Topic Overview: Structured Approach and Basic Airway Management

Module Airway 1

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Objectives

Use a structured approach to assessment and management of the airway in the emergency department (ED), including:

1. **Assessment**
   - 1.1. Assess the airway, identify symptoms and signs of airway obstruction
   - 1.2. Distinguish 'functional' from 'anatomical' causes of obstruction
   - 1.3. Distinguish between airway obstruction and impaired breathing
2. **Management**
   - 2.1. Apply assessment findings to an algorithm and institute management aimed at achieving airway patency
   - 2.2. Rehearse simple airway manoeuvres to clear an obstructed airway
   - 2.3. Use airway adjuncts appropriately to clear an obstructed airway
3. **Advanced management and decision making**
   - 3.1. Know signs that predict patients at imminent risk of obstruction
   - 3.2. Incorporate multiple relevant factors into your assessment and consider the options for definitive interventions such as intubation or non-invasive ventilation

1. Introduction

Abnormalities of airway and breathing are common, either as primary conditions, or in association with an acute condition affecting another system(s). Thus early and effective airway and breathing management is central to the initial management of any potentially unstable patient, as shown in the universal algorithm

A - Airway (+ C Spine)
B - Breathing
C - Circulation
D - Disability
E – Exposure/Electrolytes

Disorders of A and B often present with non-specific signs, and they frequently coexist, so distinguishing one from the other may be difficult. But it is important to do so, because the treatments for each differ considerably, and both are associated with therapeutic procedures which may cause life threatening complications.
A focused airway history and examination will guide management. The AcBCDE approach used in other areas managing the critically ill should be used.

Intervention may be required if the patient does not, or is anticipated not to be able to maintain a patent airway, protect his or her airway from aspiration or adequately ventilate or oxygenate. This assessment is based on a comparison of the patient's current clinical condition and usual baseline. This should include assessment for predicted difficulty of intubation and risk of airway obstruction or aspiration induced by sedation, if the latter is considered.

2. Definitions

Anatomically, the airway extends from the mouth and nose to the first tracheal ring. Disorders arising below the carina, the lungs, chest wall and central neurological control centres for these sites, are considered as breathing related. Disorders arising in the mid trachea are rare, and can be classified as either airway or breathing related.

3. Airways in the Emergency Department

Airway management in patients presenting to EDs can be especially difficult for reasons presented below:

- Some patients' natural anatomy predisposes them to airway obstruction (see section on the difficult airway)
- Multiple patient factors increase complexity, such as:
    - Blood, fluid and secretions which may exacerbate obstruction and cause a poor view at laryngoscopy
    - Unfasted status which creates risks for aspiration
    - Unstable haemodynamics which add competing priorities for treatment
    - Underlying pathology which may contribute to obstruction and impair the effectiveness of preoxygenation
- In trauma, stabilisation of the cervical spine must occur synonymously with airway support as airway management manoeuvres involve moving the C-spine, which may exacerbate any injury. This is reflected in the revised acronym AcBCDE.

4. Airway Assessment

Characteristic signs of airway obstruction which should be excluded in your assessment are shown in Table 1.

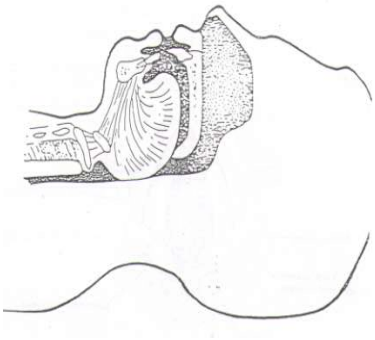
Table 1: Symptoms and signs of upper airway obstruction

Look for:	**Consider the patient unstable if:**
Chest wall excursion	• Absent or "see-saw"
Listen and feel for expired gases at the mouth	• Reduced breath
Oxygen Saturation (SaO2) and colour	• SaO2 less than 95 %, or cyanosed
Functional obstruction (sedation, narcotisation, coma)	• Reduced level of consciousness • Snoring, periodic breathing
Anatomical obstruction (post-surgical swelling, haematoma, foreign body, traumatised larynx)	• The patient may be alert and anxious • The patient may prefer to sit forward and reluctant to lie flat • Dysphagia (difficulty swallowing), dysphonia (soft voice)/hoarse voice, drooling, stridor , croupy barky cough • Prolonged expiration>3 seconds
Tracheal obstruction (sputum plugging, trauma) ▪ ***Anatomical*** *(foreign body, mucous plugging, traumatic dislocation)* ▪ ***Functional*** *(tracheomalacia post thyroidectomy)*	• Stridor persists throughout inspiration and expiration • Signs of both airway and breathing compromise

5. Functional versus anatomical airway obstruction

The most common cause of airway obstruction is ***functional collapse*** of the soft tissue of the oro-pharynx and the tongue (Figure 1).

Figure 1: Saggital view of airway showing patent and obstructed airway



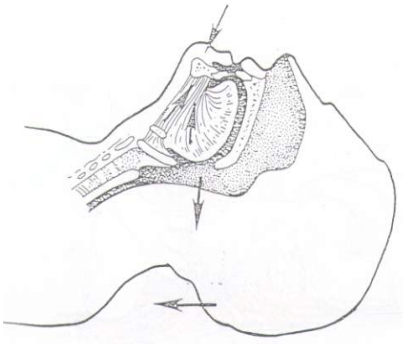


Figure 1a: *Functional airway obstruction caused by the base of the tongue in the presence of sedation or reduced muscle tone*

Figure 1b: *Normal airway or airway made patent by head tile chin lift manouvre*

This may be in association with several factors that reduce the level of consciousness (LOC). Other common causes of airway obstruction in patients in the ward or presenting to the ED are summarised in Table 2.

Table 2: Causes of upper airway obstruction

FUNCTIONAL:	**ANATOMICAL:**
Reduced LOC ▪ Drugs ▪ Head Injury ▪ Shock ▪ CVA ▪ Neurological disorders ▪ Hypoglycaemia ▪ Hypothermia ▪ Hypothyroidism ▪ Sepsis	**Soft Tissue Swelling** ▪ Allergic angioedema ▪ Burns ▪ Haematoma: post surgical ▪ Post surgical ▪ Venous obstruction (strangulation, inhaled irritants and toxins, hanging) ▪ Preeclampsia **Infection** ▪ Epiglottis, abscess, quinsy, tonsillitis ▪ Cellulitis, croup
Patients at higher risk for functional obstruction when LOC is reduced	**Trauma** ▪ Airway disruption (Blunt or penetrating trauma)
▪ Obesity ▪ Pregnancy ▪ Obstructive Sleep Apnoea ▪ Previous head/neck surgery	**Masses** ▪ Neoplastic ▪ Foreign Body ▪ Goitre

6. Discriminating between an obstructed airway and compromised breathing

This is the B component of the structured approach. Table 3 presents signs that suggest compromised breathing

Table 3: 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 < 90 % (room air), cyanosis
CO_2 retention	→ $PaCO_2$ > 50 mmHg, drowsiness
Fatigue	Drowsiness, exhaustion

7. Emergency treatment of airway obstruction

Any of the signs in Table 1, if present, should prompt an immediate response. All patients* should have:

1. O2 administered by Hudson or Non-rebreather mask
2. IV access
3. SaO2 monitoring

(*desist and defer to senior advice in children with anatomical obstruction to minimize anxiety)

Emergency treatment differs depending upon the assessment findings:

A. Functional obstruction (most common)
B. Anatomical obstruction (and suspected tracheal obstruction)
C. The airway is deemed to be patient and the problem is compromised breathing

These three conditions are presented in the **emergency algorithm for the obstructed airway. See Figure 2**.

A. Functional obstruction (most common)

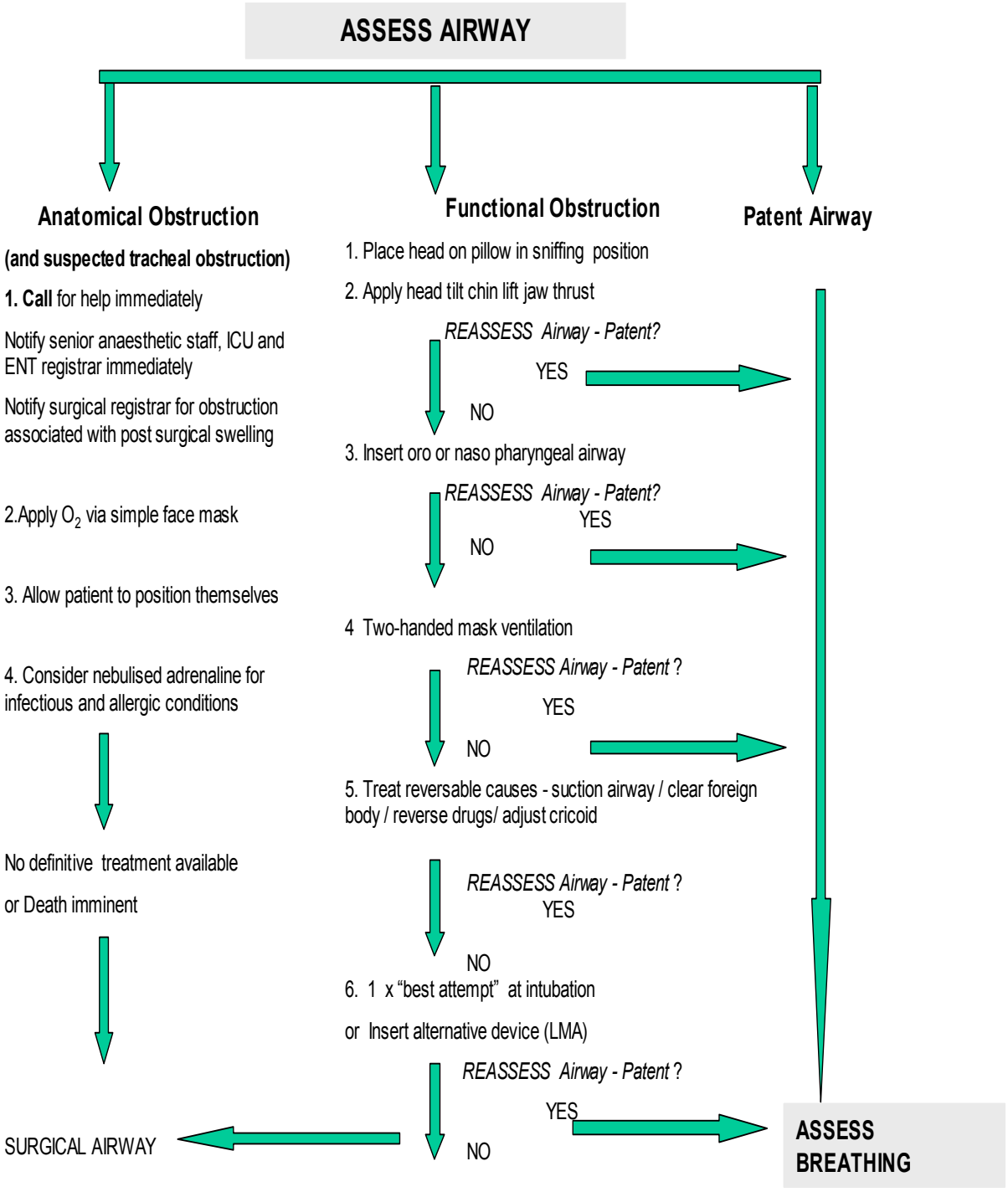
Most patients with airway obstruction have functional obstruction. The mainstays of airway support are:

1. **Always remember to protect the cervical spine if the patient has suffered trauma.**
2. **Basic manoeuvres**

Treatment aims to elevate the tongue forward. The following should be done in sequence, reassessing for patency before progression to the next step.

1. ***Position the head in the sniffing position.*** Place the patient's head on a firm pillow or folded towels in the sniffing position unless uncertainty regarding the C spine precludes this. In the supine patient the axis of the oral cavity is approximately at right angles to the axis of the pharynx and the trachea. This can contribute to airway obstruction in sedated patients. In order to open the airway these airway axes should be aligned. This alignment can be obtained by flexing the lower cervical spine at the cervicothoracic junction and extending the upper cervical spine. This is the sniffing position (position you may sniff roses or alternatively blow the head off a glass of beer.) The external auditory canal should be aligned as close as possible with the sternal notch.

Figure 2. Emergency Algorithm for the Obstructed Airway



2. ***Perform head tilt and chin lift and jaw thrust***
   a. **Jaw Thrust -** Use two hands. The angle of the jaw is lifted forwards. This causes subluxation of the mandible bilaterally and pulls the tongue away from the posterior pharynx thus opening the airway.
   b. **Chin Lift -** Stabilise the forehead with the palm of one hand whilst 2-3 fingers of the other hand lift the chin forward thus pulling the tongue away from the pharynx.

3. Insert airway adjuncts ***(oro-pharyngeal and naso-pharyngeal airways).***
   Both the oropharyngeal and nasopharyngeal airways are airway adjuncts designed to create a patent airway by bypassing the obstruction caused by the tongue and soft palate on the posterior pharyngeal wall. They are both simple in design and easy to insert given the correct technique.
   a. **Oropharyngeal Airway -** Also known as a Guedel, it is a plastic hollow curved tube with a proximal flange and colour coded for size. Choosing the correct size is important. If it is too small the Guedel will sit on the obstructing tongue, whilst if it is too big it may cause laryngospasm or pass into the oesophagus. The correct size is the distance from the corner of the mouth to the angle of the jaw. Introduce the Guedel concave side upwards. Continue as fall as you can along the hard palate until you feel resistance then rotate the airway 180 degrees and continue pushing gently forward until the flange sits comfortably against the lips. In order to tolerate a Guedel airway the patient must have a significant decrease of consciousness.
   b. **Nasopharyngeal Airway -** Constructed from soft silicone or latex, nasopharyngeal airways are very useful in patients with trismus or who have some degree of airway obstruction but are too "light" for a Guedel airway. They are hollow, have a proximal flange and a bevelled leading edge. Traditionally they are sized from the tip of the nose to the ear lobe. (though this has not been validated)**.** To insert, lubricate the distal end of the nasopharyngeal tube. Choose the larger nare then introduce the airway perpendicular to the face. The flange should be facing the midline. Sometimes a twisting motion assists its insertion. After insertion the nasopharyngeal airway should sit snugly against the nare. Gentle insertion is essentially as injuring the sensitive nasal mucosa and causing epistaxis is not uncommon. Insertion in patients with facial injury is contraindicated.

NB:THE FOLLOWING STEPS ARE COVERED IN SUBMODULE A2

4. **Two-handed mask holding and manual ventilation:**

This is a frequently neglected manoeuvre and may convert a critically obstructed airway to a marginal airway in which some 02 is being exchanged. A manual ventilation bag and mask are used and the most experienced airway person should take the mask. Basic manoeuvres should still be in place.

Until this point there is often insufficient evidence to diagnose airway obstruction from breathing failure in apnoeic patients. This step is performed here to make that assessment. If the patient can be adequately ventilated with bag and mask, without evidence of airway obstruction, then you assume their problem is breathing failure. They may have had an obstructed airway, which you are managing with basic manoeuvres, and you can go back and reassess this. This is a critical step because it is not appropriate to proceed to intubation to relieve airway obstruction if the airway is not obstructed.

5. **Reversal of causes:**

These may help to support a patient with an obstructed airway but are not active steps in either clearing or protecting the airway. These include:

- Reversal of sedation with naloxone or flumazenil, if appropriate
- O2 therapy (including high flow O2 via nasal prongs)
- Adrenaline if acute airway oedema is suspected
- Removal of cricoid pressure during a 'can't intubate – can't ventilate' difficult intubation

6. Intubation:

This is indicated if airway patency cannot be attained with the above manoeuvres. Intubation is discussed below. The two key points are:

- Everything should be optimized and you should have only one attempt
- Do not use drugs to facilitate intubation. Muscle relaxants (short and long acting) are contraindicated if the airway is known to be obstructed.
- It is important not to become fixated on intubation– although intubation is the gold standard in airway management for maintaining a patent and protected airway, the procedure should be performed by the right person, with the right skills at the right time, in the right place, with the right preparation and the right back up plan.

7. Intubation alternatives:

The Laryngeal Mask Airway (LMA) is a cuffed device designed to sit in the hypopharynx with the forward facing aperture apposing the laryngeal inlet. It is connected to a manual resuscitator (bag and mask) to ventilate the patient. The LMA can be used prior to or as an alternative to endotracheal intubation depending on the experience and skills of the clinicians.

8. Emergency Surgical Airway:

If the airway cannot be made patent with steps in the functional pathway, then proceed to a surgical airway. Several techniqus have been described and collective term is 'infraglottic rescue'. This is the end-point for the obstructed airway. A patient should never be allowed to succumb to an obstructed airway without an attempt at this procedure by an appropriately trained person. Conversely this procedure carries high risks and it should never be embarked upon unless all other supraglottic rescue' steps in the obstructed airway algorithm, described above, have been conscientiously performed.

B: Anatomical obstruction (and suspected tracheal obstruction)

If the patient is alert and there is an anatomical obstruction then the basic interventions, used in the more common presentation of functional obstruction, are unlikely to help and may exacerbate the obstruction. The key treatment steps are:

1. Call for specialized assistance immediately (Emergency physician, Anaesthetist, ENT surgeon, Intensivist) as the patient is likely to require a definitive surgical airway.
2. Apply O2 via Hudson (6-8L/min) or non rebreathing (10L/min) mask.
3. Allow the patient to sit in their preferred posture. Patients will often assume the best posture for maximum airway patency, if conscious. Do not force the patient to lie down.
4. Do not sedate these patients – this may cause sudden, complete obstruction.
5. Prepare to perform an emergency surgical airway.

C: The airway is deemed to be patient and the problem has compromised breathing

Once the airway is made patent using the steps explained under 'functional' obstruction the patient's breathing should be assessed (See section 6 Table 3).Management of compromised breathing is dealt within Submodule 2.

8. Predictors of Difficult Airway

A number of procedures are performed in the ED under sedation. Sedation can cause functional airway obstruction and impair breathing. Some patients are especially at risk of this. It is essential that we identify at-risk patients by assessing them for predictive signs of 'difficult airway'.

The term 'difficult airway' has no clear universally accepted definition. Because of this, the literature is difficult to interpret, and more importantly, a documented history of difficult airway in a patient's medical records can mean different things to different people. Theoretically a difficult airway includes risk of functional airway obstruction and difficult bag valve mask ventilation; difficulty with LMA placement; difficult intubation or likelihood of failed surgical airway in the event the latter is attempted.

8.1 Risk factors for functional airway obstruction and difficult bag valve mask ventilation

Table 4 provides criteria suggesting difficulty with airway management using simple manoeuvres and bag and mask ventilation.

Table 4: 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)

8.2 Predictors of difficult LMA insertion

These are essentially the same as 8.1 with the exception of the presence of a beard

8.3 Predictors of difficult intubation

A popular definition of difficult intubation is one that requires excessive lifting force, external laryngeal manipulation, multiple devices, multiple operators, multiple attempts or is performed with an inadequate glottic view. The opponents to this definition feel that "difficult intubation" is not the issue and consider it far more important to focus on "failed intubation". There are multiple systems of assessment because none are both sensitive and specific enough to ensure that no patient would be missed in the assessment. Even with meticulous assessment, only 50% of difficult intubations can be predicted. **LEMON** – an assessment of difficulty of intubation, has been prospectively validated in a trial of 156 patients.

Table 5: Predictors of difficult intubation

L Look externally → general impression / body habitus / unusual anatomy / facial trauma
E Evaluate 3:3:2 →Size of mandible / distance between mentum and hyoid / extent of mouth opening
3 ; Assesses mouth opening. 3 of patient's fingers can be placed between their incisors
3 ; Assesses volume of submandibular space. Normal patient can fit 3 fingers between mentum and hyoid
2 ; Identifies location of larynx relative to base of tongue. Normally, a patient should be able to place 2 fingers between superior notch of thyroid and hyoid.
NB All relative measurements are in terms of the patients fingers
M Mallampati score →

Class 1 ; fauceal pillars / uvula / soft palate visible
Class 2 ; Soft palate and uvula visible
Class 3 ; Soft palate only ; Uvula masked by base of tongue
Class 4 ; Soft palate not visible
O Obstruction / Obesity → Supraglottic masses / infection / trauma / tumour
N Neck Mobility → Any decreased cervical spine mobility (including forced immobility from cervical immobilization for trauma) will compromise laryngoscopy

8.4 Predictors of difficult surgical airway

Table 6: Predictors of difficult surgical airway

Bearded
Obese (BMI >26)
Goitre
Trauma to front of neck
Previous surgery to neck or larynx
Previous long term intubation or known tracheal stenosis

9. Airway Management Options

A number of management options described are dealt with in the Airway submodules. See box

A1	**A2**	**A3**	**A4**	**E LEARNING**
Simple airway manoeuvers	Nasal Prongs	Intubation	Surgical Airway	Non-Invasive Ventilation
Airway Adjuncts	Oxygen Masks – variable and fixed	Rapid sequence induction		
	Bag Valve Masks			
	Laryngeal Masks			

10. Summary

Oxygenation is an absolute priority and in most cases can be achieved with simple airway manoeuvres, positioning and bag mask ventilation. It is important not to become fixated on intubation– although intubation is the gold standard in airway management for maintaining a patent and protected airway, the procedure should be performed by the right person, with the right skills at the right time, in the right place, with the right preparation and the right back up plan. **Patients don't die from failure to intubate – they die from failure to oxygenate**

11. References

•Airway Management in Emergencies, Kovacs G and Law J.Adam, Second ed, 2011, Peoples Publishing house.

• Morikawa S, Safar P, Decarlo J. Influence of the head/jaw position upon upper airway patency. *Anesthesiology*. 1961;22:265-270.

•Uzun L et al. Effectiveness of the jaw-thrust manoeuvre in opening the airway: a flexible fibreoptic endoscopic study. *ORL J Otorhinolaryngol Relat Spec*. 2005;67(1);39-44.

• Gabbott DA, Baskett PJ. Management of the airway and ventilation during resuscitation. *BR J Anaesthesia*. 1997;79(2):159-171.

•Roberts K, Porter K. How do you size a nasopharyngeal airway. *Resuscitation*. 2003;56(1):19-23