OXYGEN THERAPY

Revision 2016

AIRWAY MANAGEMENT

After ensuring your own safety at the scene of a sick or injured person, one of the first priorities is the **airway.** If the victim cannot exchange air, all resuscitation efforts are useless. The basic procedures listed in this booklet, if properly performed, will be a great asset to a wide variety of medical & trauma patients.

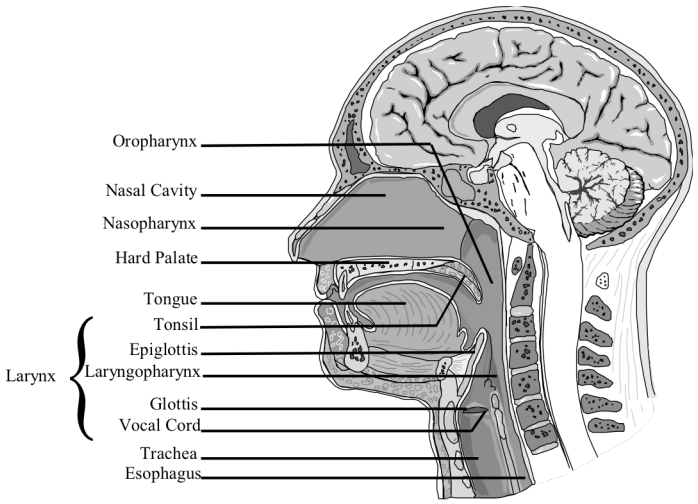
Airway Management on the part of the rescuer is of paramount importance. Annual re-certification with CPR is required to maintain current standards with the *Canadian First Aid School, in accordance with Provincial Legislation & International Resuscitation Guidelines.*

The delivery of oxygen, use of adjunctive airways, pocket masks, etc. all require responsibility on behalf of the rescuer. Oxygen is a medication and, if properly used, is an excellent tool in combating shock.

NEVER DELAY RESUSCITATION EFFORTS TO WAIT FOR SPECIAL EQUIPMENT / APPARATUS

Airway Anatomy

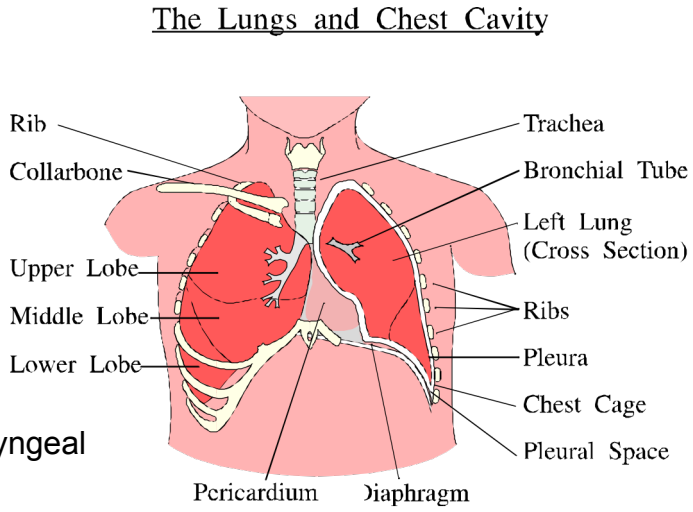
Air enters the nostrils and/or mouth, passes through the nasopharynx, oropharynx, through the vocal cords (glottic opening) into the trachea, bronchi, bronchioles to the alveoli where blood gas exchange takes place (diffusion).



Airway Obstruction

The **UNCONSCIOUS PATIENT**

The most common cause of airway obstruction is the patient's own tongue. As the patient loses consciousness, the muscles of the tongue relax allowing the tongue to fall back on the throat, thereby obstructing the airway. The tongue is attached to the lower jaw, hence the *Jaw Thrust* manoeuvre will help open the airway. Placement of an Oropharyngeal Airway (OPA), or Nasopharyngeal Airway (NPA) will help maintain an open airway by holding the tongue upward (anterior).



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The CONSCIOUS PATIENT

The airway can be compromised by several factors:

- **Anaphylaxis (Severe Allergic Reaction)** can cause edema or swelling of the tongue, airway, and epiglottis in addition to severe bronchospasm and increased production of mucous secretions.

- **Burns** – Patients who have been involved in a fire or have inhaled superheated smoke and gases are also at risk of airway edema and blistering.

- **Foreign Body Airway Obstruction** – Choking on food, liquid, vomitus or small objects can lead to either partial or complete airway obstruction. Choking can cause death if not corrected. Refer to a CPR manual for complete information on choking and the proper application of the abdominal and/or chest thrust manoeuvre.

- **Gas Inhalation** – Inhaling certain gases can cause edema and, in some cases, have a corrosive effect on the airway and lungs. In addition to the traumatic effects of gas inhalation, it is important to note that many gases are also Central Nervous System (CNS) depressants. The effects of these central nervous system depressants can decrease respirations, pulse and the level of consciousness.

- **Trauma** – Direct trauma to the throat, neck and chest wall can cause obstruction and edema.

The PEDIATRIC PATIENT

Infants and children are at risk of airway compromise for the same reasons as adults. However, there are special concerns such as a smaller diameter airway and an upper airway which is hypersensitive to abrasions, etc. which can lead to severe edema. Remember, according to current guidelines, when an unconscious child is choking on a foreign body, finger sweeps are performed only when the object is visible.

Removal of Foreign Objects

The removal of vomitus, blood, mucous, or other liquids can be attained by suction, if available. If necessary, the patient may be log rolled to clear the airway. Ensure that the C-Spine (cervical spine) is stabilized when log rolling a trauma patient.

Edema of the Airway

Edema of the airway (swelling of the soft tissue along the airway) can be caused by anaphylaxis, blunt trauma, viral infections, etc. A high-pitched squeal or cough may be present. This casualty requires oxygenation and is a very high priority emergency. Arrange for **RAPID TRANSPORTATION.**

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The OROPHARYNGEAL AIRWAY (OPA) & NASOPHARYNGEAL AIRWAY (NPA)

The OPA is a soft plastic device used to keep the tongue from the posterior pharynx (back of the throat) and therein prevents obstruction of the airway. Proper sizing, insertion and observation are extremely important. The OPA is only as effective as the rescuer using it.

The OPA is to be used only on unconscious patients without gag reflexes, and who may or may not be breathing spontaneously. It is designed primarily to maintain an open airway; it is not an excuse for the rescuer to forget about the airway or respirations. The patient must be assessed constantly to prevent obstruction by vomitus, blood, mucous, etc.

If a patient gags upon insertion of the OPA, pull it back out immediately and be prepared for the possibility of vomiting. Do not be discouraged! This indicates that your patient has a moderate level of consciousness. However, continue to assess the airway, respiratory rate, quality, and depth, etc. Also, assist the patient with supplementary or positive pressure oxygen therapy as necessary.

*Nasopharyngeal airways are inserted through the patient's nostril, and also help keep the airway open. They are better tolerated in patients that are not "fully" unconscious without a gag reflex. They are the first airway of choice for most basic responders in austere conditions, including military applications. *These will be demonstrated in class**

It is generally accepted that any trauma victim with a decreased level of consciousness should receive 100% oxygen using the Bag-Valve mask device. These patients require you to provide positive pressure ventilation for them. Ensure you constantly assess the victim's level of consciousness and other vital signs as well.

Trauma victims with a respiratory rate greater than 24 breaths per minute may also be in distress. The victim may have high CO_2 levels, or may be hyperventilating from the effects of shock. It is difficult to assess which condition is present, thus monitor the patient closely and administer oxygen as appropriate to the LOC and the ABC's. Positive pressure ventilatory assistance may be necessary.

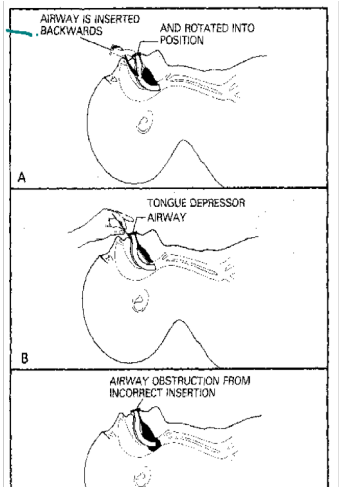
OPA sizes range from pediatric to the largest adult. **To find the correct size, you can measure the airway from the middle of the patient's lips to the angle of the lower jaw or from the patient's earlobe to the corner (edge) of his/her mouth.**

AVERAGE SIZES

Adult:					
Standard	#4	#5	#6		
Metric	#10	#11	#12		
Children:					
Standard	#0	#1	#2	#3	#4
Metric	#5.5	#6	#7	#8	#10

Insertion of and OPA

Insert the OPA upside down until it reaches the posterior pharynx, then rotate it halfway. This allows it to slip behind the tongue. The airway of a child can become damaged by rotation of the OPA. In this case, displace the tongue forward and out of the way to allow the OPA to be inserted directly in place (use a tongue depressor).



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Methods for Opening the Airway

In keeping with current guidelines, the method of head-tilt-chin lift is not acceptable in the trauma patient or any victim whose cause of injury is unknown. **ALWAYS SUSPECT A SPINAL INJURY**. To open the airway while avoiding further neck injury, use the MODIFIED JAW THRUST manoeuvre.

The **modified jaw thrust** is a one-rescuer method of opening the airway, which also allows the rescuer to stabilize the head and neck. By placing your hands on both sides of the patient's head, you displace the lower mandible upward. **This is by far the most acceptable method.**

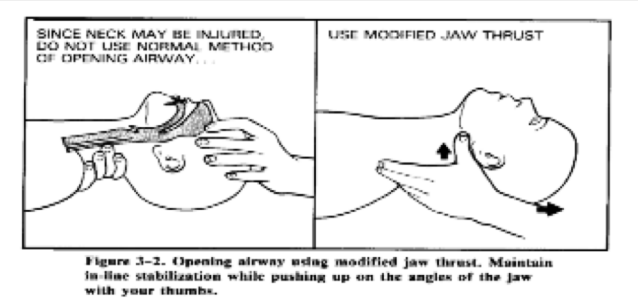

Figure 3–2. Opening airway using modified jaw thrust. Maintain in-line stabilization while pushing up on the angles of the jaw with your thumbs.

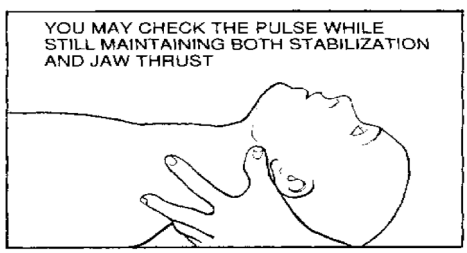

Figure 3-3. Checking carotid pulse.

Supplemental Oxygen Devices

<u>Oxygen Flow Rates</u>

The size of the oxygen tank should suit the needs of the response team (i.e. an inner city pool or dental office does not require an "M" cylinder for their patient). However, an ambulance from a rural area would need a tank capable of running for a longer duration of time.

Delivery System	**O_2 Setting/LPM**	**% Oxygen Fi02**
Nasal Cannula (prongs)	1- 6	25-44
Simple Mask	10-15	40-60
Pocket Mask c/w O_2 inlet*	10-15	50-60
Non-Rebreather Mask	10-15	60-90
Bag-Valve-Mask (reservoir)	10-25	100

D Tank:	360 litres
Jumbo D Tank:	675 litres
E Tank:	675 litres
M Tank:	2000 litres

NOTE: 2000-2200 psi is considered normal pressure for most size tanks.

**Based on a non-breathing patient receiving positive pressure ventilatory assistance from a rescuer. The pocket mask can also be used for breathing patient if no other delivery system is available. (Follow simple mask settings and remove mucous filter and one-way valve).*

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Nasal Cannula

The nasal cannula is the only supplemental device that does not cover the mouth as a mask does. For this reason, the cannula is useful for the following conscious patients:

PROS: **Claustrophobia** – some patients will not tolerate a mask covering their face. The cannula is usually well tolerated.

Vomiting – patients who have been vomiting but also require oxygen for their condition will benefit from the cannula.

Confined Space Rescue or High Angle Extrication – if the patient is strapped down to a spineboard or is secured in a basket stretcher for transport, severe airway distress can occur if the patient vomits with a mask on, and cannot clear their own airway. If the patient is wearing a cannula and vomiting occurs, the stretcher can be rolled and the patient's airway cleared.

CONS: The oxygen concentration of the cannula can only reach a maximum of 44%. This does not make it useful for patients requiring high flow oxygen. Some examples of such patients would be for treatment of asthma, severe shock, etc.

Simple Mask:

The simple mask is not a widely used device. It covers both mouth and nose. It has a head strap to hold it securely to the face, plus a nose clip to ensure a good seal. There are exhalation ports without flap valves on both sides of the mask.

PROS: A simple mask is a good medium concentration device for use on conscious patient with spontaneous respirations. The simple mask is capable of oxygen concentrations of 40-60%. This is a generally well-accepted device available in pediatric and adult sizes alike.

CONS: Oxygen concentrations are at 60% maximum. In addition, it is difficult to assess breathing depth and quality. It is important that the litre flow is set no lower than 10 Lpm for an adult as the exhaled CO_2 may not clear the mask and the patient may actually get reduced oxygen concentration as a consequence.

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Non-Rebreather Mask:

The non-rebreather mask covers the mouth and nose, and is similar in design to the simple mask. However, there is an additional reservoir bag and a one-way valve. All incoming oxygen is directed into the reservoir, which allows inhalation through the valve and into the patient's lungs.

The valves on either one or both of the exhalation ports prevents atmospheric air from entering the mask during inhalation thus increasing oxygen concentrations. If one flap valve is used on the exhalation port, 60-90% oxygen concentration is attainable. If two flap valves are covering both exhalation ports, up to 100% oxygen concentration is attainable. However, if both exhalation ports prevent incoming atmospheric air and the oxygen source either runs empty or the tubing becomes kinked during a rescue, there is potential for the patient to suffocate. For this reason, most rescuers prefer non-rebreather masks with only one side flap valve.

PROS: While ensuring the same litre flow as the simple mask of 10-15 lpm, you attain approximately 30-50% **better** oxygen concentrations. The reservoir bag may be observed during respiration. This allows the rescuer to assess the rate and quality of breathing, in addition to observing chest excursion (expansion).

CONS: There is a risk of suffocation with the mask models that include two exhalation side flaps valves. However, with close patient monitoring the risk in minimal.

Patient Care and Supplemental Devices

Nasal Cannula:
The cannula should be placed on the patient and looped behind the ears. If the prongs are curved, they should curve inferior (downward) into the nostrils. In addition, the oxygen should NOT be turned on until the cannula is in position.

If a cannula is to be used for longer than 30 minutes, humidified oxygen should be considered to prevent drying and possible bleeding of the nasal passages.

Simple Mask:
Oxygen should be turned on prior to applying the mask to the patient. In addition, please ensure that you take the time to inform your patient of your intentions, and encourage them to continue to breathe normally.

Non-Rebreather Mask:
As with the simple mask, turn the oxygen on and let the patient know what you are doing. You will need to apply gentle pressure to the one way flap valve over the reservoir bag to facilitate filling of the reservoir prior to placing the mask on the patient. This is referred to as “priming the reservoir bag”.

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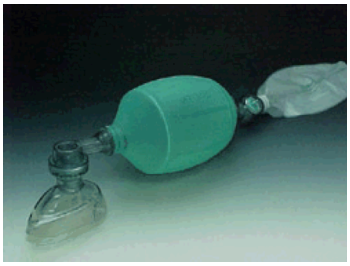
Resuscitative Oxygen Therapy *(Positive Pressure)*

There are several different delivery systems that may be referred to as Resuscitators. Before we list them however, we should review their use for patient resuscitation. Generally, we resuscitate those patients who breathe <12 breaths/ min., suffer from an altered LOC (level of consciousness) or have experienced a head injury. In addition, virtually any injury or illness causing reduced respiratory rate, volume, and level of consciousness, would benefit from BVM resuscitation using oxygen therapy. In some cases, the need for resuscitation is obvious, as in respiratory or cardio-respiratory arrest situations.

Bag-Valve Mask (BVM):



Typically silicone, rubber or soft plastic in construction, this device consists of 4 parts:

- Reservoir Bag c/w oxygen tubing
- Bag
- Valve
- Mask

This method of resuscitation is widely used in hospital and pre-hospital settings alike. It is used with an OPA (oropharyngeal airway) at the basic level of care. The Advanced Life Support community will usually intubate the patient and hook up the BVM directly. Used in conjunction with an OPA, NPA or both, this is one of the best resuscitative methods available to the BLS rescuer.

Oxygen flow for adults is set between 10-25 Lpm and flows into the base of the bag near the reservoir. The oxygen is directed into the reservoir if it is attached. If not, oxygen flows directly into the bag. When the rescuer squeezes the bag, oxygen is forced through the valve, mask, and hopefully, into the patient. It is important to understand the limitations of this device. The BVM should only be used by qualified & trained personnel, who review their skills on a regular basis. Recently we made it a policy that the BVM should only be used with two rescuers. *One rescuer can provide better resuscitation using a pocket mask with an oxygen inlet.*

PROS: The BVM is an excellent device for use on hypoxic and/or apneic patient because it has a high oxygen delivery capability when used with a reservoir bag. BVM's are available for adults, children, infant and neonate sizes, and are either reusable or disposable. The BVM delivers 100% oxygen concentration with a reservoir bag when operated properly.

CONS: Unless this device is used on a regular basis by a rescuer, it can prove difficult to operate. Constant training and review is recommended. It has been proven that when used by a single rescuer, minimal tidal volumes are delivered due to inexperience, a poor mask seal, and/or squeezing the bag incompletely. It is recommended that this device **be used by two rescuers**. One person maintains the mask seal, monitors the airway, breathing and circulation constantly and the other person squeezes the bag and monitors oxygen flow rates. The BVM is a large device and should be stored in an appropriate storage case. As well, this device is susceptible to damage during extreme cold weather use.

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Pocket Mask:

- Made out of durable plastic
- Comes with a one way valve & a mucous filter
- Also available with a head strap & oxygen inlet

PROS: The pocket mask has popular benefits including size, versatility, low cost and ease of use. Its use is taught in many CPR and first aid courses.

CONS: Because pocket masks are made of plastic, they are susceptible to breakage in extremely cold weather. It should always be stored in a warm environment or close to the body in a holder. This unit should also be taken out of its holder every month and inspected visually for cracks, tears, etc. It is difficult to criticize the pocket mask because its quality is exceptional, and use is relatively easy.

Pulse Oximetry

The saturation of oxygen in the body can be measured with a portable pulse Oximeter. This device is usually attached to the clean fingertip, and in some cases like pediatric patients, it is attached to the foot or earlobe. It sends an infrared light wave through the tissues, and receives the signal on the other side of the probe. This tells the team the percentage of 02 bound to the hemoglobin in the patient's bloodstream. Current thinking and evidence suggests that a value of 94% or greater is considered "normal" in most cases. Because the pulse Oximeter provides us with an actual value, we refer to it as a "quantifiable" means of measuring 02 therapy we may be delivering to the patient. The portable devices are often less than $40.00 and are considered a basic and fundamental means of measuring blood 02 levels as we provide care, and possibly 02 therapy.
They do have limitations such as dirty fingers, dark nail polish, and have been shown to deliver false-positive results in the case of carbon monoxide inhalation. ILCOR recommends "not" giving supplemental 02 to potential cardiac patients if their room air saturation is already greater than 94%. Talk with your instructor about this important situation, as current evidence suggests 02 may worsen an ongoing heart attack.

Oxygen Tank Safety Considerations

It is important to remember that Oxygen tanks are compressed cylinders, and as such, carry risks in operational mode and storage. Here is a brief safety list:

- Do not store O_2 cylinders around open flames. O_2 as a gas is not flammable, but does support combustion aggressively.
- Do not use compressed 02 around oil or grease. In particular, do not attempt to "lube" sticky cylinders or regulators. Always contact an approved service technician for maintenance problems.
- When O_2 tanks are stored, they should be secured and prevented from the risk of falling, or being struck.
- Protect the regulator from bumps and falls. Many commercial O_2 tank kits and bags are designed to protect the regulator and cylinder.
- Have the tank maintained and filled by an approved technician. They will ensure that the cylinder is safe, free from defects, and receives periodic hydrostatic testing on a scheduled basis.
- Ensure that O_2 tanks and regulators are not used underwater. They are not designed for the atmospheric pressures exerted in such environments.

Conclusion

The Canadian College of Emergency Medical Services endeavours to provide the most current and up-to-date information and training when it comes to Airway management and 02 therapy. It's important that you follow the advice, medical control guidelines and most current science when providing this medication. Feel free to contact us at any time should you have questions, concerns, or recommendations for our programmes.

Sincerely,
Canadian College of Emergency Medical Services

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