OXYGEN THERAPY - THE BASICS

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Definition

• Oxygen therapy is a medical treatment that provides extra oxygen to the tissues of the body through the lungs, a process known as respiration.

• Oxygen is essential for the body to function properly. The body needs oxygen to survive. The heart relies on oxygen to beat and pump blood. If not enough oxygen is circulating in the blood, it's hard for the tissues of the heart to keep pumping.

• Documented or suspected hypoxemia, or deficient oxygenation of the blood, defined as a Pao2 (Partial Pressure of Oxygen) below 60 mm Hg, an Sao2 (Saturation of Oxygen) or Spo2 (Percentage of Oxygen Saturation) below 90%, needs O2

Supplemental oxygen is used to treat medical conditions in which the tissues of body do not have enough oxygen, including:

• Asthma
• Chronic Bronchitis
• Anaemia
• Pulmonary oedema
• Congestive Heart Failure
• Severe trauma
• Acute myocardial infarction
• Oxygen is also used to treat victims of smoke inhalation. It helps reduce the spasms and swelling that smoke causes in the lungs.
• Mountain climbers and pilots use supplemental oxygen when they are at heights where there is not enough oxygen in the atmosphere.

• In the hospital, oxygen is used during surgery to help give anaesthesia. After surgery, a person may be given oxygen for a short time to help awaken from the anaesthesia.
• Oxygen is also given to improve the results of some treatments.

Air transit
• Room air consists of about 21% oxygen, 78% nitrogen, and 1% other gases, so the fractional concentration of oxygen in inspired air is 21%.
• By giving supplemental oxygen, you can raise the patients to as much as 100% oxygen.

Physiology of Respiration
• Exchange of O2 and CO2 between the outside atmosphere and the cells of the human body. This process has a very short-term cycle, which consist of inspiration, expiration and a rest and the average length of time implied in one whole cycle is about 3 seconds.
• Oxygen is transported to the tissues in two ways: About 97% of oxygen is bound to haemoglobin, and the other 3% is dissolved in plasma. The ABG of 80 to 100 mm Hg is considered normal, but will increase if the patient receives a higher oxygen concentration.
Organs of the Respiratory system

• Upper airway-nose, pharynx, larynx
• Lower airway-trachea, bronchi and lungs, alveoli, pleura

CONTROL OF RESPIRATION:
• Medulla oblongata
The respiratory system works independently of the person’s spontaneous control, although one can obtain some suppression of breathing, which is only to a certain extent.

MAJOR MANIFESTATION OF RESPIRATORY PROBLEMS:
• Cough and sputum
• Haemoptysis
• Hoarseness
• Dyspnoea-wheeze
• Chest pain

Clinical Assessment

• Change in respiration (tachypnoea and dyspnoea)
• Pale at first, then cyanosis
• Hostile, uncooperative, anxious, restless, irritable, disorientated to lethargic, comatose without treatment
• increasing tachycardia to bradycardia
• Hypertension to hypotension

Respiratory Rates

Will vary with age and gender: 12-18 breaths per minute is considered normal in a healthy adult (Blows 2001).

Abnormal Respirations includes:
• Tachypnoea: regular but over 20 b/m
• Bradypnoea: regular but less than 12 b/m
• Apnoea: Absence of respirations, patient gasps
• Dyspnoea: Difficulty in breathing
• Cheyne-Stokes respirations: Breathing shallow, very slow, laboured with apnoea (as in the dying)
• Hyperventilation: Breathing rapid due to physical/psychological cause. E.g. pain/panic
More than 30 b/m is severe hyperventilation
Giving Oxygen

- Wall-mounted Oxygen point
- Compressed gas cylinder: Oxygen tank (most common way)
- Oxygen concentrator: This device removes most of another gas, nitrogen, from the air, which makes the oxygen more concentrated.

Facts

- Oxygen discovered in 1772
- First use as medical remedy in 1783
- Odourless, tasteless and invisible gas
- Considered as drug-trained personnel
- Combustible ⚡
- Can be toxic ☠

Health & Safety

- No smoking-signs 😷
- Five feet away from stoves, candles, fireplaces
- No cleaning fluid, paint thinner, aerosol sprays, oil, grease, alcohol, antiseptic
- Keep upright and secured
- Never knock cylinders violently, drop or allow to fall over
- Avoid dragging cylinders

- Never cover or store near curtains
- Do not overstock
- Prior to use check expiry and that the cylinder is the correct one
- For the flow rate to remain satisfactory, tubing should be kept as short as possible. Prevent kinking
- Never fully empty the cylinder prior to returning
• Always remove the plastic dust cover from valve
• Do not over-tighten flow meter to cylinder-never use a tool
• Report any defective cylinders to medical gas section
• Fire extinguisher
• Water-based lubricants on lips and nostrils-not oil-based

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**Aim of Therapy**

• Improve respiratory function
• Relief from anxiety
• Promotion of rest and preservation of energy
• Prevention of further complications
• Restoration to optimum level of functioning
• Remain calm-especially in an emergency, remain with client, inform patient
• Establish patent airway

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**Benefits**

• Increases oxygen concentration in the alveoli
• Increases arterial oxygen levels
• Increases percentage of inspired oxygen
• Increases oxygen delivered to the tissues

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• Assist breathing, coughing, positioning
• Provide O2 etc
• Provide hydration and humidification
• Remove secretions
• Assess respiratory status and vital signs
• No smoking
**Oxygen-delivery Systems**

- Devices to deliver oxygen to the patient fall into four groups:
  - Low flow systems
  - Reservoir systems
  - High flow systems
  - Enclosures systems

**Low flow system:**
- Nasal catheter-25%-40% O2-4-8L/m
- Nasal cannula-25%-40% O2-2-6L/m-continuous flow-stable, mild respiratory distress
- Tracheostomy oxygen adapters
- Transtracheal catheters

**Reservoir system:**
- Simple mask (no reservoir)-24%-100% O2-10-15L/m-acute to moderate respiratory failure
- Reservoir masks come in two types: a partial rebreather mask and a non-rebreather mask.

**Both masks have a reservoir bag that fills with oxygen, and the bag must be kept inflated. Both can deliver higher oxygen concentrations than a simple face mask.**

- A partial rebreather mask has no one-way valves; a non-rebreather mask has a small one-way valve on the outside of the mask and another inside the mask at the top of the bag where it connects to the mask. These valves allow expired CO2 to leave the mask.
- Partial rebreathing delivers-40%-70% O2-8-15L/m-pneumonia, pulmonary oedema, pulmonary embolism. Client rebreaths ½ of expired air
High Flow System:

- Venturi mask-precise O2 concentrations-colour-coded:
  24% 3L blue, 28% 6L white, 31% 8L orange, 35% 12L yellow, 40% 15L red, 50% 15L pink-used on COPD patients

- Nebuliser/aerosol mask-35% O2 or compressed air with high humidity for nebulised treatment or when humidified O2 needed.

Enclosure systems:

- Oxygen hoods-surround the head of the neonate or small infant
- Closed incubators-for small infants with temperature instability

In Resuscitation:

- Mouth shield (no O2 supplement)-16-18%-compact, disposable, has one way valve for CPR only
- Pocket mask with O2 inlet-90%-10L/m-for single rescuer at scene of emergency-high flow O2 for clients not obtaining adequate air exchange-<8 or >24 b/m
- Bag-valve mask with reservoir (Ambu bag)-100% O2-12-15L/m-high flow for patients not obtaining adequate air exchange-<8 or >24b/m

Other Systems

- Oropharyngeal/Guedal airway
- Nasal airway
- Endotracheal tube-ETT
- LMA
- Suction devices
- CPAP(Continuous Positive Airway Pressure), BPAP (Biphasic Positive Airways Pressure, IPPV (Intermittent Positive Pressure Ventilation)
Humidifiers

- No subjective or objective evidence supports routine humidification of oxygen at flows $\leq 4$ L/min.

Adverse Reactions

- Tearing, pain, oedema of eyes
- Burning, substernal chest pain
- Nasal congestion, sinus pain
- Sore throat, pharyngeal irritation
- Tracheal irritation
- Severe cough
- Nausea

Infection Control

- **Universal precautions** and measures to limit the transmission of tuberculosis must be adhered to at all times.
- Under normal circumstances, low-flow oxygen systems do not present clinically important risk of infection and do not require routine replacement on the same patient.
  - Nasopharyngeal catheters should be changed every 24 hours.
  - Transtracheal catheters should be changed every 3 months.

- Reservoir systems: Under normal circumstances, reservoir systems do not present clinically important risk of infection and do not require routine replacement on the same patient.
- Other devices: Between patients, subject equipment (e.g., probes, oxygen sensors) to high level disinfection.
- Nebuliser solutions: Use only sterile fluids and dispense them aseptically.
Avoid oxygen toxicity

- Especially in patients with chronic obstructive pulmonary disease [COPD]
- Maintain F1O2 (fractional concentration of oxygen in inspired air) of 40% or less to prevent these problems.

Measuring Oxygen Saturation

ABGs-Arterial Blood Gases

- Insertion of a needle into an artery and taking of a blood sample. The artery chosen for this test may be the radial artery at the wrist or the brachial artery on the elbow. An examination of the blood sample provides several measures, including the amount of oxygen and carbon dioxide and its pH.

Pulse Oximeter

- A pulse oximeter, is a noninvasive device used to measure pulse rate and oxygen saturation. It also records and reports pulse rate.
- An oximeter probe is typically clipped to a finger or ear lobe, or is attached to the body with adhesive. It has a sensor that measures the light passing through the skin.

Oximeter Reading

- A normal Spo2 or Sao2 value is above 94%
- Supplemental oxygen use for those who demonstrate saturation levels at 88% or lower as measured by a pulse oximeter. If dependent oedema, polycythemia, or cor pulmonale is also present, a patient can meet the requirement with a saturation level of 89%. Some patients may not qualify for oxygen therapy at rest but can qualify for oxygen during ambulation, sleep, or exercise.
Hyperbaric Oxygen (HBO)

- HBO is another form of oxygen therapy. Compressed oxygen is given at a high level of pressure. 100% oxygen is delivered at a pressure more than 1 1/2 times the normal atmospheric pressure. HBO treats:
  - Carbon monoxide poisoning
  - Gangrene, or tissue death and infection
  - Burns
  - Infections
  - Some wounds that won't heal
  - Severe smoke inhalation
  - Decompression sickness

SUMMARY

- Useful to support life
- Should be administered with care and not given indiscriminately
- Training
- Extra oxygen tank and proper equipment
- Oxygen is expensive. Please close unwanted escape of Oxygen