

# Chapter 1: Airway

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## Introduction

The airway is an integral part to the management of the critically ill patient. It is the first part of ABCs and is one of the first priorities. A patient with an inadequate airway could die within minutes. In the absence of an inadequate airway, a definitive airway may also be established to facilitate mechanical ventilation, tracheal toileting and control CO<sub>2</sub>. In this chapter, we will look at:

1. Recognition of an inadequate airway
2. Methods of establishing an airway
3. Algorithms for airway obstruction and difficult airways
4. Methods of confirming and monitoring for an adequate airway

## Assessment of the airway

The 3 principles of assessing the airway is:

1. Airway patency
2. Airway protection
3. Airway difficulty

### Airway patency

One of the key components of airway assessment is to identify whether the airway is patent, such that adequate ventilation can occur. In any assessment, it is important to look, feel and listen. An assessment should encompass multiple signs, and a reliance should not involve only a single sign.

Look for:

- breathing effort
- Chest and abdominal movements
- Misting of the oxygen mask
- Evidence of trauma to the face or neck including burns

### Red alert signs

- If the patient is in distress, working hard
- Or the opposite, unconscious
- Tracheal tug
- Paradoxical chest and abdominal movements (sea sawing)

- Cyanosis maybe a late sign

#### Feel:

- Air flow through the mouth and nose
- Chest wall movements
- In trauma, consider
  - Feel for abnormal anatomy such as laryngeal fracture
  - Subcutaneous emphysema around the airway

#### Listen:

- Breathing noises
- Breath sounds

#### Red alert signs

- Stridor. This can be exacerbated by lying the patient flat.
- Gurgling and not clearing secretions
- Silent chest

#### Airway protection

The assessment of airway protection look at the risk of airway soiling, causing aspiration which may lead to aspiration pneumonitis and subsequently pneumonia. There are three things to consider in this assessment:

1. How well can the patient protect the airway
2. How high the risk of airway soiling is
3. What the trajectory of the patient is

#### How well can the patient protect the airway

You need to assess for:

1. **Level of consciousness.** For the patient to be able to protect their airway they require intact airway reflexes. A surrogate measure of this is how alert and awake they are. Traditionally, people have used a GCS of 8 or less as a cut-off, but this is extrapolated from guidelines from trauma, and therefore should be used as a guide, NOT the sole reason for obtaining a determining airway protection.
2. **Ability to cough.** This is an essential aspect of airway protection. Types of patients that may fit under this category (but not limited to) include those with severe neuropathies or myopathies.

### How high the risk of soiling is

You need to weigh the ability of the patients to protect their airway against the risk of soiling. A patient may have a GCS of 11, but if he is actively vomiting or regurgitating, depending on the context, a definitive airway may still be indicated.

### The trajectory of the patient

The airway management of the patient must take into consideration of the likely trajectory of the patient's condition. If the patient is likely to improve, then simple measures such as putting the patient in the recovery position as a temporary solution to protect the airway maybe used. An example would be a patient who has suffered a seizure, is post-ictal and showing signs of waking up. In this instance the risks of intubating the patient outweighs the benefits.

If the patient's airway is currently adequate but you anticipate a deterioration, the patient requires transport, then you may elect to intubate this patient anyway.

### Airway difficulty assessment

It is important to get an idea of how difficult the airway may be to help you plan. This is especially if you have a manageable airway with adequate ventilation and you are about to embark on intubation. In this instance you will have time to prepare for a difficult airway if you identified one. In a lot of ICU cases, you will not be able to do the full anaesthetic airway assessment, and sometimes, you will have to make do what is accessible to be assessed.

The four areas that you need to assess are:

1. Mouth
2. Neck
3. Body
4. History

#### Mouth

Assess for:

1. Signs of trauma and bleeding
2. Mouth opening: Good mouth opening is good, small mouth opening is bad
3. Teeth: No teeth good, protruding teeth and poor dentition are bad
4. Mallampati score (1)
5. Beard makes for difficult bag mask ventilation

#### Neck

Assess for:

1. Neck extension. If in a collar and needs inline immobilisation, expect a grade view poorer.
2. Thick neck suggest difficulty
3. Signs of neck trauma, step in the thyroid or cricoid, subcutaneous emphysema

## Body

Obesity is associated with difficult bag masking. It is important to ramp the patient up for intubation. It is associated with OSA and thick necks which can be associated with difficulty in intubation.

## History

You may not be able to get a history from the patient. However, other sources that can be considered are family, GP and clinical notes. Look for:

- History of difficult intubation
- Previous surgeries, cancers and/or radiotherapy around the airway, neck, or mouth
- Medical conditions associated with difficult airways, including, but not limited to:
  - Connective tissue disease, e.g. scleroderma, rheumatoid arthritis, ankylosing spondylitis

## Managing the difficult airway

There are many different types and levels of registrars that attend our unit. Accordingly, the level of skill and comfort with airways are very different. The details of intubation are described in section 2 and 3 of this chapter, but it is important that if you think the intubation will be difficult, seek help, **REGARDLESS** of your airway expertise. Discuss the case with the on call ICU consultant and seek help from the duty anaesthetic registrar +/- anaesthetist.

## Establishing the airway

In this section, we will discuss simple techniques to open an obstructed airway to advance techniques of endotracheal intubation and surgical airways.

### Opening the airway

In a patient with reduced level of consciousness, airway obstruction is caused by reduced tone of the airway muscles and often the culprit is the tongue when it falls posteriorly. Simple manoeuvres with chin tilt and jaw thrust in a patient can relieve an obstructed airway. This in itself may be enough to allow the patient to ventilate, either spontaneously or through a bag mask ventilator.

### Airway adjuncts

To assist with establishing a patent airway, there are several airway adjuncts which can be used to bypass the tongue to relieve the obstruction. These include the oropharyngeal airway, the nasopharyngeal airway and supraglottic devices, such as the laryngeal mask airway.

#### *Oropharyngeal airway*

The oropharyngeal airway is the “go to” adjunct as it is the easiest to use and has the least number of disadvantages. To size the device, the device should be the length between the edge of the mouth to the earlobe. There are a variety of ways of inserting the device, but the concept of insertion is to get the device around the tongue, rather than “through” the tongue. One common technique is to insert this upside down into the mouth and rotating this 180 degrees to the right way round once the tip is around where the soft palate is. This

the least traumatic of all techniques with the main downside of the device being that it is uncomfortable and may not be tolerated by patients who are still partially conscious and have intact gag.

#### *Nasopharyngeal airway*

The nasopharyngeal airway bypasses the tongue through the nasopharynx. To size this device, the length of the tube should reach from the patient's nostril to the earlobe. The device should be lubricated and gently inserted horizontally into the nostril. The advantage of this device is that it can be used in patients with intact gag reflex. The disadvantages include that it is contraindicated in patients with suspected base of skull fracture and a patient's with recent transphenoidal surgery, as the device may protrude intracranially. It can also cause trauma and epistaxis, which may complicate subsequent airway management.

#### *Laryngeal mask airway*

The laryngeal mask airway (2) bypasses the tongue and ideally sits just above the glottis and allows ventilation. There are a variety of these devices, with some offering some form of aspiration protection as well. In the ICU context, this is a rescue device to provide a method to facilitate ventilation where intubation is not available or feasible. Definitive airway will still need to be obtained and options include waking the patient up (generally not feasible in ICU patients), intubation through the LMA with or without the aid of a fibroptic, or surgical airway.

#### *Endotracheal intubation*

Endotracheal intubation is the definitive airway management. The indications for this include:

- To establish and maintain airway patency (e.g. obstructed airway in an unconscious patient)
- To establish and maintain airway protection (e.g. to prevent aspiration in an unconscious patient)
- To facilitate mechanical ventilation (e.g. patients with severe pneumonia with hypoxia, or neurosurgical patients that need CO<sub>2</sub> control)
- To allow for tracheal toileting (e.g. patients that can't cough well enough to clear sputum)

This can be done most commonly orally, but also done through nasally (commonly in paediatrics), and via a tracheostomy.

#### *Oral intubation*

It is not anticipated that all of you will have the ability to intubate a patient. In this instance the key is to:

- Identify an airway issue
- Identify potential difficult airway
- Ask for help early

- Other ICU registrars
- Anaesthetic registrars
- ICU consultant
- Anaesthetic consultants

Endotracheal intubation in the ICU patient is different from theatre intubations. Rapid sequence is often required, can potentially happen anywhere in the hospital, in a critically ill patient, with staff who are not as well experienced as an anaesthetic technician.

The key to a successful intubation is **preparation**:

- Personnel: Ensure you have a team of people with delegated roles, with clearly identified team leader and good communication. The team leader does not have to be you, but should be the person most capable of fulfilling this role.
- Plan: A clear plan which includes the process of intubation and what to do if you fail to intubate. This is to be communicated to your team
- Pharmaceuticals: Ensure you have all your intubation drugs drawn up and ready before induction. Be sure to have vasopressors/atropine ready as well. You should also consider sedation and relaxants after intubation
- Equipment: Basics include laryngoscope, endotracheal tube (at least 2 sizes ready), oropharyngeal airway, bag mask ventilator, ventilator, Oxygen, suction, LMA, bougie and if available, videolaryngoscopy of some form
- Monitoring: End tidal CO<sub>2</sub>, ECG, blood pressure monitoring and sats probe are the minimum requirements

The process of intubation with rapid sequence is:

1. Preparation as per above
2. Preoxygenate, use the bag mask and apply over the face of the patient and obtain the best seal you can. Turn the oxygen flow as high as you can. You can also apply nasal prongs to the patient to provide additional oxygen. Traditionally taught to be around 2 minutes.
3. Position the patient. Sniff the morning breeze is the classical position, where the lower neck is flexed and the upper neck is extended. Usually, this would be around 1-2 pillows underneath the patient's head. In obese patients, you may need to ramp the patient up.
4. Have suction ready, an assistant should palpate for the cricothyroid cartilage in preparation for cricothyroid pressure once the patient is in the process of being anaesthetized.
5. Give a predetermined dose of induction agent and a rapid acting muscle relaxant. Most commonly, this will be propofol and suxamethonium.
6. Wait for completion of fasciculation. Sometimes, this will not be seen, in which case wait around 60s.
7. Apply direct laryngoscopy, and the tip of blade placed between the tongue and epiglottis.
8. Identify the vocal cords and insert the endotracheal tube.
9. Connect the tube to the end tidal CO<sub>2</sub> monitor and bag mask with the cuff blown up.
10. Ventilate the patient. Confirm the presence of end tidal CO<sub>2</sub>, movement of the chest as well as auscultate the chest to ensure bilateral breath sounds. If unilateral, check the distance of the tube. This is usually 20-24cm in a normal adult at the

teeth. You may need to pull back the tube as the tube maybe endobronchial. If you are uncertain, you may pull the tube back while have direct vision of the cords with the use of the laryngoscope.

11. Connect up to ventilator. Give ongoing sedation+/-relaxants. Monitor blood pressure and apply vasopressors as required.
12. Check tube placement with CXR before transporting the patient somewhere else.

### The unexpected difficult airway

Intubations in the critically ill in an emergency scenario has a higher risk of being difficult.

Factors that makes higher incidence of difficult airway include:

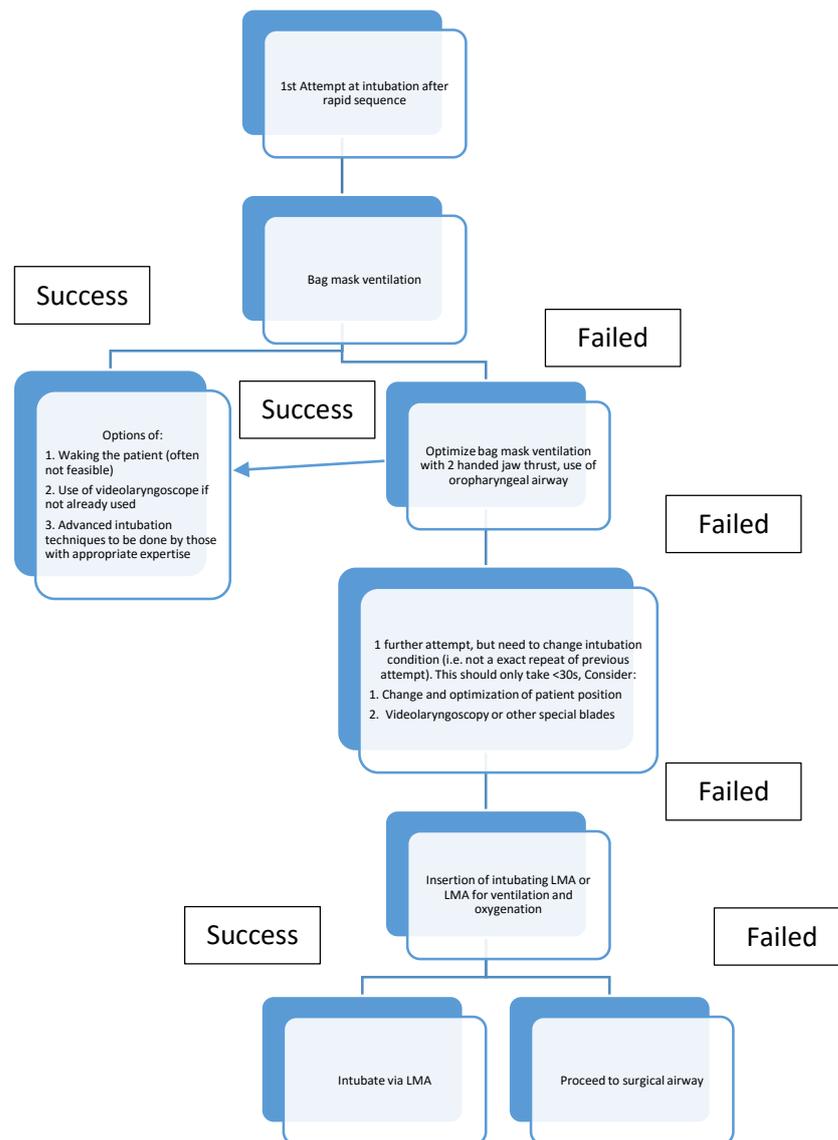
- pre-intubation assessment of a difficult airway is not always possible e.g. patient needs immediate intubation, no patient cooperation with assessment
- patient is not in an ideal position e.g. on a ward bed
- patient is not in an ideal environment with untrained assistants e.g. ward
- patient has airway soiling e.g. bleeding, aspiration

In this section, we will look at the management of the unexpected difficult airway in the critically ill. As in the previous section, if the difficult airway is predicted, help should be sought from the airway emergency team, on call anaesthetist and your consultant, and techniques where spontaneous ventilation can be maintained is used. However, because of the risk factors stated above, you may find yourself unable to intubate after you have induced the patient.

The principles of managing an unexpected difficult intubation (3)

include:

- Call for help early
- Maintain oxygenation
- Establish definitive airway but this does not trump oxygenation.
- Establish a surgical airway rapidly if in a can't oxygenate can't intubate situation



If initial intubation attempt has failed, priority should be given to oxygenate the patient. The easiest way to achieve this is the use of the bag mask ventilation. This can be further optimized by a two-handed jaw thrust, chin lift as well as adjuncts such as oropharyngeal airway. Nasopharyngeal airway insertion has a danger of causing epistaxis which may make a difficult intubation more difficult. If this is successful, then intubation should be reattempted. Depending on your level of experience, this may mean you want to wait for help if help is coming rapidly. This attempt needs to be different from the initial attempt, as repeated attempts will cause airway trauma and worsening of difficulty. This could include repositioning if not already in the optimal position, a different and more experienced operator, or a different intubation technique, commonly the use of videolaryngoscopy if not already in use. If bag mask ventilation fails despite optimization, then the LMA should be inserted. This is preferably an intubating LMA, but any correctly sized LMA is adequate. The LMA will not protect the airway, but can potentially oxygenate and ventilate the patient. If this is successful, then once the expertise and equipment is available, the patient can be intubated through the LMA. This may be the operating room with the aid of an anaesthetist. If oxygenation fails with the LMA then the right therapy would be then to proceed with a surgical airway. This should be attempted by the person most skilled and experienced.

## References

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