**Oxygenation**

Oxygenation is the process by which concentrations of oxygen increases within the body tissues and cells. It is necessary to maintain life and health.

**Factors Affecting Oxygenation**

1. **Development factors**: At birth, the fluid filled lungs drain first and PCO2 rises. This cause neonate to take first breath. Lungs are gradually expanding till 2 weeks of age. Changes in aging that affect respiratory system of elders become especially important if the system is compromised by changes such as infection, physical or emotional stress.

2. **Physiological factors**: Whenever diseases can exert their effect on oxygenation including disease of respiretory system like COPD, pneumonia, arny tumor in respiratory system, airway obstruction, etc. Disease which leads to ineffective breathing pattern including Guillain- Barre syndrome, myasthenia gravis, scoliosis, hypnosis, chest wall and pleural defects, any major abdominal or thoracic surgery can cause oxygen insufficiency. Disease of cardiovascular system including anemia or congenital cardiac anomalies that also affect oxygenation.

3. **Behavioral factors**: Whenever stress is there both physiologic and psychological responses can effect oxygenation. They may be hyper ventilation, in which PO2 rises and CO2 falls. The person may experience light headedness and numbness and tingling of the fingers, toes and around mouth. On the other hand, there is release of epinephrine through sympathetic stimulation.

4**. Life style factors:** Physical activity or exercise increase the rate and depth of respiration and hence supply of oxygen in body. But in sedentary people there is lack of alveolar expansion and essential deep breathing pattern. So, these people are less efficient in responding to respiratory stressors.

a. There are some occupational hazards, which can place a person in oxygen insufficiency, e.g. silicosis.

b. Smoking also adversely affects one's ability to maintain good oxygenation status.

5. **Environmental factors**: Altitude, heat, cold and air pollution affect oxygenation, The higher the altitude and lower is the PCO2 a patient breathes. Air pollution can cause stinging of eyes, headache, dizziness, coughing and choking even in healthy people.

6. **Medications:** Certain medications including sedatives, hypnotics and anti anxiety drugs (e.g. diazepam, phenobarbital) and narcotics including morphine can cause respiratory depression.

**HYPOXIA**

Hypoxia is a condition in which the body or a region of the body is deprived of adequate oxygen supply.

**Signs and Symptoms of Hypoxia**

1 Tachypnea, dyspnea

2 Tachycardia

3. Dysrythmias

4. Hypertension

5 Anemia

6. Restlessness

7. Disorientation

8. Lethargy

9. Cyanosis, clubbing

INHALATIONS

Inhalation means breathing air or vapour into the lungs through the nose or mouth.

Inhalation is of two types:

1. Dry inhalation

2. Moist inhalation

1. Dry inhalation:

a . A substance such as ammonia may be inhaled in the treatment of fainting.

b. Amyl nitrate may be inhaled to relieve angina (pain in the heart).

c. Oxygen inhalation.

d. Inhalation of general anaesthetic drugs

e. Aerosol spray.

2. Moist inhalation: Steam inhalation.

**OXYGEN THERAPY**

Definition

Oxygen therapy is the administration of oxygen at concentrations greater than that in room air to treat or to prevent hypoxia. Oxygen delivery system are classified as stationary, portable, or ambulatory and oxygen can be administered by mask, nasal cannula and tent.

**Goals of Oxygen Therapy**

* To correct hypoxia by raising alveolar and blood levels of oxygen
* To decrease symptoms of hypoxia. Supplemental oxygen can help to relieve symptoms of hypoxia, lessen dyspnea /work of breathing improves mental function.
* To minimize cardiopulmonary workload.

**Special Considerations**

1. Oxygen is a gas, which has no smell or color and is heavier than air.

2. It is stored at high pressure in black and white cylinders.

3. Smoking is not allowed anywhere nearby oxygen cylinder.

4. No open fire or any inflammable material should be kept near the oxygen cylinder

5. Oil, grease or alcohol should never be used on the connections of the cylinder.

6. The cylinder is mounted on a stand for easy transport and should be tested before taking it to the bedside. To test it, open the cylinder with the key and then open the small valve very little and test the flow of oxygen from the cylinder into a bottle half filled with water (wolf bottle). The bottle has a rubber cork with two holes, tubes passing through it.

7. The cylinder is connected by means of rubber tubing to the longer tube.

8. Oxygen flows into the wolf bottle and then oxygen is given to the patient.

**Nurses Responsibilities**

1. 24 hours availability of oxygen to meet emergencies. The nurse should see that the cylinders are full and all the apparatus is in working condition, the key is attached with the cylinder in a bag.

2. Explain to the client the dangers of lighting matches or smoking cigarettes, cigars, pipes. Be sure the client has no matches, cigarettes or smoking materials in the bed side table.

3. Make sure that warning signs (OXYGEN NO SMOKING) are posted on the Client's door and above the client's bed.

5. There should not be any leakage in rubber tubing.

6. There should be written order for Oxygen inhalation and specific dose must be prescribed to avoid oxygen toxicity

7. Use regulator to reduce the pressure of the oxygen in the cylinder to a safer level.

8. Measure the flow in litres per minute. Adjust the flow of Oxygen 2 to 4 litres per minute for adults when the nasal catheter is used.

9. Use sterile or disposable nasal catheters to avoid infection

10. The catheter should be changed at least every 8 hours to avoid blockage of catheter

11. The catheter may be taped to the forehead for the comfort of the patient and to keep it in place.

12. Patient's nostrils should be lubricated with petroleum jelly, if there is any sign of irritation.

13. Oxygen administration must never be stopped until the cause of hypoxia is reversed.

14. If nurse is leaving the patient for short period, leave a call bell near the patient.

15. The premature babies should be given oxygen inhalation only for a short time and at a very low concentration to avoid retrolental fibroplasia.

16. Observe the patient, receiving oxygen inhalation continuously to detect early signs of oxygen toxicity

17. Since oxygen helps in combustion, fire precautions are to be taken when the oxygen is on flow.

18. Always be careful when you give high levels of oxygen to a client with COPD. The elevated levels of oxygen in the patient's body can depress their stimulus to breathe

19. Never use oxygen in the hyperventilation patient.

20. Wear gloves every time when you might come into the contact with the client's respiratory secretions (Rationale: To prevent the spread of infection)

Indications

Some of the conditions, where oxygen therapy is used are

1. Hypoxemia

2. Severe respiratory distress (e.g. acute asthma or pneumonia)

3. Severe trauma

4 . Cyanosis

5. Cyanide poisoning

6. Pulmonary edema

7. Shock

8. Circulatory failure

9. Asphyxia

10. Critically ill patient

11. Acute myocardial infarction

12. Short-term therapy, such as post anaesthesia recovery

Hyperbaric oxygen therapy is used in the following conditions

1. Gas gangrene

2. Decompression sickness

3. Air embolism

4. Smoke inhalation

5. Carbon monoxide poisoning

6. Cerebral hypoxic event

**Methods of Oxygen Administration**

* **Nasal Catheter**

It is inserted through nostril with the end of the catheter resting in the oropharynx. Nasal catheter should be changed to another nostril every8 hours. It is not frequently used as may irritate nostrils and cause trauma.

**Procedure**

1. Explain the procedure to the patient and get his cooperation.

2. Bring the oxygen cylinder to the bedside.

3. Bring a tray containing a small bowl of water, swabs to for lubricating and kidney tray, adhesive tape

4. Clean the nostril, if necessary.

5. Attach the catheter to the tubing, turn on the Oxygen and adjust the flow, testing by putting the end of the catheter in the bowl of water where oxygen bubbles are seen.

6. Lubricate the catheter and insert it gently along the floor of the nose for about 7 cm. It should lie in the pharynx.

7. Fix the catheter to the cheek or forehead with adhesive tape.

8. Check the oxygen flow and adjust to (40-60 bubbles) or as ordered by the doctor. Check the flow at regular intervals.

9. A child may need to have the arms splinted.

10. Record the time, the oxygen therapy has begun and stopped.

11. Report to the doctor.

* **Nasal Cannula**

It is disposable. Plastic device with two protruding prongs for inserting into nostrils, connected to an oxygen source. Used for low medium concentrations of oxygen 24-44%, it is a low Oxygen device. This device delivers an unpredictable amount of oxygen ranging from 25-45 % at 1-6 L/min. depending on how much the patient inhales through the mouth. Higher flow rates are uncomfortable for the patient. A high flow rate can quickly dry out the nasal mucosa and become rapidly uncomfortable.

**Equipment**

1. Nasal cannula FG 12 or 18 with connecting tubing

2. Humidifier

3. Oxygen source

4. Flow meter

5. Adhesive tape

**Procedure**

1. Check physician's order for oxygen administration.

2. Gather equipments.

3. ldentify patient and check identification against physician's order

4. Assess patient respiratory status.

5. Connect a humidifying bottle to an oxygen flow meter and fill with sterile water to the appropriate level.

6. Explain to the patient the purpose and rationale of oxygen therapy via nasal catheter and allow questions, to allay anxiety and have a sense of security.

7. Place the patient in a comfortable position.

8. Adjust the oxygen to the prescribed oxygen flow rate. (4-6 litres per minute).

9. Listen for the oxygen flowing through the cannula.

10. Wash hands to prevent infection.

11. Place the nasal prongs in the nares, drape tubing Over the ears and loosely tighten the tubing below the chin.

12. Position the cannula for comfort. May need to place gauze behind the ears to reduce friction caused by the tubing

13. Wash and dry hands.

14. Provide nose care every 4 hours.

* **Face Masks**

There are two kinds of masks- the nasal type, which covers only the nose and the oro-nasal, which covers both the mouth and the nose. The mask must fit the patient's face, the headband is adjusted and cooperation of the patient obtained. The mask is removed at intervals for washing the patient's face and for feeling fresh. Commonly used types of masks are:

1. **Simple face mask:** Simple mask is made up of clear, flexible, plastic or rubber that can be molded to fit the face. The placing of mask over the patient's face in- creases the size of the oxygen reservoir beyond the limit of the anatomic reservoir; therefore a higher FiO2 can be delivered.

It has vents on the sides for the room air to leak in and there by diluting the source O2 it also allows exhaled. CO2  to escape through vents. It is used when increased O2 delivery is needed for short periods (less than 12 hours)

2. Partial rebreather mask: Partial Rebreathing mask with reservoir, it is a moderate oxygen device delivers 35- 60% oxygen. Oxygen reservoir bag attached allows the client to rebreath about the first third of the exhaled air.

It increases FiOg by recycling expired O2. It should not be totally deflated. The mask is having a reservoir bag the inflated during inspiration and expiration. The oxygen flow rate must be maintained at a minimum of 6 L/min. to ensure that the patient does not rebreath large amount of exhaled air. The remaining exhaled air exits through the Vents.

3. Non-rebreathing mask with reservoir: It is a high oxygen device which delivers 95% Oxygen at 10-12 L/min. Two valves added to Rebreathing mask which prevents entry of room air during inspiration and retention of exhaled gases during expiration. It contains a reservoir bag to entrain oxygen. One way valve between the mask and the reservoir prevent the room air and the client's exhaled air entering the bag so only oxygen in the bag is inspired Oxygen dilution.

4. **Venturi masks:** It provides 24%-50% oxygen by mixing room air with a precise amount of oxygen thereby delivering a precise FiO2. The size of the port and the oxygen liter flow determine the FiO2. The mask should be fitted to the patient as best as possible to prevent entry of room air around the mask which would alter the FiO2.

**Venturi effect:** Oxygen is forced through a jet orifice entering the mask. As there is pressure drop across jet orifice, room air entrainment occurs through side ports Color coded valves are used in the venturi mask.

**Steps of Procedure**

Equipment

1. Oxygen mask

2. Oxygen source

3. Flow meter

4. Humidifier

5. Auto saturation, if available

**Procedure**

1. ldentify patient.

2. Check physician's order foroxygen administration.

3. Gather equipment.

4. Explain purpose and rationale of mask to patient. Allow questions to allay anxiety and obtain consent.

5. Choose a mask that fit well.

6. Check distilled water in humidifier if at appropriate level and ensure the water is fresh and change water every 24 hours. To avoid infection by using water that is not freshly changed. To avoid inhalation of dry oxygen. Wash and dry hands to avoid infection.

8. Put the patient in a comfortable position.

9. Regulate flow of oxygen and water vapors through mask before administration. To avoid overflow of oxygen and humidity

10. Place the mask with elastic

11. Secure the mask with an elastic strap.

12. Regulate oxygen concentration as per physician's order and in accordance with auto saturation.

**Transtracheal Oxygen Delivery**

This is used for oxygen dependent patients. Oxygen is delivered through a small, narrow plastic cannula surgically inserted through the skin directily into trachea. A collar around the neck holds the catheter in place.

Advantages

1. Used on the end of ET tube when weaning from ventilator.

2. Provides accurate FiO2.

3. Provide good humidity.

**Special Consideration**

The nurse keeps the catheter in place by injecting 1.5 ml of normal saline in it, moving a cleaning in and out then re-injecting, 5 ml saline twice or thrice a day.

**CPAP (Continuous Positive Airway Pressure)**

**Nasal CPAP**

It consists of a single nasopharyngeal tube that deliver 2-8cm of positive pressure with or without O2.

**Nursing Care**

1. Frequent suction

2. Tube care

3. Change the nasal tube

**Methods used in Case of Pediatric**

In Case of Infants

Oxygen hood is a clear plastic shell encompasses the baby's head, it is well tolerated by infants. It allows easy access to chest, trunk and extremities. Size of hood limits use to younger than age l year. Oxygen hood delivers 80-90% Oxygen at 10-15 liters per minute.

**Special Consideration**

The gas should not be allowed to blow directly into infants face and the hood should not rub against infant's chin, neck or shoulder.

**In Case of Children**

**Oxygen Tent**

It is made up of rectangular clear, plastic canopy with outlets that connects to Oxygen source. Flow rate is adjusted at 10-15 L/min, after flooding the tent for 5 minutes.

**Procedure:**

This apparatus is more expensive but disturbs the patient less.

The tent may be strong transparent material with sleeves for nursing and feeding purposes.

The sides of the tent are tucked in under the mattress to make the tent airtight.

Oxygen from a cylinder is admitted into the tent and regulated.

Used air is sucked out into a box containing calcium chloride, which absorbs the carbon dioxide.

A radiator with ice keeps the tent cool.

**Hazards of Oxygen Inhalation**

1. Infection: It may occur because of use of contaminated equipment.

2. Combustion: Oxygen supports combustion so fire is a potential hazard when oxygen is administered.

3. Drying of mucous membrane of the respiratory tract: If oxygen is administered without sufficient humidity, it causes drying and irritation of mucous membrane.

4. Atelectasis: Increased oxygen concentration leads to depletion of nitrogen (as nitrogen helps to keep alveoli expanded). So, atelectasis may occurs.

5. Oxygen induced apnea: Since carbon dioxide is removed completely from the blood by high concentration of oxygen, the respiratory centre is not stimulated sufficiently which leads to cessation of respiration.

6. Retrolental fibroplasia: Oxygen therapy affects the eyes especially in infants. In infants very high concentration of Oxygen will develop fibrotic changes behind lens which impairs light penetration to retina.

7. Oxygen toxicity: It primarily affects lungs and central nervous system. The toxicity will depends upon the PO2 and time of exposure. Time of exposure, i.e. higher the PO2 and exposure time the greater the toxicity.

**Nursing Responsibilities**

**In Oxygen Administration**

Assessment

1 Skin and mucus membrane.

2. Breathing patterns.

3 Chest movements.

4 Lung sounds.

5. Presence of clinical signs of hypoxia.

6. Presence of clinical signs of hypercapnia

7. Presence of clinical signs of Oz toxicity

**Documentation**

1 Date and time when oxygen started.

2. Method of delivery.

3. Oxygen concentration and flow rate.

4. Patient observation.

5 Any complication

**Evaluation**

1. Breathing pattern regular and at normal rate.

2. Pink color in nail beds, lips and conjunctiva of eyes Atrial oxygen concentration or hemoglobin level. Oxygen saturation within normal limits.

**Steam inhalation :**

**Definition:** breathing warm and moist vapors is called steam inhalation.

**Purposes:**

* To relieve the symptoms of cold and sinusitis causes inflammation and congestion of mucous membrane.
* To lose mucus and relieve coughing.
* To warm and moisten the air to relieve dyspnea and irritation in air passages.
* To provide antiseptic effect.
* To prevent excessive dryness of the mucus membrane
* To relieve spastic conditions of the larynx and bronchi.

**Articles required:**

* Nelson inhaler
* Jug with hot water
* Towel
* Face towel
* Sputum cup
* Small basin
* Cotton swabs
* Gauze pieces

**General instructions:**

* The water level in the inhaler should be just below the spout.
* The temperature of the water should be maintained between 120 to 140̊ or 60 to 76̊ C.
* The mouth of the spout must be kept away from the patient to prevent scalding.
* Protect the patient from cold air. The windows and doors are closed and the fan is put off during the treatment.
* Ask the patient to empty the bladder before starting the therapy.
* Watch the patient throughout the procedure.
* Place a sputum cup reach of the patient.

**Nelson’s inhaler method:**

* The inhaler has a glass mouth piece passing through the cork of the inhaler and an air inlet at the side.
* Explain the procedure to the client.
* Provide comfortable position. (sitting position)
* Pour the boiled water below the air inlet.
* Add the drug ordered.
* Cork the inhaler.
* Wrap the inhaler with a toweland gauze piece
* Wrap the piece of the gauze around the mouthpiece of the inhaler.
* Cover the patient with bath towel. Place the inhaler in front of the patient and ask him to keep his mouth piece and breathe in by mouth to receive the steam and breathe out through nose removing his lips from the mouthpiece.
* Continue the treatment for 15-20min.
* Wipe the patients face and keep him warm and in same room for at least 1 hour.
* Record the procedure and replace the articles, discard the waste products.