Topic Overview: Airway Management in the Emergency Department

Module Airway Module 2

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Objectives

1. Review the structured approach to assessment of airway and breathing and identify compromised breathing
2. Use oxygen delivery systems appropriately
3. Practice bag valve mask ventilation (BMV)
4. Practice and discuss the use of laryngeal masks when BMV ineffective
5. Make appropriate decisions about airway management in the emergency department

Take home message:
Patients don't die from failure to intubate……they die from failure to oxygenate

1. Assessment of compromised breathing

A structured assessment incorporating history and examination should be performed on all patients presenting to the ED using the AcBCDE framework (See Submodule A1). Signs suggesting compromised breathing (as opposed to obstructed airway) are shown in Table 1. Recall that it is essential to assess the patient for risk factors for difficult airway before administering sedation (See Table 2 below and Tables 4-7 in Submodule A1).

Table 1: Assessment of breathing

Look for:	**Consider the patient unstable if:**
Reduced (central hypoventilation)	→ Respiratory rate < 8
Increased	→ Respiratory rate > 30
Increased work of breathing	→ Use of accessory muscles
Reduced oxygen saturation	→ SaO_2 < 95 % (room air), cyanosis
CO_2 retention	→ $PaCO_2$ > 50 mmHg, drowsiness
Fatigue	→ Drowsiness, exhaustion

Table 2: Predictors of difficult bag and mask ventilation

BOOTS – an assessment of difficulty of bag valve mask ventilation
Bearded
Older (>55)
Obese (BMI >26)
Toothless
Snores (or a history of Obstructive Sleep Apnoea)

2. Oxygen Delivery Systems

These are classified into systems that deliver a 'variable' or a 'fixed' concentration of O2 (see Table 2)

Table 2: Attributes of fixed and variable O2 delivery systems

Variable	Fixed
• FiO2 is unknown and determined by the inspiratory flow rate(IFR). The more dyspnoeic the patient is, the higher their inspiratory flow rate and the more air they will entrain resulting in lower FiO2 Include: • Nasal cannulae • Husdon Masks • Masks with non-rebreathing bags	• FiO2 is known and constant • Properties are based on the venturi principle • Useful when low FiO2 required (COPD) • In very dyspnoeic patients with very high inspiratory flow rates, will become variable systems Include: • Venturi systems

Nasal Cannula

Apply 02 at 1-4l/min. Uses dead space of nasopharynx as a reservoir of oxygen. Delivered Fi02 not known. At high flows the nasopharyngeal mucosa quickly dries, this can be uncomfortable for the patient. There are high flow nasal cannulae systems that are now used commonly in the emergency department, delivering flows of up to 40L per minutes in the spontaneously breathing patient. Should be used as an adjunct for intubation, at high flows for apnoeic oxygenation.

Hudson Masks

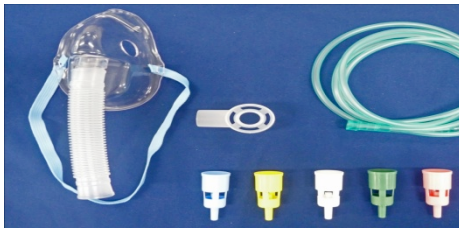
Clear mask covering the nose and mouth, elastic head strap, oxygen tubing. Apply 02 at 6-10l/min. On the side of the mask are a series of perforated holes that entrain air if the patient's inspiratory flow exceeds the wall oxygen flow. Simple to attach. (Variable 02 delivery)

Non-Rebreather Mask

Similar face mask to the "Hudson" mask with attached reservoir bag containing 1-2 valves which direct wall oxygen to the reservoir bag. During inspiration a disc valve allows the patient to breathe from the reservoir bag. The valve stops expired air going back into the reservoir bag but a second valve allows the expired air to escape back into the atmosphere. Typical Fi02 delivered 50%-80%.

Fixed Delivery Venturi System

There is a Venturi valve between the wall oxygen and the mask. The jet creates pressure that entrains surrounding room air. The size of the valve determines the amount of room air entrained and therefore the Fi02. The colour coded valves available in FiO2 of 24%, 28%, 31%, 35%, 40%, 50%. These should be used where the amount of oxygen delivered should be known.



3. Bag Valve Mask Ventilation (BMV)

3.1 Major Uses of BVM Ventilation in the ED

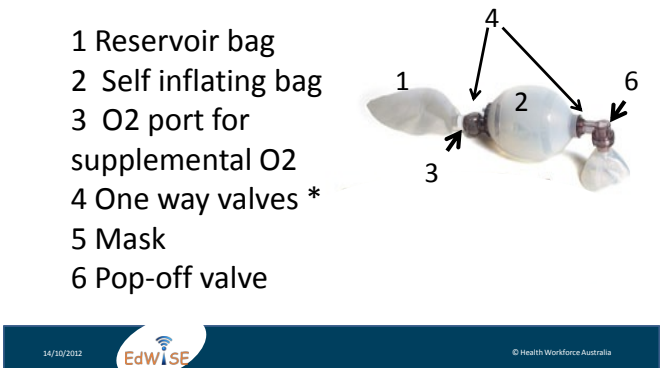
1 - Pre oxygenation*
2 - Assisting the ventilation of a patient who is hypoventilating or hypoxic
3- Ventilating the apnoeic patient

** In the spontaneously breathing patient you can give high FiO2 oxygen by attaching the device to high flow 02 and gently getting a seal between the mask and the patients face. The one-way valve will allow passive oxygenation without compressing the bag.*

3.2. Equipment for BMV

The most commonly used device in the ED is the self-inflating bag and mask. The components are shown in figure 1.

Figure 1: Self inflating bag



*allow flow from reservoir to patient and from bag to patient

With a perfect seal and system well pre-primed with O2, the system can provide 100% O2 but the FiO2 is typically closer to 80% otherwise and will be room air if O2 is not connected (or falls off).

3.3. Performing BMV

1. Equipment
Adequate equipment comprises:
1) O2 source – 15L/min
2) BVM (ideally self-inflating)
3) Masks (of various sizes)
4) Equipment in case of obstructed airway (see A1)
5) Wide bore sucker with suction source
6) Monitoring 1) Pulse oximeter, ET Co2 Waveform capnography
2) Blood pressure and ECG monitoring

2. Equipment Check. Many self inflating bags are now single use and disposable…they therefore come fully assembled. The re-usable self inflating bags are sterilised and during this process the valves are removed and the unit needs to be re-assembled. Often the valves are re-assembled incorrectly. This can lead to a failure to ventilate the patient and death so equipment checks are vital if using re-usable self inflating bags.

Perform these steps to check the valves: Connect O2, Take mask off, Hold finger/thumb over end of BVM where mask normally attaches, Squeeze bag……if assembled correctly and valve is in right way, you should not be able to compress the bag when mask end is occluded, Remove thumb…bag should compress easily / gas should be felt coming out of bag / as self inflating bag re-expands, reservoir bag should be seen to start to collapse (as it empties in self-inflating bag. Have suction available.

3. Position and technique

1. The classic position is **"sniffing" position** noting there is some debate about this in the literature with some authors suggesting simple extension is better (Adnet et al and Takenaka et al). Ideal positioning is to align external auditory meatus with the sternal notch (this theoretically provides better alignment of the oro-pharyngeal axes than does the sniffing position). Obese patients often need a shoulder roll or ramping to achieve this. Cervical spine injury or precautions should be considered whilst positioning the patient. One member of the team should keep the C-spine in alignment when the collar is removed and in the positioning process.
2. Apply **simple airway manoeuvres**: 1) Head tilt (with appropriate spinal precautions); 2) jaw thrust; 3) Chin lift
3. Use **airway adjuncts** if patency cannot be easily achieved → OP +/- NP (both NP and OP may be required)
4. Achieve a **seal** between mask and face. The mask size needs to be appropriate (bridge of nose to mental protuberance (it should not extend below jaw)). Bring the face up to mask.
5. **Hand position** - Thumb → Mask at bridge of nose, Index finger → Lower mask over mental process of mandible, Middle finger → On lower border of mental process of mandible, lifting it up toward mask, Fingers 4 & 5 → Angle of jaw and mandibular border, performing jaw thrust (and lifting mandible up toward mask)
6. **Oxygenation and ventilation** is the primary aim of BVM
   6.1. Vent rate → About 10-12 per minute (adults) / Infants will need faster rates (20 -30)
   6.2. Aim for TV about 6 – 8 mls/kg → monitored by discernible chest rise
7. The self inflating bag should be gently squeezed in order to get visible chest rise. Ventilating with excessive force may cause gastric distension and precipitate vomiting. It also may compromise lung expansion by the pressure of a distended stomach.

Figure 2: technique for BMV

4. Assessment of adequacy of BMV

Look	For chest expansion and make sure the stomach is not distending. Look for waveform capnography. At the skin colour of the patient.
Listen	For the pulse oximeter. For any oxygen leak around the mask.
Feel	The compliance of the self inflating bag. If obstruction is present the bag will feel hard to empty; if a leak is present the bag will empty quicly or collapse when compressing For escaping air around the mask.

Troubleshooting BMV

1. Hyperventilation - often the bag is compressed far too quickly (due to nerves / "endogenous adrenalin in the resuscitator"). Count and maintain respiratory rate at 12-15 for adults
2. Poor chest wall movement – check the following
    1) Check mask size and seal
    2) Patient's position
    3) Check for airway obstruction and follow the algorithm in A1. In particular
        Use airway adjuncts
        Use two-handed ventilation with two operators (Davidovic et al)

5. The Laryngeal Mask Airway (LMA)

The LMA is considered a 'supra-glottic' rescue device for the obstructed airway and is used to gain an emergency airway in the case of a failed intubation. It provides a simple adjunct to assist in ventilation and is a skill that should be learned and practised by all staff involved in managing the airway. Relative contraindications would be when there is a high risk of passive regurgitation of stomach contents, high airway pressures are required or there is distorted upper airway anatomy.

The laryngeal mask has two fused components, the tube (with a standard 15mm connector) fused to a bowl shaped distal cuff that is inflated via a valve on an inflation line. With the opening of its lumen facing the laryngeal inlet, the mask conforms to the shape of the pharynx. They come in reusable and single use forms. See Figure 3. Sizes range from 1 (Neonates) to 5 (Large adults). A small adult female would accept a size 3, a larger adult male a size 5. Numerous LMAs are available such as LMA classic/classic excel,unique. LMA proseal. LMA supreme. Some are developed so you can intubate through them eg LMA Fastrach.

Technique

Multiple different techniques are taught for insertion. Assessment of adequacy of ventilation is similar to that for BMV.

Figure 3: The LMA

Complications

- Injury to friable pharyngeal tissues.
- Over inflation of cuff causing airway obstruction/ pressure necrosis.
- Increased difficulty in patients with cervical collar in position.
- Cuff leak due to laceration on teeth with improper insertion.
- Laryngospasm (rarely).

6. References

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