

Coventry Airway Management course

Airway workshops

The workshops are based on [DAS Guidelines](#) for managing un-anticipated difficult intubation. In addition lung isolation techniques workshop is recently introduced to this course. The aim of this workshop is understand the correct placement of double lumen tubes using fiberoptic scope and also provide guidance in the cases where lung isolation is required in the presence of a difficult airway.

ORSIM bronchoscopy Simulator

This station will employ the ORSIM™ airway simulator where the delegates have an opportunity to practice endoscopy skills and to gain realistic experience of performing difficult fiberoptic intubation. It provides you with manual dexterity for airway endoscopy along with 3-D airway anatomy.

Participants will learn the skills of handling FOS using ORSIM simulator in an increasing complexity. Start with simple skills, nasal, oral endoscopy followed by endoscopy in difficult airway scenarios

Videolaryngoscopy

Main objectives are

1. To understand how the technique of videolaryngoscopy (VL) is different from direct laryngoscopy (DL).
2. To understand each VL is different. One need to have prior experience to use them in a difficult scenario, hence their use in routine cases allows the user to understand the common problems encountered
3. A four-step technique (described below) is useful in minimising airway trauma and improving the success rate. This particularly helpful for non- channelled VLs such as Glidescope

Videolaryngoscopes have a definite role in the management of difficult intubation. They improve the laryngoscopic view and also improve the success rate of intubation. As they are based on the principle of indirect laryngoscopy, at the first instance we must understand the difference between direct and indirect laryngoscopy.

Direct versus indirect laryngoscopy

A ‘ line of sight’ from eye to larynx is essential for direct laryngoscopy. This is achieved by

- Extension of the head at atlanto-occipital joint, combined with a slightly flexed cervical spine – the ‘sniffing the morning air’ position.
- Compression of structures on the floor of the mouth using a direct laryngoscope (Macintosh Laryngoscope).

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Indirect laryngoscopy using VLs does not require the alignment of oral, pharyngeal and laryngeal axes. Most videolaryngoscopes have a miniature camera and a light emitting diode (LED) located at the tip of the blade.

Laryngoscopy versus tracheal intubation

For videolaryngoscopy, the procedure of tracheal intubation can be divided into two steps.

- Visualisation of the larynx
- Placement of the tube in the trachea

In general, visualization of the larynx is easy with most videolaryngoscopes but further skill is required for placing the tube in the trachea. Despite having a good view of larynx, one may fail to intubate the trachea. Success of second component (placement of tube in the trachea) requires experience, understanding the working principles of a given videolaryngoscope and the psychomotor skills (hand eye coordination) of aligning the tube tip with the glottis.

The technique varies based on the type of videolaryngoscope chosen.

For a non-channelled VL

In order to place the tube in the trachea, a dedicated stylet (for Glidescope) or a bougie (for C-Mac) is required. The placement of stylet or bougie requires practice and good hand –eye co-ordination.

One of the common problems is anterior impingement of the stylet or bougie with the anterior tracheal wall. This may require lateral rotation of the bougie or stylet and gentle advancement. Similar problem may happen with the tube needing gentle rotation and advancement

With a channelled VL, it is important to align the glottis with the tube tip. It is important to understand gap (angle) between the anterior lip of the blade and tube as it emerges from the channel. This varies with the blade type (King vision, Airtraq, Pentax AWS)

Four step technique for Non-channelled VL

- Try like direct laryngoscopy: look into the oral cavity –direct view
- Look at the monitor –indirect view
- Direct view of the airway, under direct vision advance the tube (mounted on a stylet) or bougie into the oral cavity-direct view
- Now look at the monitor (indirect view) and pass the tube through glottis.
With glidescope, a grade 2 view will help in aligning the tube with the glottis

Take all precautions to avoid blind spot (blind instrumentation of airway), always ensure that tip of the tube /stylet is advanced under vision (direct or indirect).

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Classification of indirect laryngoscopes

Optical stylets		Bonfils	Shikani		
Rigid laryngoscopes	with tube channel	Airtraq	Pentax Airway Scope	King vision	
	With guiding plate	Venner AP Advance			
	without tube channel	Bullard	C-Mac	Glidescope	McGrath

Working principle of indirect laryngoscopes involves either a micro camera that captures the image and transmits the image to a monitor screen or a system of fibreoptic fibres (an optical system in Airtraq that transmits the image to view finder).

Nasal and Oral fibreoptic intubation

Differences in nasal and oral endoscopy

	Nasal	Oral
Angle to larynx	Straight	More acute
Air space	Relatively smaller Scope follows definite path	Bigger and wider – scope likely to move sideways
Airway maintenance	Jaw thrust / pulling tongue	Airway aids and route guides

Oral route needs route guides such as Berman, Ovasapian airway

- Nasal anatomy. Appreciation of the fact that airspace appears at the top of the screen or at 11-12 clock position when standing at the head end of the patient. This will reverse if the operator stands in front of the patient.
- Preparation of the nasal mucosa with a vasoconstrictor such as ephedrine or otrivine nasal drops in asleep patients and LA + vasoconstrictor is essential to reduce risk of bleeding.
- Size of tubes should ideally be limited to 6.0-6.5 ETT

Tube placement

- Railroading tube over scope: **Tube impingement**– slightly withdraw and rotate anticlockwise if impingement on laryngeal structures occurs, Factors that influence impingement: Tube size/design/route of intubation

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- Tube selection
 - Size: larger tubes – greater gap between the insertion cord of the scope and tube tend to impinge on the laryngeal structures.

Length: nasal route, may need to cut the tube by about 2-3 cm to have enough length of the insertion cord to be free at the distal end. Ensure that the distal end of the scope should be in the mid trachea or just above the carina.

Flexibility of the tube: armoured /blue portex nasal tubes are easier to insert.

Tube tip: tubes with acute angle tips are not ideal, short-bevelled, curved tube tip easier to insert (especially proprietary ILMA tube).

- Preparation of tube – pre-warming, cutting to appropriate size and lubrication prior to loading onto a scope.
- Before removing the scope, measure the distance between carina and the end of the tube

Plan B

Intubation through supra-glottic airway devices (SADs)

Fibreoptic assisted intubation via LMA/I gel

There are two different techniques of achieving this.

- One stage fibreoptic guided intubation.
- Two stage procedure using an “Aintree” intubating catheter.

2015 DAS guidelines recommend use of second generation SADs such as I gel.

One stage fibreoptic guided intubation can be performed by directly loading a size 6 mm ID, endotracheal tube over the fibreoptic scope. But there are certain limitations with this technique. The length of LMA tube is about 22-24 cm. The distance from the LMA bars to the glottis is about 3.6 cm in males and 3.1 cm in females. Hence the length of a standard ETT may not be enough to reach the mid trachea (figure 1), the cuff of the ETT may be just lying at the level of vocal cords. To avoid this risk, it is recommended to use longer tubes such as nasal RAE (figure 1) or microlaryngoscopy tube. This ensures that the ETT is safely placed in the trachea and an adequate length of the tube is left for LMA removal. If LMA removal is difficult or unsafe, then LMA can be left in place provided it does not interfere with the surgical procedure.

The disadvantages of one stage procedure are

- Only possible to use relatively smaller size tube
- Requirement of an extra length (longer) tube

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Figure 1: Nasal RAE tube and standard ETT inserted through the LMA, demonstrates the inadequate distal length with the standard ETT.



Blind intubation through LMA is not recommended as it has low success rate and can be traumatic.

Two stage procedure using Aintree intubation catheter allows oxygenation using a rapi-fit connection (figure 3) and ventilation using a of bronchoscope adopter-swivel angle piece connector (figure 4) during the procedure. It also facilitates removal of LMA and intubation using an ETT greater than 7 mm.

Figure 2: Aintree intubation catheter with rapi-fit connectors

Figure 3: Bronchoscope adopter-swivel angle piece connector with catheter mount.



Aintree intubation catheter (AIC) is an adaptation of the Cook Airway Exchange Catheter® with a larger internal diameter of 4.8 mm, can be preloaded over fiberoptic scope with diameter 4.2 mm or less. Its external diameter is 6.5 mm, facilitates railroading of ETT with internal diameter of 7 mm or larger. It is 56 cm long so that

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once loaded onto the fibre-optic laryngoscope, the distal 4 - 9 cm of the fibreoptic scope is left free, depending on the make of the fibreoptic scope (figure 5). The catheter also has two removable rapi-fit connectors either to connect to a breathing system (through 15 mm connector) or to a jet ventilator (through Leur lock connector).



Figure 4: AIC loaded on the fibreoptic scope, inserted through LMA
Note the length of fibreoptic scope at available at distal end varies between 4- 9cm

The procedure of tracheal intubation involves following steps

- Insert LMA and confirm that ventilation is possible
- Load the Aintree Intubation Catheter (AIC) over the fibreoptic scope and ensure that the distal 3 cm of the scope is unsheathed.
- Pass the fibreoptic scope preloaded with AIC through the LMA, advance through the larynx into the trachea and place the AIC in the trachea (figure 5)
- Remove the fibreoptic scope and LMA, leaving AIC positioned in the trachea (figure 6)
- If required oxygenate through AIC using rapi-fit connector by connecting to the breathing system (figure 7)
- Railroad suitable size ETT (size 7 or 7.5 mm ID) over the AIC (figure 8). 90° anti clockwise rotation may be required to facilitate the advancement of ETT through the vocal cords.
- Remove the AIC and confirm the position of the ETT with ETCO₂ or with fibreoptic scope (figure 9)

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Figure 5: Fibreoptic scope loaded with AIC passed through the LMA

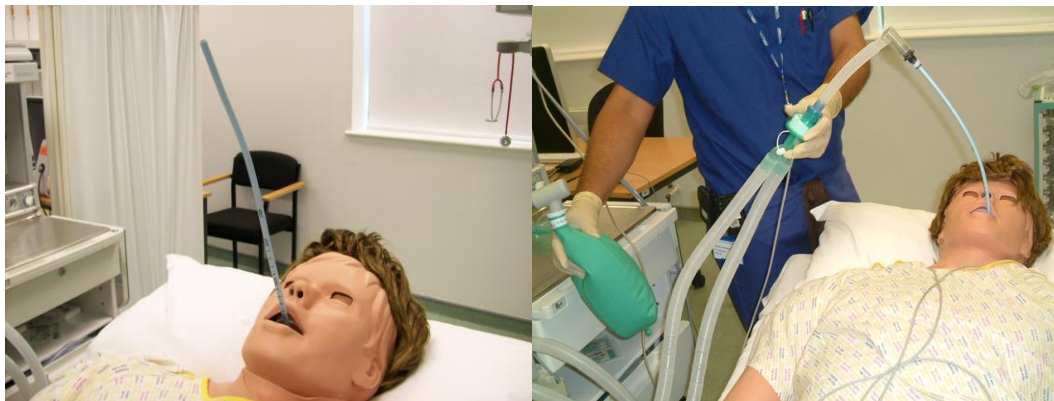


Figure 6: AIC positioned in the trachea Figure 7: Oxygenating through the AIC

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Figure 8: ETT railroaded over the AIC

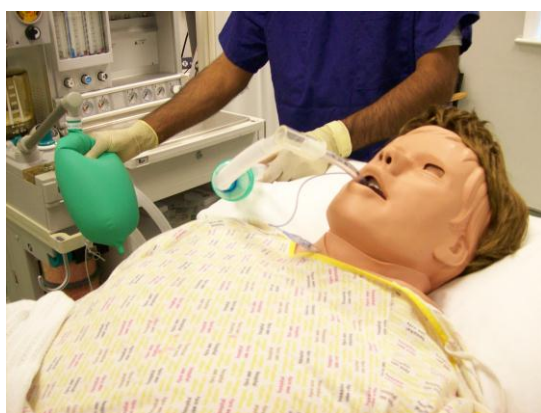


Figure 9: ETT positioned in trachea

Both fibreoptic scope and AIC can be advanced through the aperture bars of classic LMA. The LMA-unique (single use laryngeal mask) has reduced gap between the aperture bars and difficulty in advancing the AIC has been reported. The other single use LMAs do not have aperture bars and similarly i-gel supraglottic airway does not contain aperture bars. Both one-stage and two stage fibreoptic assisted tracheal intubations can be performed through i-gel.

The benefits of two stage procedure using AIC are

- Facilitates tracheal intubation using a standard size ETT
- Allows removal LMA
- Allows oxygenation during the procedure

Further reading

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Heard AMB, Lacquiere DA and Riley RH. Manikin study of fiberoptic guided intubation through the classic laryngeal mask airway with the Aintree intubating catheter vs the intubating laryngeal mask airway in the simulated difficult airway. *Anaesthesia* 2010, 65; 841-847.

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Marfin A, Rangasami J. Management of unanticipated difficult airway: the can't intubate, can ventilate scenario. In: Popat M (ed). *Difficult airway management*. Oxford University Press, Oxford 2009; p 77-89.

Izakson A, Cherniavsky G, Lazutkin A, Ezri T. The i-gel as a conduit for the Aintree intubation catheter for subsequent fiberoptic intubation Case description. *Rom J Anaesth Intensive Care* 2014; **21**: 131–3

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Plan D

Front of Neck Access

Anatomy: Cricothyroid membrane is subcutaneous in the midline located between the strap muscles of neck, on an average it is 8mm below the skin. In adults it is 9 mm high and 22 -30 mm wide, but the width between cricothyroid muscles is 9 mm. Hence largest tube that can be passed should have external diameter of less than 9mm. (6 mm tracheostomy tube has ED of 8.3 mm)

Indications: Can't intubate, can't ventilate (Can't oxygenate) scenario

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Surgical cricothyroidotomy: This involves access to airway using cuffed tube through cricothyroid membrane. Once the patient starts to desaturate and CICO scenario is confirmed, we are limited by time. Two important aspects are efficiency and success in the procedure of cricothyroidotomy.

In order to perform the technique successfully, training and familiarity with the technique and equipment is essential. Therefore if the technique is simple, less complex and involves simple and easily available equipment, it can be taught better and performed more effectively in a crisis scenario.

The following technique is described in 2015 DAS guidelines for managing unanticipated difficult intubation

‘Stab, Twist, Bougie, Tube’

1. Continue attempts at rescue oxygenation via upper airway (assistant)
2. Stand on the patient’s left hand side if you are right handed †
3. ***Perform a laryngeal handshake*** to identify the laryngeal anatomy
4. Stabilize the larynx using the left hand
5. Use left index finger to identify the cricothyroid membrane
6. Hold the scalpel in your right hand, make a transverse stab incision through the skin and cricothyroid membrane with the cutting edge of the blade facing towards you
7. Keep the scalpel perpendicular to the skin and turn it through 90° so the sharp edge faces the feet
8. Swap hands, hold the scalpel with your left hand
9. Maintain gentle traction pulling the scalpel towards you (laterally) with the left hand keeping the scalpel handle vertical to the skin (not slanted)
10. Pick the bougie up with your right hand
11. Holding the bougie parallel to the floor, at a right angle to the trachea slide the coude tip of the bougie down the side of the scalpel blade furthest from you into the trachea.
12. Rotate and align the bougie with the patient’s trachea and advance gently up to 10-15cm
13. Remove the scalpel
14. Stabilize trachea and tension skin with left hand
15. Railroad a lubricated size 6.0* cuffed tracheal tube over the bougie
16. Rotate the tube over the bougie as it is advanced. Avoid excessive advancement and endobronchial intubation.

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17. Remove the bougie.
18. Inflate the cuff and confirm ventilation with capnography.
19. Secure the tube.

Impalpable cricothyroid membrane: Scalpel-finger-bougie technique

This approach is indicated when the cricothyroid membrane is impalpable or if other techniques have failed.

Equipment, patient and operator position as for scalpel technique

1. Continue attempts at rescue oxygenation via upper airway (assistant)
2. Attempt to identify the laryngeal anatomy using a laryngeal handshake
3. If an ultrasound machine is immediately available and switched on it may help to identify the midline and major blood vessels
4. Tension skin using the left hand
5. Make an 8-10cm vertical skin incision, caudad to cephalad
6. Use blunt dissection with fingers of both hands to separate strap muscles and identify and stabilize the larynx with left hand
7. Proceed with “scalpel technique” as above

Reproduced from Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. C. Frerk, V. S. Mitchell, A. F. McNarry, C. Mendonca, R. Bhagrath, A. Patel, E. P. O’Sullivan, N. M. Woodall and I. Ahmad, Difficult Airway Society intubation guidelines working group. British Journal of Anaesthesia, 115 (6): 827–848 (2015) doi:10.1093/bja/aev371

Complications include failure, haemorrhage, surgical emphysema, oesophageal perforation, tracheal laceration, misplacement; vocal cord paresis, subglottic stenosis and laryngeal stenosis

NAP4 revealed a higher failure rate with cannula cricothyroidotomy (63% with narrow bore vs 43% wide bore) as compared to surgical cricothyroidotomy

Other techniques

Needle cricothyrotomy & TTJV: The Ravussin 13G cannula is less likely to kink, but it needs jet injector (manujet at 1-2 bar pressure) to ventilate the lungs. Exhalation is passive and must occur through pharynx and larynx. In case of complete airway obstruction, a second cannula through cricothyroid membrane may be required to facilitate exhalation.

- *Serious complications such as perforation of tracheal wall, surgical emphysema, barotrauma, kinking of the cannula can occur.*
- *This technique is temporary measure to oxygenate. Due to various reasons patient may require surgical crocothyroidotomy or tracheostomy.*

Large purpose made cannula with an ID of 4 mm or more. Lungs can be ventilated using anaesthetic breathing system provided a cuffed tube is placed in the trachea via cricothyroidotomy. Exhlation is possible through these cannulae.

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2 devices available: Quick track (Freelance surgical), 4mm ID, cannula over needle technique. Cuffed version is preferable.

Melker (cook): 4mm/6mm cuffed & uncuffed, seldinger technique.