

Lesson 62: Pulse Oximetry and Oxygen Saturation/Application of Oxygen per Nasal Cannula/Non-Sealing Mask

I. Theory and Mechanics of Pulse Oximetry

- A. A pulse *oximeter* uses two sensors and a light source to determine what percentage of oxygen saturation is in the blood. The device uses the color of the blood to determine the oxygen content of the blood.
 - 1. Each sensor detects for a different color of light.
 - 2. Oxygenated blood is a brighter shade of red than un-oxygenated blood.
 - 3. The device measures the difference between the two to determine the percentage of oxygen saturation.
- B. The probe for the oximeter must be placed on a pulsing vascular bed.
 - 1. Identifies arterial blood.
 - 2. The device also identifies pulse rate and displays pulse beats.
 - 3. Most devices will not provide a reading unless a pulse is detected.
 - 4. The most appropriate location for the probe is either the nail bed or earlobe.
- C. Pulse oximeters are generally considered to be accurate within 2 - 3%.
 - 1. Findings identify whether the resident is improving or deteriorating, based on serial readings rather than a single reading.
- D. The resulting numbers are indicated as percentage of oxygen saturation (SaO₂)
 - 1. When reporting the reading, the ratio may be expressed as “O₂ Sat is 98%.”
- E. Interpreting the results:
 - 1. Normal oxygen saturation is considered to range between 97% to 99%.
 - 2. Readings between 93% and 97% may be normal for some residents; on the other hand, some residents may be very sick with a reading of >97%.
 - 3. Readings of 90% or less may indicate that the resident needs ventilatory assistance. Promptly notify the nurse for further assessment should a reading of 90% or less be obtained.
 - 4. Comparing pre and post-oxygen application readings can determine if the oxygen delivery is resulting in improvement. Consult the nurse for any lack of improvement in the oxygen saturation percentages after oxygen has been administered.
- F. Conditions Adversely Affecting Pulse Oximetry Readings
 - 1. Carbon monoxide poisoning will result in an artificially high SaO₂ reading.
 - a. Remember, the device is detecting the color of the blood. Carbon Monoxide turns arterial blood bright red.
 - 2. Cigarette smokers will often have altered readings.
 - a. Cigarette smoke contains CO₂, which may lead to an artificially high reading.
 - b. If the resident has been smoking for a long time, it is not unusual to have an SaO₂ reading of 93—95% as his/her normal reading.
 - 3. Cold extremities may lead to low readings.
 - a. Due to poor circulation to the extremities
 - b. The hands can be warmed by rubbing prior to application of the probe on the resident’s finger, however, this is not always effective.
 - 4. High-intensity lighting may lead to abnormally high readings.
 - a. This can be corrected by either turning off the bright light or moving the resident to another location.
 - 5. Hypovolemia may lead to artificially high readings.
 - a. The hemoglobin may be well saturated with oxygen, but there is less of it (lower volume), so the tissues may not be getting as much as they need to survive.
 - b. If the resident is in, or is headed for, shock, the device does not have the ability to detect a saturation level from a weak pulse.
 - 6. Anemic residents may produce normal or near-normal readings, but may not be getting enough oxygen at the cellular level (similar to the hypovolemic resident).
 - 7. Pulse oximeters may have difficulty sensing color in dark-skinned residents.
 - a. Often, repositioning the probe will correct this.

8. Fingernail polish or acrylic nails may prevent the device from working.
 - a. If the device will not produce a reading, use nail polish remover or switch the probe to an earlobe.
 - b. You could also try turning the probe side-ways on the finger or moving it to the great toe.
9. Some medications cause peripheral vasoconstriction.
 - a. Be certain to review the history and medication section of the MAR (medication administration record). Consult the nurse should this be of potential concern.
10. Excessive resident movement can alter readings
 - a. Make certain the resident remains still when obtaining readings.
11. Failure to clean and maintain the oximeter can result in false readings.

II. Procedure

The manufacturer's instructions for the type/brand of oximeter utilized must be reviewed to ensure knowledge of the following:

- A. Techniques for Using the Pulse Oximeter:
 1. proper application of the finger probe
 2. activation of the unit
 3. how to ensure the device is detecting a pulse
 4. what to do if a pulse is not detected
 5. proper application of other types of probes available to the provider
 6. how to obtain serial readings
 7. use of other ancillary features (pulse rate, automatic b/p, printers, etc.)
 8. deactivation of the unit
- B. Maintenance of the Oximeter:
 1. location of the battery compartment
 2. identification of type of battery power used
 3. if rechargeable batteries are used, characteristics and type of battery and recharging recommendations
 4. cleaning and maintenance of the probes
 5. inspection of the device for loose or broken wires, damaged contacts, etc.
 6. troubleshooting techniques for common problems:
 - a. machine will not activate
 - b. machine activated, but no reading provided
 - c. replacing a faulty sensor probe
 - d. ancillary functions of the machine fail to work
 7. cleaning, maintenance and proper storage of the device
 8. documentation of quality control testing

III. Emergency Situations Requiring Oxygen Administration

- A. A QMA may not apply oxygen to a resident in an emergency situation without a physician's order, however, there is often a PRN order for oxygen to be administered if the resident is short of breath or if the oxygen saturation level falls below a specified percentage.

IV. Oxygen is a Treatment and is to be Applied as Part of a Resident's Emergency Treatment Plan Only

- A. The QMA must obtain a pulse oximetry reading of a resident's oxygen saturation level when the resident has displayed signs and symptoms of respiratory distress.
- B. The QMA must correctly interpret the pulse oximetry reading before applying oxygen in an emergency situation.
- C. The QMA must identify an emergency situation that requires the administration of oxygen.
 1. Before initiating oxygen therapy, the QMA must check the resident's written physician's order noting the indication for oxygen application and the type of therapy ordered.
 2. The QMA must become familiar with the types of oxygen available in the facility and the location of equipment to initiate oxygen administration.

3. Immediately after the emergency, the QMA shall verbally notify the nurse on duty or on call and appropriately document the action and notification of the event.

V. QMAs May Administer Oxygen Using One of Two Methods in an Emergency Situation

A. **Nasal cannula** - a long slender tube that runs from the oxygen tank to the small plastic prongs that fit into the resident's nostrils.

1. The two prongs that project from the end of the nasal cannula tubing are placed about ½-inch into the resident's nostrils after the oxygen has been turned on.
2. Do not use petroleum jelly (Vaseline) as a lubricant to prevent irritation of nares. It can act as a fuel and produce fire. Use of a water soluble lubricant is appropriate if necessary (i.e., KY lubricant).
3. This method supplies oxygen at low concentrations (22% to 30%) at flow rates of 1 to 5 liters per minute.
4. The flow rate of oxygen administration must be ordered by a physician.
5. Major concerns associated with the use of the nasal cannula when the oxygen administration flow rate is above 8 liters per minute are:
 - a. the resident has a tendency to swallow air, and
 - b. the nasal or pharyngeal passage becomes irritated.
6. Instruct the resident to breathe through the nose. Mouth breathing dilutes the oxygen concentration received.
7. Inspect the nares for irritation as well as behind the ears where skin breakdown can occur from continuous contact with the tubes delivering the oxygen.
8. Monitor the liter flow to ensure the physician's order is followed and the flow has not been changed/increased by the resident or a visitor (i.e., unqualified individuals).
9. Refer to facility policies and procedures addressing the frequency of nasal cannula tubing change.
10. When not in use, the nasal cannula should be coiled and placed in a plastic bag for storage to prevent contamination.

B. **Non-sealing mask** - a long slender plastic tube that extends from the oxygen tank to a plastic mask shaped like a cup. A mask is advantageous for residents who are unable to breathe solely through their nose.

1. The non-sealing mask covers the resident's nose and mouth, and has holes on the sides of the mask.
2. A piece of elastic holds the mask securely on the resident's face.
3. Some masks have a metal clip that can be bent over the bridge of the resident's nose to secure the mask snugly.
4. The straps are adjusted around the resident's head and over the ears.
5. The holes on the sides of the mask allow air from the room to enter during the inhalation process.
6. The use of a non-sealing mask must be ordered by a physician.
7. When a non-sealing mask is used, the resident will not be able to speak.
8. The QMA must be certain that the resident can signal for assistance.
9. A major concern with the use of a face mask is pressure and moisture accumulation on the resident's face.
 - a. Report any redness or discoloration to the resident's facial skin.
10. Monitor the liter flow to ensure the physician's order is followed and the flow has not been changed/increased by the resident or a visitor (i.e., unqualified individuals).
11. Refer to facility policies and procedures addressing the frequency of mask/tubing change.
12. When not in use, the mask should be placed in a plastic bag for storage to prevent contamination.

VI. Oxygen dries out the mucous membranes of the mouth and respiratory system. The physician may order humidity to be placed on the oxygen source before administration of oxygen. By doing so, the gas passes through the water and water vapor is picked up before being transmitted to the resident.

- A. Humidity is added to oxygen in the form of sterile/distilled water.
 - 1. When the bottle of sterile/distilled water is opened, the QMA must write the date and time the bottle was opened on the label of the bottle.
 - 2. Store the sterile/distilled water in the refrigerator after opening or per facility policy.
 - 3. Sterile/distilled water should be discarded after two weeks from the date opened or per facility policy.
 - 3. Add sterile/distilled water to the humidifier bottle to the fill level line.
 - 4. Many facilities utilize pre-filled humidifier bottles. In this case, the old bottle is discarded when empty and a new pre-filled bottle is screwed into place on the tank.

VII. Types of Oxygen

- A. Compressed or Liquid Oxygen
 - 1. Can be administered from large stationary tanks or small portable tanks as compressed gas or liquid oxygen.
 - 2. The facility may utilize large storage tanks from which portable tanks are trans-filled. If so, the QMA must receive necessary training relative to the trans-filling of oxygen from the storage tank to the portable.
- B. Portable Oxygen Units
 - 1. Contain electronic oxygen-conserving devices.
 - 2. These units only contain a few pounds of liquid oxygen.
 - 3. Portable units can provide oxygen for up to eight hours. Refer to manufacturer's instructions.
- C. Stationary Systems
 - 1. The most common oxygen system.
 - 2. This system is called a concentrator.
 - 3. An electrical device extracts oxygen from the room air and circulates the oxygen back to the resident through the oxygen tubing.
 - 4. An oxygen concentrator weighs approximately 35 pounds.
 - 5. A concentrator is an electric piece of equipment and must be plugged into a wall outlet to operate.
 - 6. In the event of facility power failure, an oxygen concentrator should be plugged into emergency outlets to ensure the continued delivery of oxygen.

VIII. Oxygen is a Flammable Substance

- A. Maintain safety precautions.
 - 1. Keep the oxygen away from open flames or heat sources. There should be "No Smoking" near an oxygen tank.
 - 2. Oxygen does not burn by itself but does facilitate combustion.
 - 3. Supply tanks should be stored safely, secured to a wall and away from heaters and furnaces.
 - 4. DO NOT USE petroleum lubricants (Vaseline) to the resident's nares during the administration of oxygen.
 - 5. To prevent leakage, always keep the oxygen system upright. Make certain the system is turned off if it is not in use.
 - 6. Do not place carpets, bedclothes or furniture over the tubing as it may cause a tubing leak.
- B. Should a fire occur in the building, turn off all sources of oxygen.

IX. Procedure

- A. Identify what constitutes the resident's respiratory distress before applying emergency oxygen.
 - 1. Obtain a pulse oximetry reading to determine the resident's oxygenation saturation level.
 - 2. Signs/symptoms of respiratory distress include:
 - a. increased rapid pulse
 - b. rapid, shallow respirations
 - c. increased restlessness or light headedness
 - d. flaring of the nares

- e. *substernal* or *intercostal* retractions
 - f. cyanosis
- B. Review the physician's orders:
1. What source of oxygen supply is to be used?
 2. What oxygen delivery system is to be used?
 3. What is the rate of administration for the oxygen per the physician's order?
 4. What are the physician-ordered parameters for the application of emergency oxygen?
- C. Assemble your equipment:
1. oxygen supply
 2. regulator or flow meter
 3. oxygen tubing
 4. nasal cannula or non-sealing mask
 5. humidification device if ordered by the physician.
 6. sterile water to use in the ordered humidification device or a pre-filled bottle.
- D. Perform INITIAL STEPS.
- E. Prepare the resident, ask non-essential personnel or visitors to leave the resident's room
- F. Test the equipment for proper operation before applying oxygen
1. Make certain that there is no kinking in the plastic tubing that obstructs the flow of oxygen
- G. Position the resident in a Semi-Fowler's or Fowler's position to maintain an open airway.
- H. Apply the ordered oxygen administration device (i.e., nasal cannula or non-sealing mask) to the resident.
1. Application of a nasal cannula requires the ½ inch prongs at the end of the plastic tubing to be inserted into the nasal cavity pointing in a downward direction.
 - a. The tubing extends across the facial area and is placed above and behind each ear and is rejoined below the chin and held by a sliding plastic device.
 - b. The sliding plastic device holding the two pieces of plastic tubing together can be moved up slightly to increase the tension on the tubing around the resident's ears and hold the tubing in place.
 2. Application of non-sealing face mask
 - a. The mask fits snugly over the resident's nose and mouth.
 - b. Straps are adjusted around the head and over the ears.
 - c. The small holes on the sides of the mask allow carbon dioxide to escape during exhalation, and air to enter the mask during inhalation.
- I. The QMA must immediately verbally notify the nurse on duty or on call when emergency oxygen has been administered to a resident.
- J. The QMA must document the following information when oxygen has been initiated:
1. Date and time that the oxygen was administered.
 2. Type of oxygen therapy and the liter flow.
 3. Resident tolerance of the procedure.
- K. Continue to monitor the resident until further assistance arrives or until distress subsides. **DO NOT LEAVE THE RESIDENT ALONE** until distress subsides.
1. Some residents respond with fear, panic, restlessness and continued feelings of suffocation.
 2. Remain calm and reassure the resident until further assistance arrives.

NOTES:

