) Equipment:

1) Monitors: including- ECG, pulse rate, SPO2, EtCO2, non invasive blood pressure, and body temperature.
2) Tray with labeled emergency drugs.
3) Airway maintenance kit: including- Ventilator, face masks, airway adjuncts, self inflating bags, Venturi masks, endotracheal tubes, laryngoscopes and tracheotomy sets and suction apparatus with catheters.
4) Portable defibrillator.
5) Crystalloid and colloid I.V fluids with I.V canulae and giving sets.
6) Immediate access to: Oxygen, air, pipe connections, clinical labs, x-ray, blood bank, vacuum for suction.
7) Good ventilation (waste anesthetic gases).
8) Good lighting.

PACU discharge criteria: For discharging the patient from the PACU into the ward, he/ she should be:

1) A wake (general anesthesia).
2) Able to Moving (bend knees) and feel legs (spinal and epidural anesthesia).
3) With good skeletal muscles power.
4) With stable vital signs and normal state parameters.
5) With a controlled pain.
6) With a controlled nausea and vomiting.
7) With a normal color.

المحاضرة الثالثة

Oxygen therapy in ICU

Oxygen therapy is the administration of oxygen at a concentration greater than that found in the environmental atmosphere which is 21%.

The purpose of oxygen therapy is to increase oxygen saturation in tissues where it levels are too low due to illness, injury or anesthesia.

Indications for O2 therapy:

1) Respiratory failure.
2) Acute myocardial infarction.
3) Cardiac failure.
4) Shock.
5) Hypermetabolic state induced trauma, burns or sepsis.
6) Severe anemia.
7) Cyanide poisoning.
8) During CPR (cardiopulmonary resuscitation).
9) During anesthesia.
10) Drug induced respiratory depression.

Sources of oxygen:

Oxygen is delivered to the patient either from an O2 cylinder or from an O2 central source through a pipeline.

A reducing valve (O2 regulator) is connected to the cylinder to reduce the high pressure to an adequate pressure the patient's airways can tolerate, it is also contains a pressure gauge shows the amount the amount of the O2 in the tank, a flow meter controls the O2 rate (liter/minute) and a humidifier preventing the dryness of the mucous membranes of the respiratory tree.

A wall outlet delivers the O2 that supplied by the central O2 source, that wall outlet contains a flow meter to control the O2 rate, some wall outlets contains a humidifier and some of them not because the O2 may delivered moist from the central systems already.

O2 delivery devices

O2 delivery devices Oxygen is delivered from taps at 100% concentration, then put through different devices at different rates to adjust the oxygen concentration that the patient inspires, the percentage of oxygen inspired depends on the flow rate and the delivery device, the flow rate can be set on the wall tap: it varies from 0 – 15L per minute. Delivery devices work with different flow rates.

They include:

1) Hudson mask (simple face mask) : It has holes in, so ambient air can enter the mask and dilutes the O2, this mask delivers 30-40% O2, with 5 – 10 L/min flow rate.

2) Non-rebreather mask: It has a reservoir bag and a one way valve to prevent re-breathing, delivers 85-90% O2, with 15 L/min flow rate.

3) Venturi mask: The mechanism of action is usually quoted as depending on the Venturi effect (reduction in fluid pressure that results when a fluid flows through a constricted section of a pipe), another opinion states it works on the principle of jet mixing.

It delivers 24 60% O2, different color jets deliver different rates, flow rate varies with color, correct flow rate to use with each color it is shown on mask, along with the percentage of oxygen delivered.

Types:

a) BLUE = 2-4L/min = 24% O2

b) WHITE = 4-6L/min = 28% O2

c) YELLOW = 8-10L/min = 35% O2

d) RED = 10-12L/min = 40% O2

e) GREEN = 12-15L/min = 60% O2

4) Nasal cannula: It has two protruding prongs for insertion into the nostrils, delivers 24-30% O2, with 1 – 4 L/min flow rate (4L will dry the nose, 2L is more comfortable).

5) Oxygen tent: It consists of a canopy placed over the head and shoulders, or over the entire body to provide O2 at a higher level than normal.

Non-invasive ventilation

Non-invasive ventilation Is the delivery of oxygen (ventilation support) via with a tight fitting mask attached to a ventilator face mask and therefore eliminating the need of endotracheal interventions.

Non-invasive ventilation (NIV) refers either to CPAP or BiPAP:

1) CPAP (continuous positive airways pressure): It gives a continuous pressure (analogous to PEEP: positive end expiratory pressure), usual settings are 5, 7.5 or 10 cmH20.

The aim of CPAP is to splint airways, reduce alveolar collapse, enables alveolar recruitment and to increase the functional residual capacity.

2) BiPAP (bilevel positive airways pressure): The ventilator delivers two different airway pressures.

These are an inspiratory pressure and an expiratory pressure.

The expiratory pressure (EPAP) is analogous to PEEP on CPAP and is usually set between 4-6 cmH2, the inspiratory pressure (IPAP) is a higher pressure which aims to augment the patient's inspiratory effort, Common settings for IPAP are 12 cmH20 which can then be escalated depending on the patient response.

It can go up to 20 cmH20 if needed.

Invasive ventilation

Invasive ventilation requires endotracheal intubation or a tracheostomy.

However, invasive ventilation allows the intensivist to manipulate the patient's respiratory physiology controlling the respiratory rate, tidal volume, inspiratory flow, inspiration expiration ratio, the FiO2 and the airway pressure.

Patients who are ventilated may also take a long time to wean and during this time they will become physically deconditioned and rely on nasogastric feeding.

Patients who are ventilated are managed very carefully and need stress ulcer prophylaxis, DVT prophylaxis, daily chest physiotherapy, oxygen humidification and intensive monitoring of gaseous exchange.

1) Endotracheal tube: It is inserted into the trachea for the primary purpose of establishing and maintaining a patent airway and to ensure the adequate ventilation. It is nearly always inserted through the mouth (orotracheal) or nose (nasotracheal).

2) Tracheostomy tube: It is inserted in a surgical procedure which consists of making an incision on the anterior aspect of the neck and opening a direct airway through an incision in the trachea.

Airway adjuncts

They used to maintain or provide a patent airway.

It does this by preventing the tongue from covering the epiglottis which could prevent the patient from breathing.

They are of 3 types:

1) Oropharyngeal airway

2) Nasopharyngeal airway

3) Laryngeal mask airway