Chapter 11

Oxygen Therapy

OXYGEN / RESPIRATORY EQUIPMENT

By the end of this session you will be able to understand:

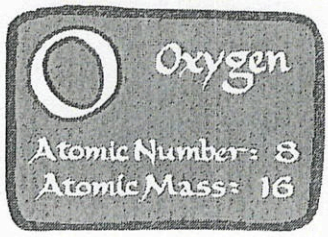
1. Oxygen
   a. What is oxygen (O2)?
   b. Indications for oxygen
   c. Oxygen delivery devices
   d. Oxygen sources
   e. Oxygen safety

2. Pulmo-Aide Machine
   a. How does it work?
   b. Maintenance

3. Hand-Held Nebulizers (HHN)
   a. What are they?
   b. Cleaning of equipment
   c. Making your own saline solution

4. Metered Dosed Inhalers (MDI)
   a. How they work
   b. Indications for use
   c. How to use correctly
      - Without a spacer device
      - With a spacer device
      - Special Considerations
   d. When to replace your MDI

OXYGEN



"Don't be afraid of being "addicted" to oxygen, we all need it!" Donald C. Rifas, MD

WHAT IS OXYGEN?

Oxygen (O_2) is a colorless, odorless, tasteless elemental gas that **supports life. All cells need oxygen to produce the energy to make muscles work.**

O_2 makes combustion **possible.**

O_2 constitutes about a **fifth of the atmosphere** (21%).

WHY WOULD YOU NEED SUPPLEMENTAL OXYGEN?

Because of lung disease, the oxygen that we breathe into our lungs may not get into our alveoli (air sacs) where gas exchange takes place. This may be true with **conditions such as pneumonia, chronic bronchitis, emphysema, and pulmonary fibrosis.**

The air that we breathe into our lungs may be blocked by large amounts of **mucus literally "plugging" our airways**.

Oxygen may not get into some areas of the lungs due to **atelectasis** (air sacs that are closed off or collapsed).

Oxygen may not get into the bloodstream due to transferring problems (the alveolar membrane is too thick, fluid in the air sacs, or because some of the capillaries have been destroyed by disease).

OXYGEN DELIVERY

Oxygen Delivery Devices

1. **Nasal cannula**
   a. A device used to transport the oxygen from an O_2 source to the patient.
   b. O_2 may be delivered in liter flows from 1- 6 liters / minute.
   c. A nasal cannula fits into the patient's nose to supply a continuous or intermittent flow of oxygen.
   d. Oxygen amounts vary with the flow of oxygen, patient's respiratory rate, and their depth of breathing.

2. **Oxygen mask**
   a. Device used to transport oxygen from an O_2 source to the patient.
   b. O_2 flows range from 7 to 15 liters / minute.
   c. Oxygen masks fit over the nose and mouth and secured by an elastic band fitting over the head.
   d. Oxygen amount varies upon the flow of oxygen, the patient's respiratory rate and their depth of breathing.
   e. The is a chance of re-breathing CO_2 with too low of a flow of O_2.

3. **Transtracheal Catheter**
   a. Device used to transport the oxygen from an O_2 source to the patient
   b. O_2 flows from 1/2 to 6 liters / minute (O_2 is often reduced by 50 %).
   c. Transtracheal catheters deliver oxygen to the lungs through a small flexible catheter that is inserted in to the trachea (windpipe).
   d. Oxygen amount varies upon the flow of oxygen, the patient's respiratory rate, and their depth of breathing.

Oxygen Conserving Devices

These are devices that allow oxygen to be used only during inhalation and/or every-other breath. They may built into the oxygen unit itself or used as an

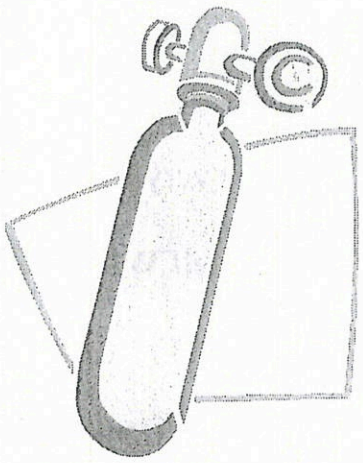
external attachment. By only using oxygen during the inhalation phase, it saves oxygen from being "wasted" and may allow the wearer more time per tank fills.

Oxygen Sources

1. **Concentrators**

   a. A stationary unit is about the size of a suitcase or small dresser.
   b. Concentrators take "room air" and separates out the oxygen to deliver not quite 100% O2 at it's lowest flowrate.
   c. The higher the flow rate, the less concentration of O2 the individual is receiving.
   d. Concentrators are powered by electricity.
      ***PRECAUTION**
      - One **MUST** have a **cylinder on standby** or have a back-up generator available in case of a power failure.
      - It is the dealer's responsibility to take care of maintaining the concentrator.
   e. Concentrators are often prescribed for continuous oxygen use along with compressed cylinders.
   f. 2 to 3 liters/minute is the usual output. Many will go as high as 6 l/m but the concentration may drop as the liter flow increases.

2. **Compressed Cylinder O2**



a. Cylinders are green in color, the most popular size; "E" (small) or "H" (large). O_2 is now also available in A and B sizes (even smaller for short-term use).

b. The oxygen is compressed and stored in a gaseous state.

c. All oxygen cylinders need a **regulator** to reduce the pressure in the cylinder to a safe, "working" pressure, and **flowmeter,** which regulates the amount of oxygen delivered to the patient.

d. Oxygen cylinders are prescribed primarily for stationary home use and low flow or intermittent use.

PRECAUTION

Make sure the cylinder is stable and cannot fall over. The cylinder will act like a rocket if the regulator is broken off.

Typical time for cylinder at continuous flow*		
	2 liters/minute	4 liters/minute
A Tank	0.6 hr – 36 min	0.3 hr – 18 min
B Tank	1.2 hr – 72 min	0.6 hr – 36 min
E Tank	5 hr – 300 min	2.5 hr – 150 min
H Tank	56 hr – 3360 min	28 hr – 1680 min

* Longer times will be noted while using a conserving device.

3. **Liquid Oxygen**

a. The O_2 is held at -297 degrees F and is in a liquid form.

b. Liquid oxygen is held in small containers similar to sophisticated thermos bottles.

c. Portable units are simple to fill from a large stationary unit. The large unit can be used while at home.

d. Liquid oxygen is designed for people on the go!

Other liquid systems

a. Helios is a relative new system and is attached to a waistband.

OXYGEN SAFETY PRECAUTIONS

Oxygen is very **SAFE** to use when you create the proper conditions.

Oxygen itself **WILL NOT** explode

Oxygen **WILL** cause anything that is burning to **burn hotter and faster.**

By using the following safety rules, you will create a very safe environment when you use your oxygen.

* The room you store your oxygen cylinders must be dry, cool, and well ventilated

* Keep all units and oxygen tubing at least **five feet** from any source of heat. This includes any open flame, furnace, heater, radiator, fireplace, oven, stove, or any large window that receives direct sunlight.

* Do not smoke while using oxygen or be around anyone who is smoking.

* Be sure that all oxygen tanks are fastened securely to their stand.

* Always change the cylinders when the pressure regulator reads 500 psi (pounds per square inch).

* Never allow grease, oil, or any other potential combustible substance to come into contact with your oxygen delivery equipment.

* Avoid skin contact with liquid oxygen or any frozen parts of liberator (filling port on the stationary tank).

* Never allow children to play on or around the liquid stationary reservoir. This may cause the unit to spill liquid oxygen and freeze anything that it touches.

* Always transport the stroller in an upright position to avoid leakage.

*When using in an automobile, always secure the tanks or liberator with a seat belt, or similar device, and open a window slightly to allow for oxygen evaporation.

Altitude and Oxygen

Altitude (feet)	Barometric Pressure (mmHg)	Equivalent Oxygen % as to sea level	% Oxygen needed to increase to sea level	Liter Flow needed (lpm) (Approximate)
0	760	21	21	0.00
2,000	707	19	23	1.00
4,000	659	18	25	1.50
6,000	609	17	27	2.00
8,000	564	15	29	3.00
10,000	523	14	31	3.50
12,000	483	13	34	4.50
14,000	446	12	37	5.50
16,000	412	11	41	6.50
18,000	379	10	45	8.00
20,000	349	9	49	9.50
22,000	321	8	54	
24,000	294	7	60	
26,000	270	7	67	
28,000	247	6	75	
30,000	226	5	85	
33,000			100	

Pulmo-Aide Nebulizer Machine

A Pulmo-Aide Nebulizer machine is an electrically powered air compressor used to power a hand-held nebulizer. Atmospheric air is drawn into the machine and then compressed and released at approximately 5-7 l/m. The air passes through the liquid medication changing the liquid into a fine particle mist enabling it to be inhaled into the lungs.

How to Use Your Nebulizer Unit

Please check the specific directions for your particular machine. There are many different kinds on the market. The following are general directions for most usage.

1. Measure the correct amount of the medication that you are using (i.e., albuterol) using a clean eyedropper or syringe and put that amount into the medicine cup. Once you know your correct number of drops, you can count them as a check.

2. Measure the correct amount of normal saline solution using a clean eyedropper and put it into the cup with the medication. If you have a pre-mixed or unit dose packaging, then open this and pour into the medication cup.

3. Attach the mouthpiece to the T-shaped part and then fasten this to the medication cup. If you use a mask, attach the mask directly to the cup.

4. Put the mouthpiece in your mouth and seal your lips tightly, but comfortably; o place the mask on your face so that it is comfortable.

5. Turn the machine switch to ON.

6. Take slow, normal breaths in through your mouth.

7. Every minute or so, take a DEEP breath in, and hold it for a few seconds, before breathing out.

8. Continue with this process until ALL the medication is gone from the cup.

9. Remember to store the medication as directed after each use.

10. Check the filter on nebulizer unit and replace the filter once a month. Your DME provider can provide these for you.

It is very important keep your Pulmo-Aide clean, inside and out. Your **must** change the **felt dust filter** each and **every month** even if it doesn't look dirty. Remember, the air that powers the nebulizer is also the air that you breathe into your lungs. Atmospheric air is full of dust and micro-organisms. If you breathe these micro-organisms into your lungs, it will cause irritation and sometimes infection.

Use a soft, damp cloth and **wipe the outside** of your Pulmo-Aide to keep dust from accumulating on the machine.

Cleaning and Disinfecting Respiratory Therapy Equipment

Most respiratory therapy equipment, hand held nebulizers, spacers, and mucus clearance devices, are designed to have the patient inhale or exhale through them. **Because of this, this equipment must be cleaned and disinfected on a regular basis to prevent the spread or colonization of micro-organisms (germs).** Micro-organisms prefer moist, warm areas to grow and your respiratory equipment meets these conditions perfectly. After a hospitalization due to infection, toss all your disposable nebulizer pieces and obtain a new setup from your respiratory equipment supplier.

After each treatment with a hand held nebulizer:

1. Disassemble all parts of the nebulizer.
2. Rinse them under a steady stream of warm water.
3. Shake off the excess water and allow parts to dry on a clean paper towel. Place another clean paper towel over the parts to prevent dust from settling on them.
4. Store the equipment in a dust-free area.

Every 3rd Day:

1. Disassemble and wash all parts in warm water mixed with a mild liquid dish detergent.
2. Scrub all parts with a "bottle brush", paying special attention to smaller areas and inside and around the mouthpiece.
3. Rinse off each piece of equipment under a steady stream on water, making sure that all of the detergent is removed.

4. Soak the pieces for 20 min. in a solution of 1cup vinegar and 1 ½ cups distilled water once a week. The equipment must be completely submerged in the solution.
5. Rinse all of the parts with water.
6. "Air dry" them on a clean paper towel, covering with another paper towel until dry. *Never wipe or dry the equipment with a towel!
7. Store the equipment in a cool, dry, dust-free area.

Remember! Using contaminated respiratory equipment causes lung infections!