Oxygen Therapy and Delivery Devices

A variety of oxygen-delivery devices are available for administering oxygen therapy. Which device to use often depends on the degree of hypoxia the patient is experiencing and any underlying respiratory diseases, such as chronic obstructive pulmonary disease (COPD). It is also important to consider the patient's age, level of consciousness, presence of an artificial airway, and environment (hospital or home) when choosing an oxygen-delivery device.

Nasal cannula

Most patients tolerate this device well, and it is simpler to use than a mask. The fraction of inspired oxygen (FiO 2) varies depending on the flow of oxygen in L/min and the rate and depth of the patient's breathing.

FiO 2 : 24% to 38% - Flow: 1 to 2 L

FiO 2 : 30% to 35% - Flow: 3 to 4 L

FiO 2 : 38% to 44% - Flow: 5 to 6 L

A nasal cannula is the device most often used to administer oxygen therapy. It consists of a length of tubing, usually 7 to 14 feet long, with two small prongs to insert into one of the patient's nares. It also has a plastic piece at the neck that slides up under the patient's chin to tighten the tubing and keep it in place. It is available in a range of sizes and can be used for various age groups.

A nasal cannula delivers oxygen concentrations of 22% to 50% with flow rates from 1 to 6 L/min through the cannula. The exact concentration inspired depends on the flow rate and on the patient's rate and pattern of breathing and the depth of respirations. A nasal cannula is usually used for patients who are noncritical with minor breathing problems and for patients who cannot or will not wear an oxygen mask. Because this device administers low-flow oxygen, humidification is rarely required.

simple face mask

This device requires a fairly high oxygen flow to prevent rebreathing of carbon dioxide. About 75% of the inspired volume is room air that the patient breathes through the holes in the side of the mask. An accurate FiO 2 is difficult to estimate.

FiO 2 : 35% to 65% - Flow: 8 to 12 L

A simple mask is usually used for patients who require a moderate flow rate for a short period of time. It is composed of a plastic mask that fits snugly over the patient's mouth and nose. The mask has holes on each side that are used for exhalation and for air entrainment if the flow rate is too low. An adjustable elastic strap that fits over the patient's head holds the mask in place. A piece of tubing connects the mask to the oxygen source. Extension tubing is usually added to allow the patient more freedom of movement.

A simple mask has the ability to deliver oxygen concentrations of 40% to 60% with flow rates from 6 to 10 L/min. Because carbon dioxide can build up in the mask at low flow rates, do not use a flow rate lower than 6 L/min with this type of mask. When using this mask, consider humidification to keep the patients' mucous membranes from becoming dry.

nonrebreather face mask

The reservoir bag allows a higher FiO 2 to be administered. At flow rates slower than 6 L/min, the risk of rebreathing carbon dioxide increases. A valve closes during expiration so that exhaled air does not enter the reservoir bag and is not rebreathed. The valves on the side ports of the mask allow exhalation but close on inspiration to prevent inhalation of room air.

FiO 2: 60% to 100% - Flow: 6 to 15 L

Another type of device used for oxygen therapy is a nonrebreather mask. This device is used to deliver high flow rates and high concentrations of oxygen. Like the simple mask, the nonrebreather mask fits snugly over the patient's mouth and nose. An adjustable elastic strap that fits over the patient's head holds the mask in place.

A nonrebreather mask has ports on each side that have one-way valves that keep the patient from breathing in room air to ensure that a high concentration of oxygen is delivered. The mask also has a reservoir bag that is inflated with pure oxygen. Between the mask and the bag is another one-way valve that allows the patient to breathe in the oxygen supplied by the source as well as oxygen from the reservoir. This provides the patient with an oxygen concentration of nearly 100%. A piece of tubing, usually connected to extension tubing, connects the mask to the oxygen source.

A nonrebreather mask can deliver oxygen concentrations of 60% to 95% with flow rates from 10 to 15 L/min. When using a nonrebreather mask, do not allow the reservoir bag to deflate. If it does deflate, the patient is likely to breathe in large amounts of exhaled carbon dioxide.

Venturi mask

This device uses different size adaptors to deliver a fixed or predicted FiO 2. The FiO 2 delivered depends on the flow rate and/or entrainment port size. It is used for patients who have COPD when an accurate FiO 2 is essential and carbon dioxide buildup must be kept to a minimum. Humidifiers usually are not used with this device.

FiO 2 : 60% to 100%

A Venturi mask is most often used for critically ill patients who require administration of a specific concentration of oxygen. It consists of a mask with holes on each side that allow exhaled air to escape. At the base of the mask are color-coded entrainment ports that are adjustable to allow regulation of the concentration of oxygen administered.

A Venturi mask can deliver oxygen concentrations from 24% to 60% with flow rates from 4 to 12 L/min. Because this device delivers a precise oxygen concentration and carbon dioxide buildup is minimal, it is commonly used for patients who have COPD. Humidification is usually unnecessary with this device.

face tent

This soft aerosol mask fits loosely around the patient's face and neck. It is an alternative to an aerosol mask for patients who feel claustrophobic, but it is sometimes difficult to keep in place. It is convenient for providing humidification and oxygenation; however, oxygen concentration cannot be controlled.

FiO 2: 28% to 100% Flow: 8 to 12 L

A face tent is often used as an alternative to an aerosol mask, especially for patients who report feeling claustrophobic with an aerosol mask. It is composed of a soft mask that fits under the patient's chin and loosely covers the mouth and nose. An adjustable elastic strap holds it in place.

A face tent delivers oxygen concentrations of 28% to 100% with flow rates from 8 to 12 L/min. This device is convenient for delivering both humidification and oxygen; however, it is difficult to control the concentration of oxygen administered since the actual concentration of oxygen depends on the rate and depth of the patient's respirations.

A manual resuscitation bag is used to provide high concentrations of oxygen to a patient prior to a procedure, such as suctioning or intubating, and during respiratory or cardiac arrest. It can also be used to assist patients who are breathing but not adequately.

The manual resuscitation bag consists of a mask, a self-inflating bag that is compressed to ventilate the patient, and an oxygen port where the oxygen tubing is connected. It might also have an adapter that fits onto an oxygen port where the oxygen tubing is connected. It might also have an adapter that fits onto an endotracheal tube when it is going to be used for an intubated patient.

The mask fits over the patient's nose and mouth and has a soft air-filled cushion around the mask that forms an airtight seal when placed on the patient's face. The apex, or narrow portion of the mask, is placed over the nose and the base, or broader portion of the mask, over the mouth.

The self-inflating bag is made of a firm, rubber-like material that is manually compressed to give the patient "a breath." The bag has an oxygen port where oxygen tubing can be connected if the patient requires high concentrations of oxygen. There is also a valve on the bag that ensures one-way pressure into the mask and then allows the bag to reinflate from ambient air or from an oxygen source.

A tracheostomy mask, sometimes referred to as a tracheostomy collar, is a small mask that fits over the patient's tracheostomy site. An adjustable elastic strap that fits around the patient's neck holds it in place. The mask has an exhalation port that remains patent at all times and a port that connects to the oxygen source with large-bore tubing. The flow rate is usually set at 10 L/min, with a nebulizer set at the appropriate oxygen concentration.

Patients who have artificial airways require continuous humidification since the airway bypasses the normal filtering and humidification process of the nose and mouth. The two devices most commonly used are a t-tube, also called a Briggs adaptor, and a tracheostomy mask.

A t-tube is a t-shaped device with a piece that connects the oxygen source to the artificial airway

(endotracheal tube or tracheostomy). The recommended flow rate when using a t-tube is 10 L/min, with a nebulizer set at the appropria