Awake Bronchoscopic Intubation

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Welcome

Welcome to the Toronto General Hospital Department of Anesthesia **Awake Bronchoscopic Intubation** website. The content of this website is intended for anesthesiologists of all levels, including residents, fellows and staff anesthesiologists. It also serves as a resource for Emergency and Intensive Care physicians who may be required on occasion to perform an awake bronchoscopic intubation.

There are 5 modules. Modules 1 - 4 can be taken in any order with Module 5 best completed after the other modules. Within each module, the reader starts with basic information and can move onto advanced concepts. The participant is encouraged to take the self test at the end of each module or at the completion of all the modules to reinforce learning.

Module 1 covers the 'anatomy' of the **bronchoscope** including how to use it effectively and safely.

Module 2 discusses **ancillary equipment** utilised during awake bronchoscopic intubation, including the choice of endotracheal tube and bronchoscopic intubation via a supraglottic airway.

Module 3 covers the most important aspect of awake bronchosocpic intubation – that is, deciding to do one in the first place. Physical preparation and consent of **the patient** is discussed in this module.

Module 4 is devoted to the **medications** used in awake bronchoscopic intubation: local anesthesia, antisalogogues and sedatives. Various methods of applying local anesthesia are described.

Module 5 puts the whole **procedure** together – including a step-by-step guide to awake bronchoscopic intubation.

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Module 1: The Bronchoscope - Advanced Knowledge

How does the fiberoptic bronchoscope work?

The insertion cord contains 1 – 2 light bundles and 1 image transmission bundle. These glass bundles run the length of the scope containing thousands of glass fibers, approx 8 – 10 microns in diameter. The image transmission bundle allows light to travel along the length of the fiber, being internally reflected along its length to the eyepiece whilst still retaining a sharp image of the object. Because many of these glass fibers are bundled together, the image is built as a composite of that obtained by each fibre, similar to pixels on a television screen. A typical fiberoptic bundle contains 10,000 glass fibers.

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How does the video bronchoscope work?

The light source for a video bronchoscope is generally halogen or incandescent, and is transmitted via fiberoptic bundles. The light source may also be LED. The video bronchoscope does not have an eyepiece. This is replaced by a tiny chip at the distal end of the scope that transmits images electronically. The result is an improved image, since the direct method of image acquisition is superior to coupling a video camera with a conventional fiberoptic eyepiece, which can degrade the image. The chip may be a CCD (charge coupled device) or CMOS (complimentary metal-oxide semiconductor) camera which is placed on the distal end of the scope. The articulating lever still allows control like a standard fiberoptic scope.

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Sterilization and care of the bronchoscope

Cleaning and disinfecting the bronchoscope following each use are essential parts of safe bronchoscopy. The working channel must be wire brushed and flushed using a syringe as soon as possible after use, to prevent secretions from drying and hardening. As autoclaving and heating will damage the glass fibers, a variety of cold chemical sterilization processes can be used (Steris, 2% alkaline glutaraldehyde, peracetic acid etc) according to manufacturer's recommendations. Most are time effective allowing rapid turnover of instruments. The bronchoscope should be rinsed with filtered water after sterilization. The external surface of the bronchoscope should be inspected for damage and leak-tested after each procedure. Cleaning brushes should either be single-use or be sterilized after each use. Suction valves should be disposable.

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Module 1: The Bronchoscope

Introduction

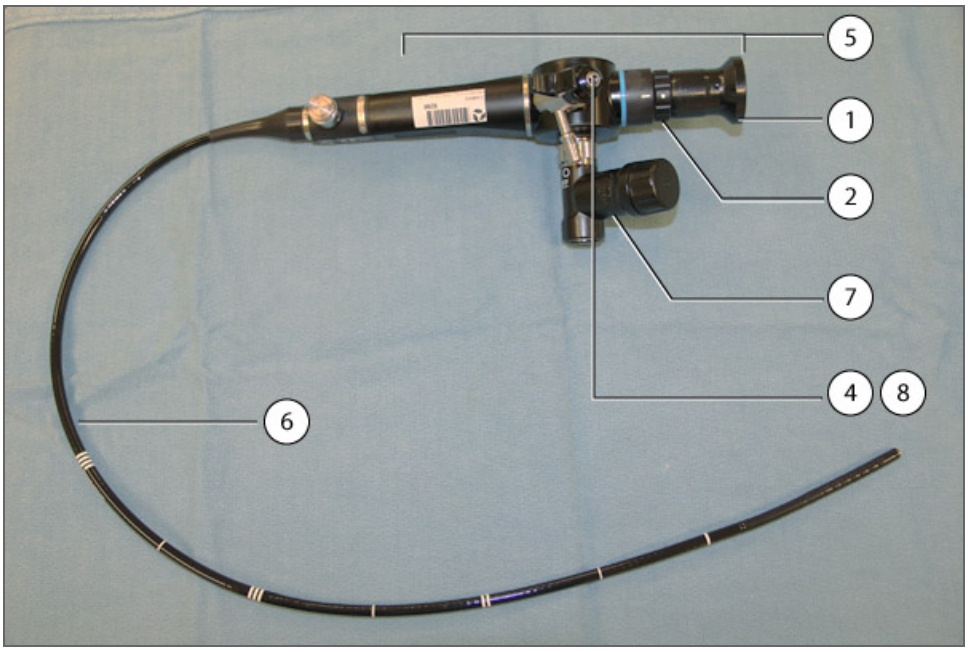
This module covers the mechanics, specifics and care of the bronchoscope.

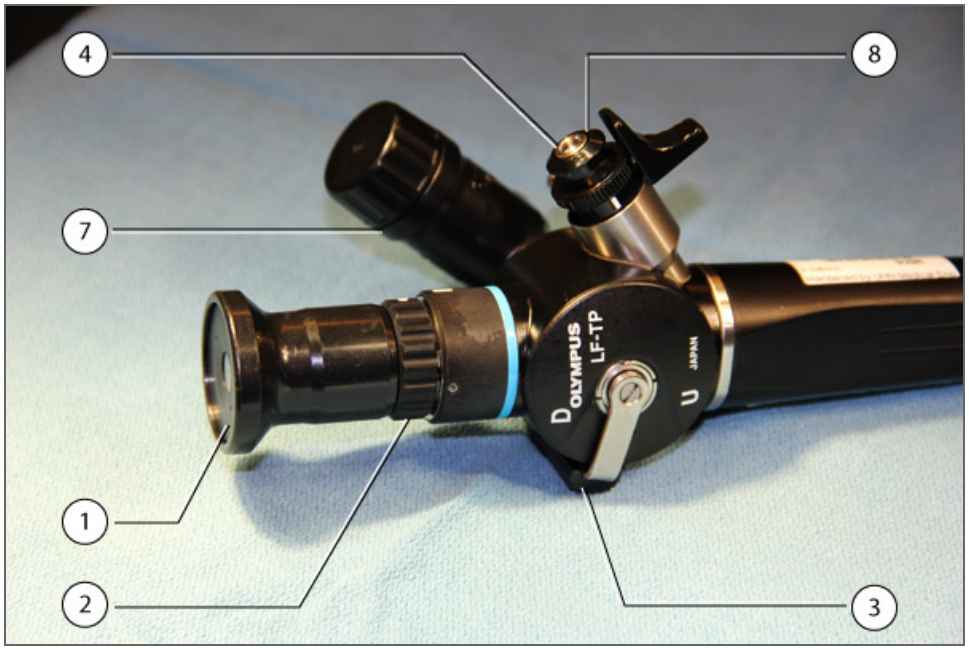
Components

Numbered descriptions of the parts of the bronchoscope below can be matched to numbers on images of the fiberoptic and video bronchoscope.

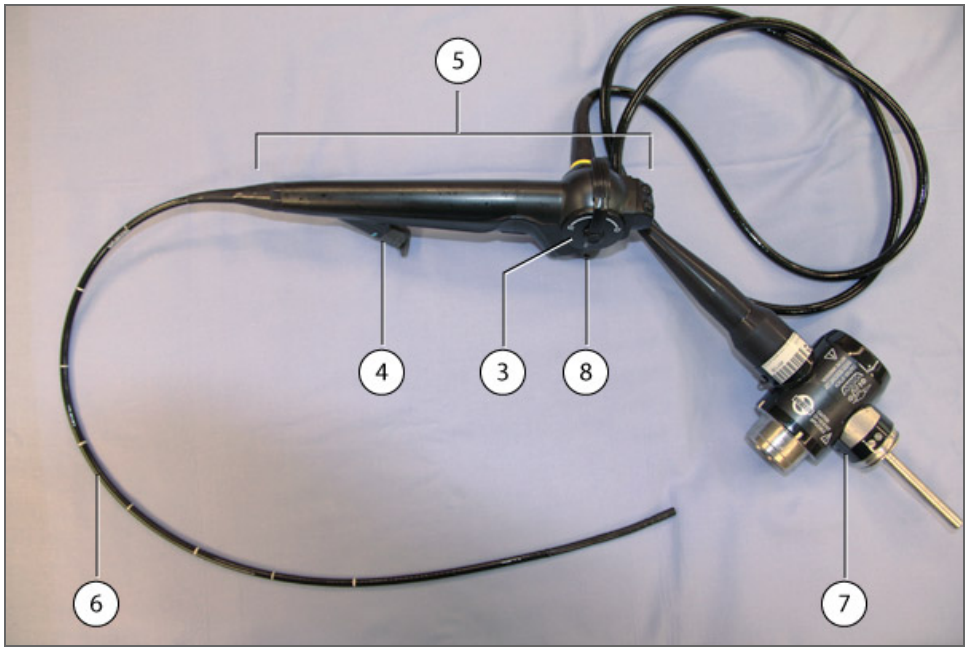
1. **Eye piece:** Can be attached to a camera for display on screen. fiberoptic scopes have an eye piece; video scopes do not.
2. **Diopter ring for focusing**
3. **Control lever:** Controls the tip. Only permits movement in a vertical plane. Two wires extend from the handle to the tip in the insertion cord. Moving the lever down, moves the tip up and moving the lever up, points the tip down. Side to side movement is accomplished by rotation of the body of the bronchoscope with the operator's wrist and shoulder.
4. **Working channel port:** For suction, instillation of local anesthetic, oxygen delivery.
5. **Body:** Incorporates the eye piece, diopter ring, control level and working channel. Grasped by the operators non-dominant hand.
6. **Insertion cord:** Contains fiberoptic bundle for light and image transmission, tip bending control wires and working channel. Average length 600mm (range 500 – 650mm).
7. **Light source:** Can be a portable battery powered source or via a cable. Light source may be halogen, incandescent or LED.
8. **Suction valve and port**

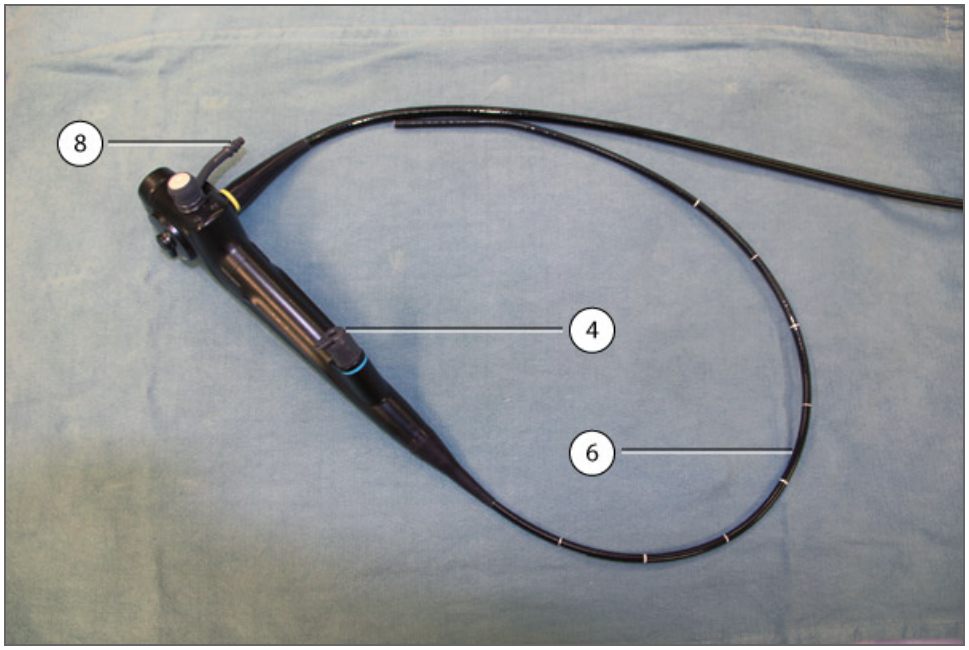
Fiberoptic Bronchoscope





Video Bronchoscope





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Examples

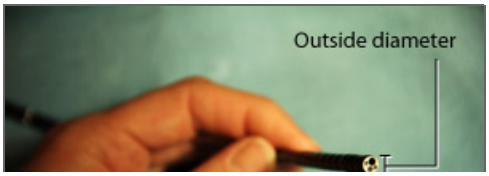
Several examples of commonly used fiberoptic and videobronchoscopes are in the table below. For further information and for additional bronchoscopes, refer to the manufacturers websites:

- Olympus videobronchoscopes
- Olympus fiberoptic bronchoscopes
- Pentax fiberoptic and videobronchoscopes

Click on a table heading to scroll to an explanation below.

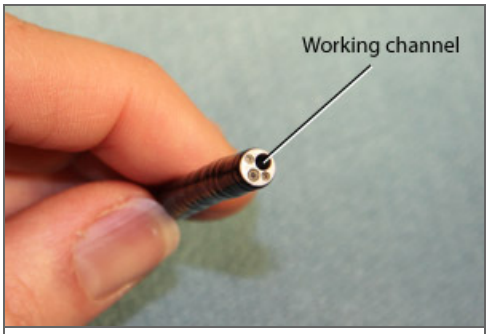
SCOPE	TYPE	OD (mm)	Working channel (mm)	Length (mm)	Tip movement	Field of view (°)
PENTAX EB1570K	Video	5.5	2.0	600	Up 210° Down 130°	120
PENTAX FB-15V	Fiberoptic	4.9	2.2	600	Up 180° Down 130°	120
OLYMPUS BF P160	Video	4.9	2.0	600	Up 180° Down 130°	120
OLYMPUS LF-V	Video	4.1	1.2	600		120
STORZ 11301-BN	Fiberoptic	5.2	2.3	650	Up 140° Down 140°	110
STORZ 11302 BD	Fiberoptic	3.7	1.5	650	Up 140° Down 140°	90

1. **Type:** Is the bronchoscope a fiberoptic bronchoscope or videobronchoscope?
2. **Outside diameter**



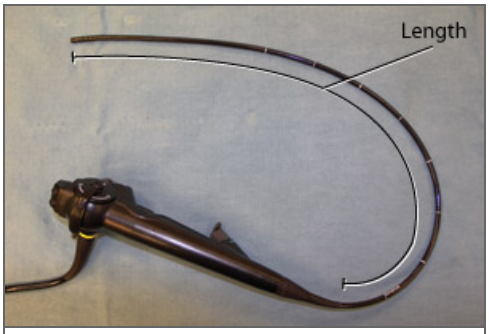
Outside diameter: Outside diameter of the insertion cord, in millimeters.

3. **Working channel**



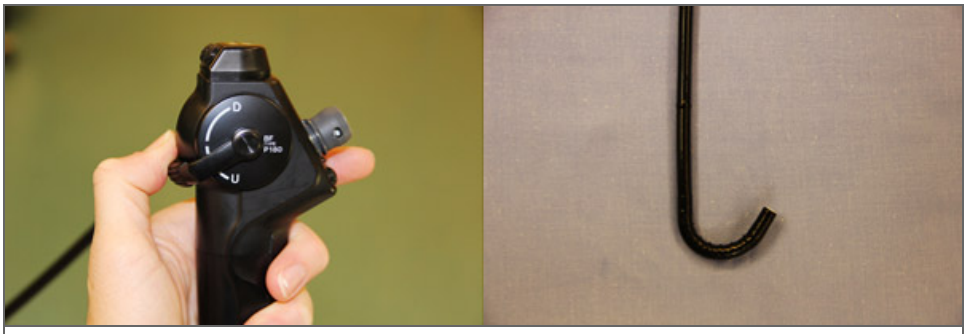
Working channel: Diameter of the working channel for suction, instillation of local anesthesia, etc.

4. **Length**

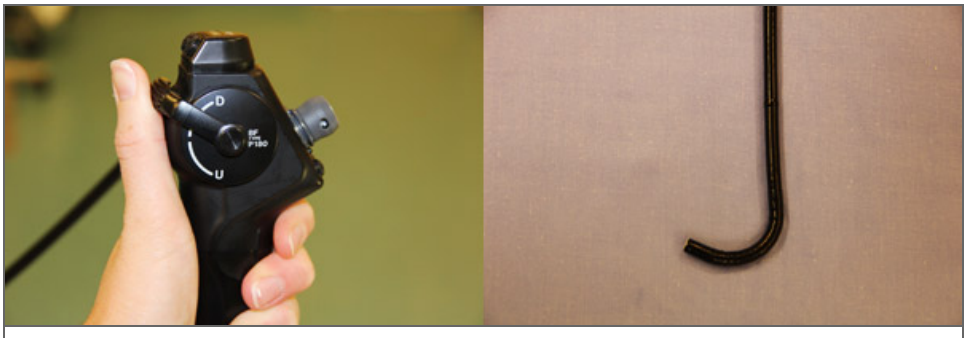


Length: Length of the insertion cord.

5. **Tip movement**

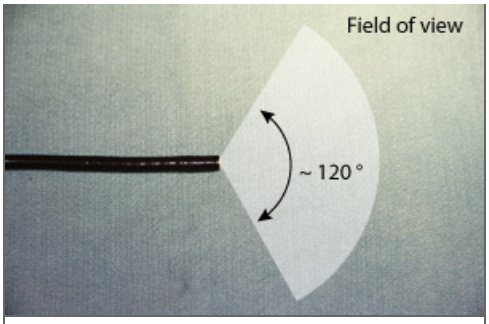


Tip movement: Degrees of movement of the tip of the bronchoscope up.



Tip movement: Degrees of movement of the tip of the bronchoscope down.

6. **Field of view**



Field of view: The area that can be observed without angulation.

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Care of the bronchoscope

- Avoid bending any part of the insertion cord other than the tip, which may result in breakage of the fiberoptic fibers.
- Avoid twisting the insertion cord which can also break fiberoptic fibers. Rotation should be from the body of the bronchoscope.
- Use a bite block in awake / unparalyzed patients to prevent inadvertent biting of the scope.
- Store with the insertion cord straight.

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Checklist prior to use

1. Bronchoscope sterilized
2. Check tip movement
3. Suction valve attached and suction available
4. Light source attached and operational
5. Connect bronchoscope to monitor if using a screen and ensure correct orientation
6. Defog tip of scope and white balance
7. Focus the eyepiece or monitor on some written words. Confirm integrity of image, i.e. no pixel drop-out
8. Lubricate the scope and load the ETT, securing it into place with a piece of tape

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Module 2: Ancillary Equipment - Advanced Knowledge

Bronchoscopic intubation via a supraglottic pathway

This pathway is most often utilized when the patient is anesthetised although it is possible to place a supraglottic airway in an awake patient after topicalization. The supraglottic airway is a conduit for the bronchoscope and ETT and permits ventilation during bronchoscopy.

Video: Bronchoscopic intubation via a supraglottic pathway.

Choice of supraglottic airway

Supraglottic airway	Image	Advantages & Disadvantages
LMA Classic™	*Click to enlarge.* 	Advantages: • Widely available Disadvantages: • Aperture bars impede passage of the ETT • ETT size limitation (size 6 ETT via LMA classic size 3 or 4, size 7 via a size 5.) • Length may prevent standard uncut ETT from reaching vocal cords • Pilot tube of ETT may not pass through LMA channel
LMA ProSeal™	*Click to enlarge.* 	Advantages: • No aperture bars Disadvantages: • Length may prevent standard uncut ETT from reaching vocal cords
LMA Supreme™	*Click to enlarge.*  	Disadvantages: • Lateral stabilizing bars can obstruct passage of the bronchoscope • Length may prevent standard uncut ETT from reaching vocal cords
LMA Excel™	*Click to enlarge.* 	Advantages: • Removable 15mm connector aids in ETT passage • Epiglottic elevator bar • No aperture bars
Intubating LMA (Fastrach™)	*Click to enlarge.*	Advantages: • Designed for intubating through • Epiglottic elevator bar to protect/elevate epiglottis

		during ETT placement • Shorter, allows ETT to reach vocal cords • Permits ETT up to size 8 • Wider bore accommodates pilot tube cuff during removal of LMA • ETT 'pusher/stabilizer' supplied with kit to ease removal of the ILMA Disadvantages: • Bulky, with preformed curve, placement difficult in patients with limited mouth opening
air-Q® (also known as Intubating Laryngeal Airway and Cook Gas)	*Click to enlarge.* 	Advantages: • Designed as intubating conduit • No aperture bars • Shorter, allows ETT to reach vocal cords • Accommodates conventional ETT • Can be left in situ during case which may be utilized during emergence
I-gel™	*Click to enlarge.*  	Advantages: • Designed for intubating through • Esophageal port • No aperture bars • Shorter, allows ETT to reach vocal cords • Gel bowl does not require inflation

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Bronchoscopic intubation with assistance from a video laryngoscope

Combining a flexible bronchoscope technique with a video laryngoscope such as a GlideScope® overcomes the difficulty with the 'blind' part of the bronchoscopic technique and simultaneously provides tongue retraction. Usually, it is not possible to see the passage of the ETT through the laryngeal inlet over the bronchoscope. Any blind technique increases the risk of trauma and bleeding, especially in the population of patients requiring awake intubation who may have a friable tumor or infection. This is more applicable to patients having asleep bronchoscopic intubation, but can also be used in awake patients, in which case the video laryngoscope takes the place of the oral intubating airway.

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Module 2: Ancillary Equipment

Introduction

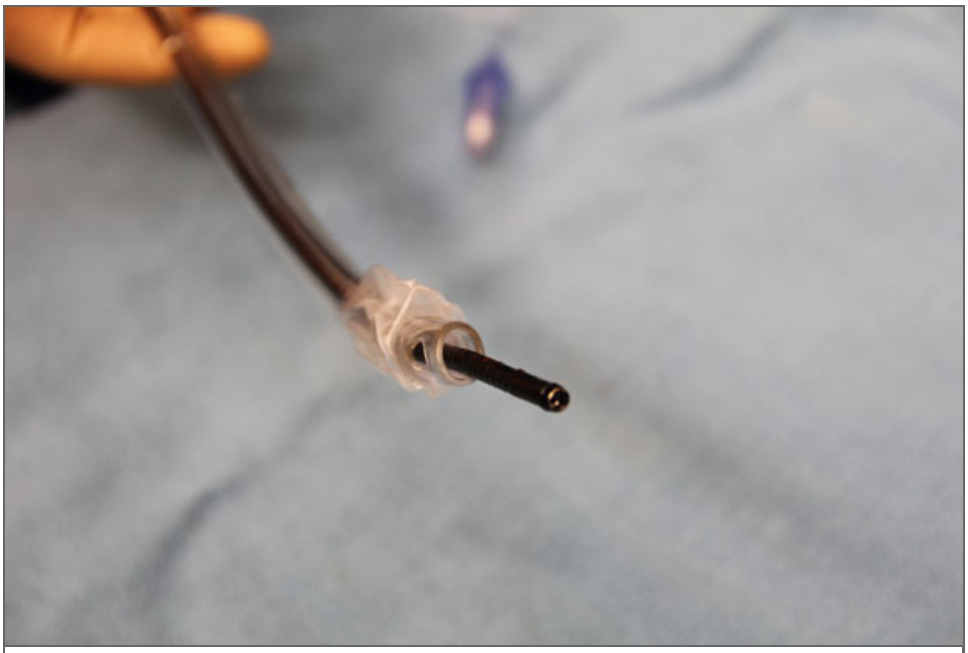
This module covers the additional equipment utilized in a bronchoscopic intubation. The bronchoscope (module 1) and equipment for applying local anaesthesia (module 4) are covered elsewhere.

Endotracheal Tube (ETT)

The choice of ETT depends on the intended site of intubation (oral vs. nasal), intended duration of intubation, availability and operator preference.

Size

The ETT should be large enough to fit over the chosen bronchoscope but small enough to pass through the nasopharynx (for nasal intubation). A smaller ETT is less likely to be difficult to advance over the bronchoscope as this avoids a size discrepancy between bronchoscope and ETT. Size 6 – 7mm is suitable for most adults. A smaller diameter ETT may be shorter, which should be taken into consideration for nasal intubation.



This is a size 8 ETT and bronchoscope with outside diameter 4.3mm.

ETT Choices

The table below outlines several choices of endotracheal tubes with their advantages and disadvantages.

Type of ETT	Nasal/Oral?	Description	Advantages & Disadvantages
Nasal RAE (Ring-Adair-Elwyn), "north facing"	Nasal	*Click to enlarge.* 	Advantages: • Length • Ability to keep away from the surgical field without kinking the tube • The bend sits comfortably just outside the nares Disadvantages:

			• Potential difficulty navigating the bronchoscope through the preformed curve
Armored ETT	Nasal or Oral	*Click to enlarge.* 	Advantages: • Less nasal trauma • Easier passage through the nose due to flexibility Disadvantages: • May be unacceptable to ICU for post-op care • May be too short to reach vocal cords when used for nasal intubation in some patients
Intubating LMA ETT	Nasal or Oral	Silicone, hemispherical bevel, with softer and more flexible tube *Click to enlarge.* 	Advantages: • Lower incidence of difficulty advancing the ETT over the bronchoscope Disadvantages: • Not always available • More expensive; choice of single-use or re-usable products • Potential for kinking • May be too short to reach vocal cords when used for nasal intubation in some patients • Non compliant cuff • May be unacceptable to ICU for post-op care
"Standard" PVC tube	Nasal or Oral	*Click to enlarge.* 	Advantages: • Widely available • Most acceptable to ICU for post-operative care Disadvantages: • May be too short to reach vocal cords when used for nasal intubation in some patients • Increased chance of nasal trauma
Parker Flex Tip™ ETT		Tapered tip *Click to enlarge.* 	Advantages: • Lower incidence of difficulty advancing the ETT over the bronchoscope

			Disadvantages: • Not always available • More expensive

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Oral Intubation Devices

Several devices assist with oral bronchoscopic intubation, with the aims of:

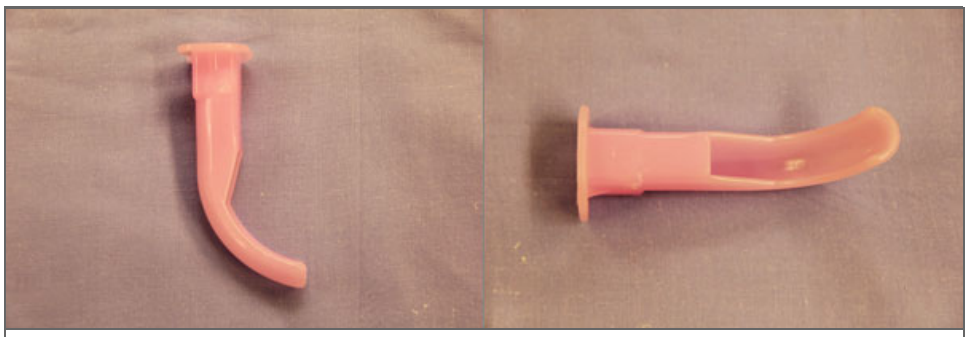
- providing a passage for the scope
- protecting the scope should the patient bite down
- ensuring the scope is midline
- holding the tongue forward

Berman Airway

The Berman airway can be opened wide to disengage it from the ETT. Because it is quite long, if it is not in line with the glottis, passing the bronchoscope into the larynx can be challenging as the bronchoscope cannot be manoeuvred within the Berman airway. Withdrawing the airway partially can help.

Williams Airway

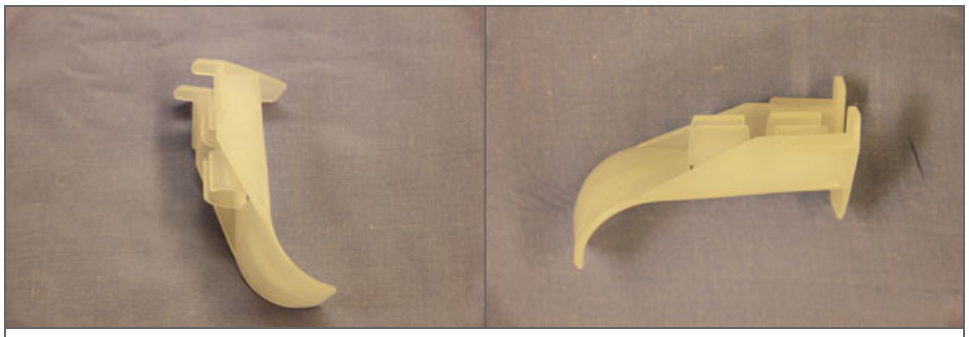
The Williams airway comes in two sizes: 90mm (accommodates an ETT size 8) and 100mm (accommodates ETT size 8.5). It requires removal of the 15mm connector from the ETT prior to removal of the airway. Similarly to the Berman, if it is not lined up with the glottis, manoeuvring the bronchoscope within the airway is difficult.



Williams airway.

Ovassapian Airway

The Ovassapian airway comes in one size (accommodates ETT up to size 8.5). It can be 'opened' wide to disengage it from the ETT. It has a flat lingual portion to minimize movement from the midline and the open space assists with manoeuvring the bronchoscope.



Ovassapian airway.

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Aintree Catheter

When loaded on the bronchoscope, only the distal 3-4cm of the bronchoscope protrudes from the end, allowing manoeuvring. The pediatric size bronchoscope is placed in the lumen of the Aintree catheter. Both devices are then placed together – via a supraglottic airway or oral intubating device or via the nose. The bronchoscope is removed and the endotracheal tube is then railroaded over the Aintree catheter.

Inner diameter: 4.8mm (bronchoscope must have outside diameter of 4.4mm or less). *Outer diameter*: 6.5mm (muse use ETT of 7.0mm or greater). *Length*: 56cm.

Video: ETT railroaded over Aintree catheter.

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Module 3: The Patient

Introduction

This module covers the decision-making process and preparation of the patient requiring an awake intubation. The choice of oral vs. nasal intubation is discussed.

Who needs an awake intubation?

The hardest part of performing an awake intubation, is deciding if the patient requires one. Although it is common to equate 'awake intubation' with bronchoscopic intubation, this is not necessarily the case. The first decision relates to consciousness/muscle relaxation; the second decision relates to the device chosen.

Airway Approach Algorithm (W.H. Rosenblatt): Use this interactive tool to decide if an awake intubation is necessary. View the airway approach algorithm.

Must the airway be controlled?

Yes No

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Which patients are best suited for awake bronchoscopic intubation?

This procedure is best for patients for whom there is time to adequately anesthetize with topical agents (however, several techniques allow rapid local anesthesia). The patient should be co-operative and able to understand the planned procedure.

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Which patients are poorly suited for an awake intubation?

Patients should not undergo awake intubation if there is:

- a language or developmental barrier to co-operation
- hypoxia requiring immediate intubation
- risk of airway bleeding including coagulopathy or friable tissues (bronchoscopy can make bleeding worse)
- blood or significant sections in the airway (can make the view impossible)
- a patient with narrowed airways will have further reduction in effective lumen for gas exchange as the bronchoscope is advanced

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Patient preparation and consent

Consent

Explain to patient why they require an awake intubation – establishing rapport and co-operation is an important part of the process. For example:

"An important part of my job is to look after your breathing during the operation. Under a general anesthetic you will not be breathing on your own – instead we will be placing a breathing tube into your windpipe and using a ventilator to help you. Your anatomy differs from normal, such that it is likely to be difficult to place the breathing tube. Therefore we need to do this before you go to sleep, and once we have confirmed that the breathing tube is in the correct location, we can safely give you the anesthetic. We will give you sedation and freezing medication which

will make this as comfortable as possible and you may have little or no memory of this later. We will proceed at a pace you are comfortable with and we can stop at any time. Please raise your hand during the procedure if you are uncomfortable and need me to stop."

Physical preparation

- **IV**
- **Monitors:** pulse oximetry, ECG and BP
- **Oxygen:** nasal prongs, oxygen catheter into opposite nostril or via the working channel of the bronchoscope

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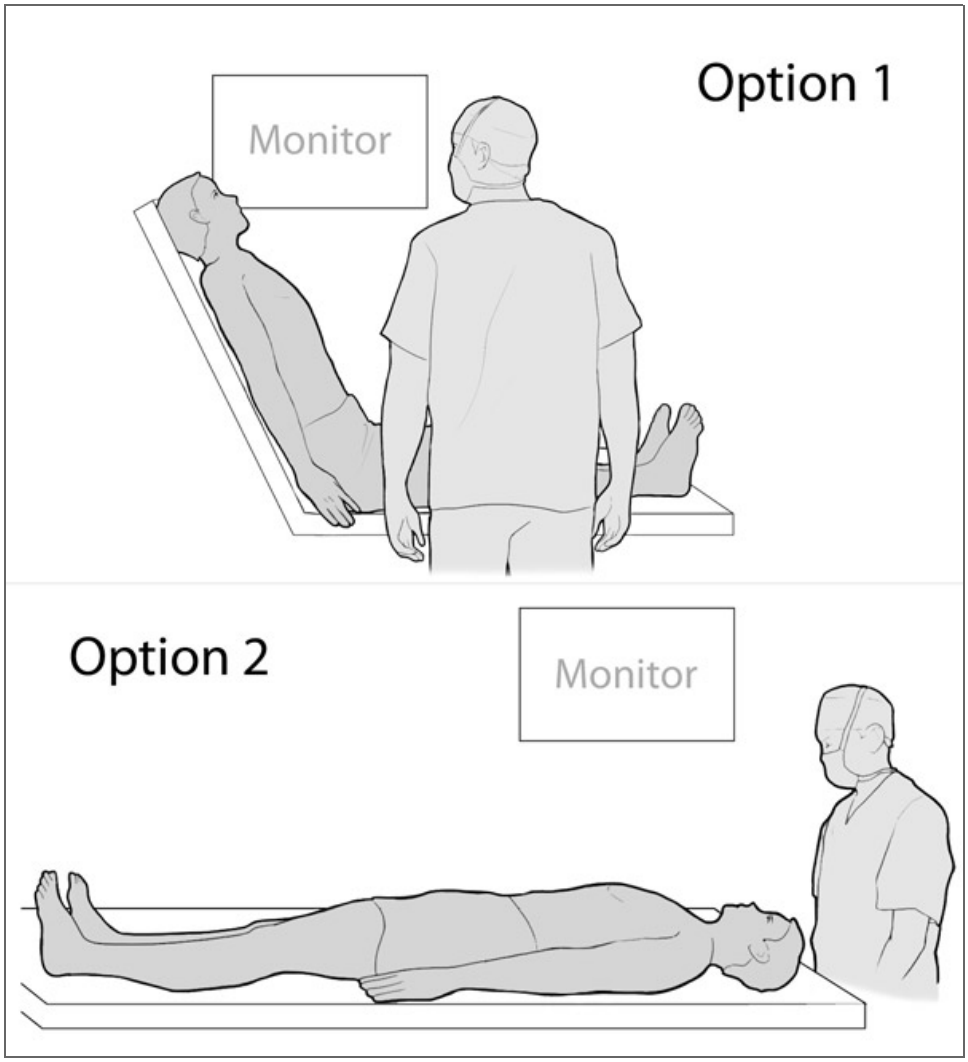
Patient positioning

Option 1: Patient sitting at least 45° upright, facing the operator, monitor on the patient's left

Option 2: Patient supine with the operator in the normal intubating position, monitor on the patient's right



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Module 3: The Patient - Advanced Knowledge

Oral vs. nasal

Oral	**Nasal**
Advantages: • May be better tolerated • No need to anesthetize nasal passages • Larger ETT possible • Shorter route • Possibly more acceptable for post-operative care in ICU	Advantages: • Allows surgical access to oral cavity • Possible in patients with very limited or no mouth opening • Better choice if gag reflex persists despite best topicalization • After entering naso-pharynx, the glottis is usually very apparent
Disadvantages: • Less direct pathway – sharp angle from the oral cavity into the larynx • Easy to stray from midline (use of an oral intubating device helps)	Disadvantages: • Passage through the nose is usually the most difficult part of the procedure and least well tolerated • ETT size limitation • Potential for epistaxis • Potential for bacteraemia

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Which nostril?

Ask the patient to sequentially block each nostril and take a deep breath—they will be able to indicate which is more patent. Studies have indicated that the left nostril is more likely to be an easier passage[1].

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Tips

Inserting the ETT into the nose:

- Use a well lubricated ETT
- Use topical vasoconstrictor to nasal mucosa
- Insert at right angles to the face[2]
- Pass along the floor of the nose to the nasopharynx

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Module 4: Medications

Introduction

This module covers the medications used during an awake bronchoscopic intubation – anti-sialogogues, local anesthetics, vasoconstrictors and sedatives. Choosing and delivering medication for an awake bronchoscopic intubation follows multiple **RULES OF 3.** Look out for the icon in the text below.

There are groups of medications that need to be considered:

1. **Anti-sialagogues**
2. **Local Anesthetics** (+/- vasoconstrictor)
3. **Sedatives**

Anti-sialagogues

There are reasons for using an anti-sialagogue:

1. Improved view due to reduced secretions
2. Increased effectiveness of the local anesthetic. Secretions dilute the local anesthetic, create a barrier between mucosa and local anesthetic and carry the local anesthetic away from the site of intended action. For all of these reasons, reduced secretions = better topicalization.
3. Reduces the risk that secretions will cause cough and/or laryngospasm

Any anticholinergic agent can be used (atropine, scopolamine or glycopyrrolate) however glycopyrrolate has several advantages including lack of central nervous system effects (it does not cross the blood brain barrier) and less tachycardia than atropine. A dose of 3 – 4 µg/kg is suggested, or for most adults 0.2mg. If the IM route is chosen, it should be given at least 15 mins before.

If dexmedetomidine is the chosen sedative, there is no need for an additional anti-sialagogue.

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Vasoconstrictors

When choosing the nasal route a vasoconstrictor should be used to reduce the risk of epistaxis. These agents primarily cause vasoconstriction of the nasal mucosa by acting as alpha 1 agonists.

Options include:

- using cocaine (generally 4%) as your chosen local anesthetic (inherent vasoconstrictor properties)
- oxymetazoline 0.05%
- xylometazoline 0.1% (Otrivin)
- phenylephrine 0.5% (or co-phenylcaine – Lidocaine 5% and phenylephrine 0.5%)

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Local Anesthetics

Once again, there are decisions to be made.

1. **Decision 1: Which agent to choose?**
2. **Decision 2: What dose to use?**
3. **Decision 3: What technique to use?**

Decision 1: Which agent to choose?

- **Lidocaine:** Readily available, comes in many strengths and formulations, rapid onset and relatively low cardiac toxicity.
- **Cocaine:** Inherent vasoconstrictor properties. Potential adverse effects include tachycardia,

hypertension and arrhythmias. More restricted availability than lidocaine. Maximum dose of 1 - 3mg/kg.

Decision 2: What dose to use?

- Suggested maximum dose of lidocaine = 5mg/kg without adrenaline and 7mg/kg with.
- Traditionally much higher doses (up to 9mg/kg) have been used safely for airway topicalization, since much of what is delivered is either swallowed or lost to the atmosphere and therefore not absorbed. However, we should also consider that plasma levels rise rapidly after topical application of local anesthetic to the respiratory tract.
- Early signs of local anesthetic toxicity include peri-oral numbness/tingling, light-headedness, metallic taste and visual/auditory disturbances.
- Calculate maximum dose of local anesthetic based on patient body weight (lean body weight) and divide this total volume among the different areas to be topicalized.

Decision 3: What technique to use?

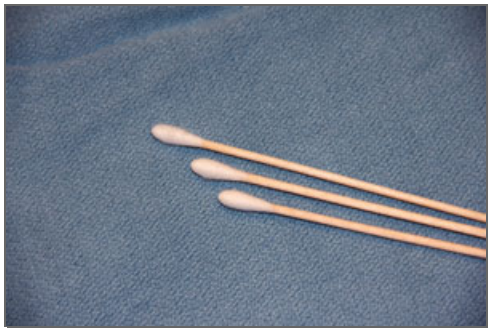
There are areas that need to be anesthetized:

1. **Nasal passage and nasopharynx**

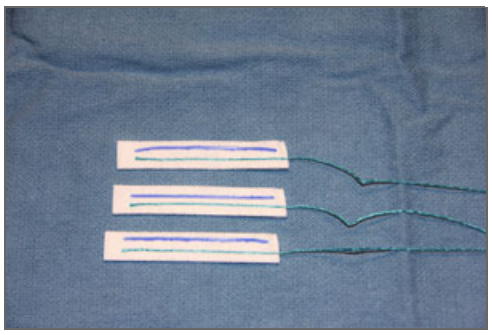
   Some suggest preparing the nose even if the oral route is planned due to passive leak of local anesthetic into the oropharynx, and, in the case of difficult oral intubation, the nose is already prepared

   Techniques for anaesthetizing the nasal passage include:

   - Cotton tipped swabs soaked in local anesthetic slowly advanced deeper into nasal cavity

   - 'Neuro patties' soaked in local anesthetic inserted into the floor of the nose and allowed to sit for 5 – 10 mins

   - Nasal mucosal atomization device (MAD™ Wolf Tory Medical)

Video: Nasal mucosal atomization device.

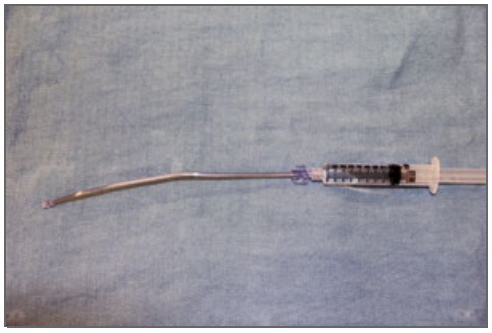
- Nasopharyngeal airway coated in local anesthetic gel (prelubricates, anaesthetizes and ensures nasal patency)

2. **Oropharynx**

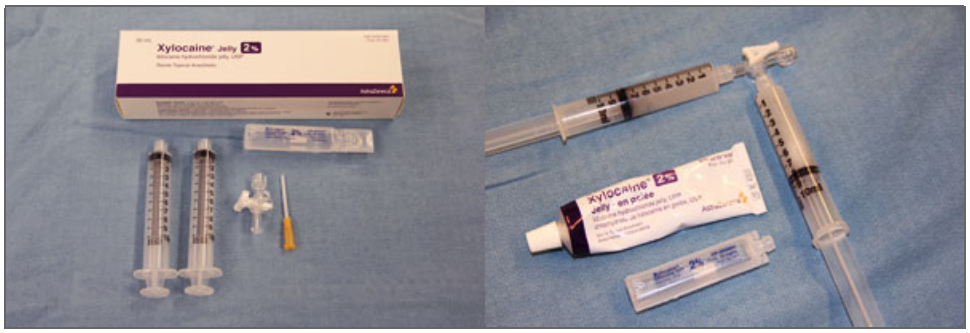
Techniques for anaesthetizing the oropharynx include:

- Nebulization of local anesthesia **4-5mL of 4% lignocaine**
- Atomization of local anesthesia using a 3 way stopcock and oxygen tubing

- Oral MAD device



- Gargling: Several ml of local anesthetic solution gargled by the patient with the excess expectorated
- "Drummonds toothpaste method": local anesthetic jelly applied to the base of the tongue and anterior tonsillar pillars via a tongue depressor; patient holds the tongue depressor in their mouth like a lollypop but instructed not to swallow; local anesthetic 'melts' and runs down the back of the hypopharynx
- "Pacey's Paste": A 50:50 mixture of 2% lidocaine solution with 2% lidocaine jelly is created with the use of a 3 way stopcock. The resulting mixture is a sticky, viscous fluid that is dribbled onto the back of the tongue.



Video: Pacey's paste.

- Various nerve blocks can also be used (See the advanced knowledge portion of this module)

3. **Larynx and Trachea**

Techniques for anaesthetizing the larynx and trachea include:

- Steady trickling of lidocaine onto the posterior portion of the tongue while the tongue is manually pulled forward (this is key as it prevents proper swallowing and facilitates

aspiration)

- Trans-tracheal injection of 2 – 3ml lidocaine via the cricothyroid membrane using a cannula (the needle is removed prior to injection, to prevent airway injury when the patient coughs
- "Spray as you go" via the working port of the bronchoscope or an epidural catheter through the working port of the scope, with aliquots delivered to the epiglottis, vocal cords then subglottic area
- Various nerve blocks can also be used (See the advanced knowledge portion of this module)

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Sedatives

The ideal sedative for awake bronchoscopic intubation will provide:

- patient comfort and co-operation
- anxiolysis
- amnesia
- attenuated airway reflexes, anti-tussive
- stable hemodynamics
- maintenance of a patent airway with spontaneous ventilation

The available agents include:

- Benzodiazepines (midazolam)
- Propofol
- Alpha 2 agonists (clonidine and dexmedetomidine)
- Opioids (fentanyl, remifentanil)
- Ketamine

For all agents, careful titration is essential and, where applicable, reversal agents should be readily accessible (naloxone, flumazenil). When a combination of agents is used, the effect may be synergistic so extreme caution is required.

Dexmedetomidine	
DOSE	Loading dose of 1µg/kg over 10 mins (0.5µg/kg for age > 65) then 0.2 – 1.0µg/kg /hour.
PREPARATION	200µg (2 mL) in 48ml saline to make a 50ml solution. Gives a concentration of 4 µg/ml.
ACTION	Highly selective alpha 2 agonist. Sedative effect is due to activation of the post synaptic alpha 2 receptors in the locus coeruleus.
CLINICAL EFFECTS	Sedative. Analgesic. Anxiolytic and Antisialogogue. Onset of sedation approx 10 – 15 mins after the start of the infusion.
ADVANTAGES	Minimal respiratory depression, no need for additional anti-sialagogue.

ADVERSE EFFECTS	Hypotension, bradycardia, sinus arrest, dry mouth. Potential for hypertension initially if high dose infusion or rapid bolus – due to stimulation of peripheral alpha 2 receptors.

Remifentanil	
DOSE	Infusion 0.02 – 0.2µg/kg/min. Alternatively, loading dose of 0.5-0.7µg/kg and infusion of 0.05-0.1 µg /kg/min. If available, can use the minto TCI protocol in a range of 2 – 5ng/ml.
ACTION	Opioid agonist
CLINICAL EFFECTS	Analgesia, sedation.
ADVANTAGES	Analgesia and depression of airway reflexes, including coughing. Rapidly titratable. Antagonist available.
ADVERSE EFFECTS	Respiratory depression, susceptible to aspiration due to depression of reflexes, bradycardia, hypotension, no amnesia therefore higher incidence of recall.

Ketamine	
DOSE	Bolus 10 – 20mg then 20mg/hr (0.2 – 0.4mg/kg/hr).
ACTION	NMDA receptor antagonist.
CLINICAL EFFECTS	Dissociative state, analgesia, sedation.
ADVANTAGES	Useful in conjunction with dexmedetomidine as it balances the bradycardia and hypotension. Bronchodilation, sympathomimetic effects without apnea.
ADVERSE EFFECTS	Excessive secretions, hallucinations.

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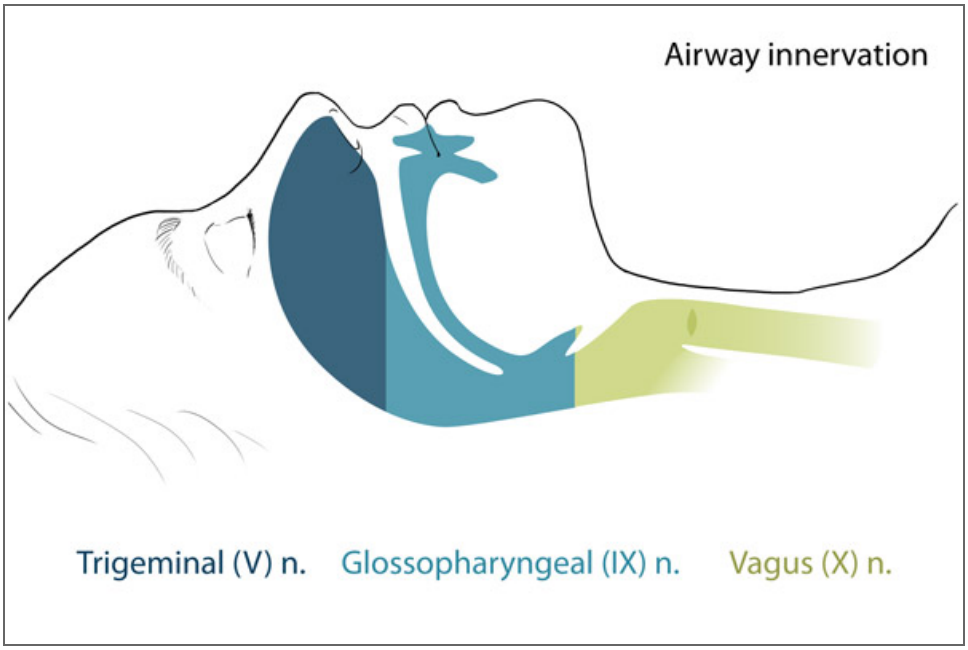
Module 4: Medications - Advanced Knowledge

Airway anatomy



nerves or their branches can selectively be blocked for an awake bronchoscopic intubation:

1. **Trigeminal nerve (CN V) (nasal cavity, mouth)**

   The nasal cavity is entirely innervated by the trigeminal nerve.

   - Anterior ethmoidal nerve (from V1) – septum
   - Greater and lesser palatine nerves, from sphenopalatine ganglion in pterygopalatine fossa (V2)
   - Nasopalatine nerve, from sphenopalatine ganglion (V2) – septum

2. **Glossopharyngeal nerve (CN IX) (posterior 1/3 tongue, pharynx, valleculae, lingual surface of epiglottis and gag reflex)**

   Gag reflex:

   - Elicited by stimulation of the glossopharyngeal nerve, efferent from vagus nerve
   - Abolished by bilateral block of glossopharyngeal nerve

3. **Vagus nerve (X) (larynx, trachea)**

   The superior laryngeal nerve divides into internal and external branches.

   - Internal branch: sensation from epiglottis to above vocal cords
   - External branch: cricothyroid muscle

   Recurrent laryngeal nerve:

   - Given off the vagus nerve during it's intra-thoracic course (loops around ligamentum arteriosum on left and around subclavian artery on right)
   - Provides sensation of larynx below and including vocal cords and trachea. Motor to all intrinsic muscles of the larynx except cricothyroid muscle
   - Glottic closure reflex (exaggeration of this reflex = laryngospasm) – this is caused by stimulation of superior laryngeal nerve, efferent from recurrent laryngeal nerve

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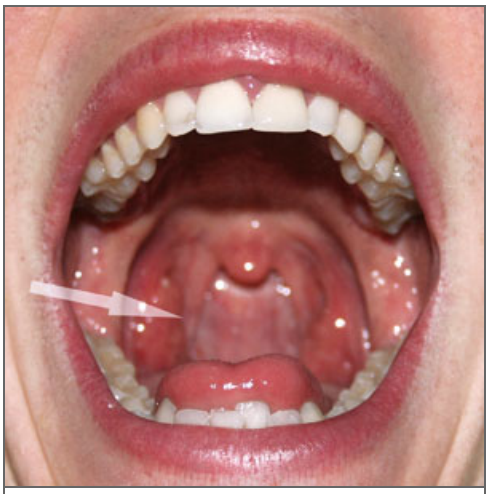
Nerve blocks

Superior laryngeal nerve (sensation to larynx above vocal cords)

- Blocked between hyoid bone and thyroid cartilage where it penetrates the thyrohyoid membrane
- Place patient supine with maximal neck extension
- Grab the hyoid between the thumb and index finger and firmly displace it towards the side to be blocked
- Advance a 25g needle to the greater cornu then walk it off inferiorly and advance it a further 2 – 3mm
- Inject 2 – 3ml and an additional 1ml as the needle is withdrawn (to block the external branch)

Glossopharyngeal nerve: (gag reflex and sensation from the oropharynx to the lingual surface of the epiglottis)

- Usually blocked by the local anesthetic applied to the back of the tongue and throat
- Can also be blocked by holding a local anesthetic soaked swab bilaterally at the palato-glossal arch (the rim of tissue than runs from the uvula to the base of the tongue)



The glossopharyngeal nerve can be blocked by holding swabs soaked in local anesthetic at the point indicated by the white arrow.

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Awake Bronchoscopic Intubation

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Module 5: Procedure - Advanced Knowledge

Difficulty visualizing the larynx

Causes

- Reduced airspace passage due to sedation, edema or obesity
- Supraglottic mass
- Distorted anatomy or deviated larynx
- Vision obscured by blood or secretions
- "Red out" – scope is likely to be in the piriform fossa or esophagus, or impacted on mucosa

Remedies

- Ask patient to protrude the tongue or phonate or breathe deeply. Alternatively, the tongue may be retracted by an assistant holding it between a folded gauze
- Use an oral intubating device
- If an oral intubating device is already in place, ensure that it is midline and withdraw slightly
- Get assistant to perform gentle jaw thrust - this elevates the tongue and epiglottis away from the posterior pharyngeal wall and opens the path
- Suction any blood or secretions with the bronchoscope or a Yankauer sucker
- Sit patient up if currently supine
- Withdraw bronchoscope slightly and ensure that it is midline
- If necessary, withdraw bronchoscope and ensure that the tip is not covered with secretions.

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Difficulty advancing the ETT over the bronchoscope

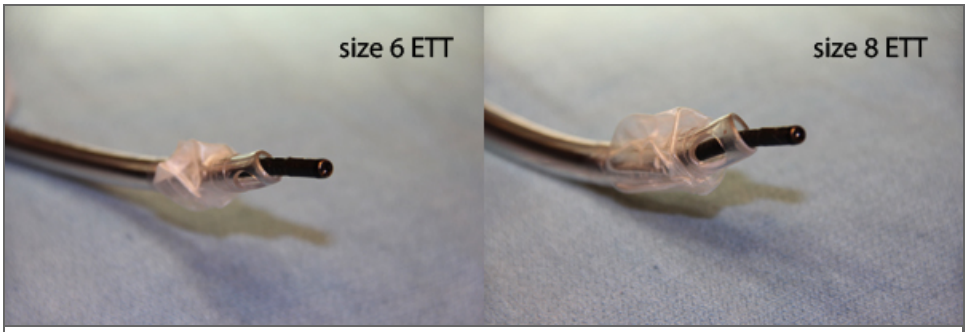
The ETT can get "caught" when passing through the vocal cords, often on the right arytenoid.

Causes

- Left facing bevel results in the tip of the ETT impinging on the right arytenoid
- Deviation of the ETT from the bronchoscope due to the gap between the two
- When performing a nasal intubation, the ETT can become impinged on the epiglottis

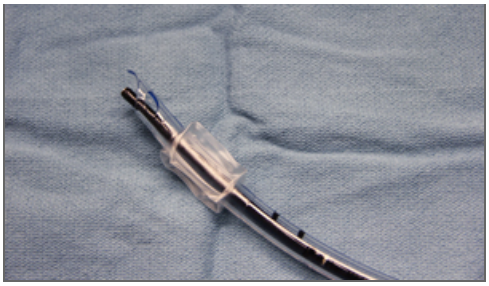
Remedies

- Rotate the ETT 90° anticlockwise on the bronchoscope resulting in the bevel facing 6 o'clock, minimizing impingement on the right arytenoid
- Use a larger bronchoscope or smaller ETT to reduce the size discrepancy between the two

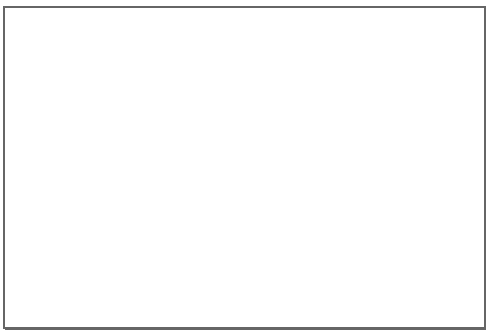


Size 6 ETT used with adult bronchoscope results in less size discrepancy between ETT and bronchoscope.

- Use an ETT with a tapered tip (intubating LMA ETT, Parker Flex-tip® tube)



- Use a 'gap filler' between the bronchoscope and ETT (either a smaller, uncuffed ETT or the Aintree catheter)



- Ask the patient to inhale deeply and attempt to advance the ETT gently on peak inspiration
- Rotate ETT 90° CLOCKWISE – bevel up, if the site of impingement is the epiglottis
- Use a video laryngoscope (eg: GlideScope) in addition to the Bronchoscope to assist with visualizing where the ETT is impinging

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Tube-first approach vs. bronchoscope-first approach

Tube first: The ETT is inserted to the back of the nasal cavity, then the bronchoscope is passed through the ETT. The bronchoscope then acts as a 'bougie' allowing the ETT to be railroaded over it.

ETT First	**Bronchoscope First**
Advantages: • Allows adequacy of nasal passage to be assessed – avoids problem of ETT not fitting into nasal cavity • Minimizes time to advance ETT into the larynx	Advantages: • Less risk of bleeding prior to entering trachea
Disadvantages: • Blind insertion may produce bleeding, rendering bronchoscopy very difficult • Blind passage into the nasopharynx may damage the mucosa	Disadvantages: • ETT can be difficult to advance over bronchoscope • Bronchoscope can pass through Murphy eye which will make advancement impossible

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Tips

- Always keep the target structure in the center of screen.
- Use small efficient movements of the bronchoscope.
- The operator should be comfortable. Arm fatigue is common if the scope is being held too high, so either lower the bed or stand on a step to allow the scope to hang freely. Hyperextension of the knees and low back strain can be reduced by elevating one leg on a stool.
- Ask the patient to take a deep breath and synchronize advancement of the ETT with vocal cord abduction.

- A small piece of tape applied to the ETT to keep it on the scope until released will prevent it from dropping.
- Warm the ETT with warm water to soften the tube and reduce fogging (especially when using a standard ETT).
- Usual depth for nasal intubation: 26 cm for women and 28 cm for men.

Tips to prevent fogging:

- Use an anti-fog solution on the tip of the bronchoscope.
- Apply 2L/min of oxygen through the working channel of the scope.

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Awake Bronchoscopic Intubation

Toronto General Hospital Department of Anesthesia
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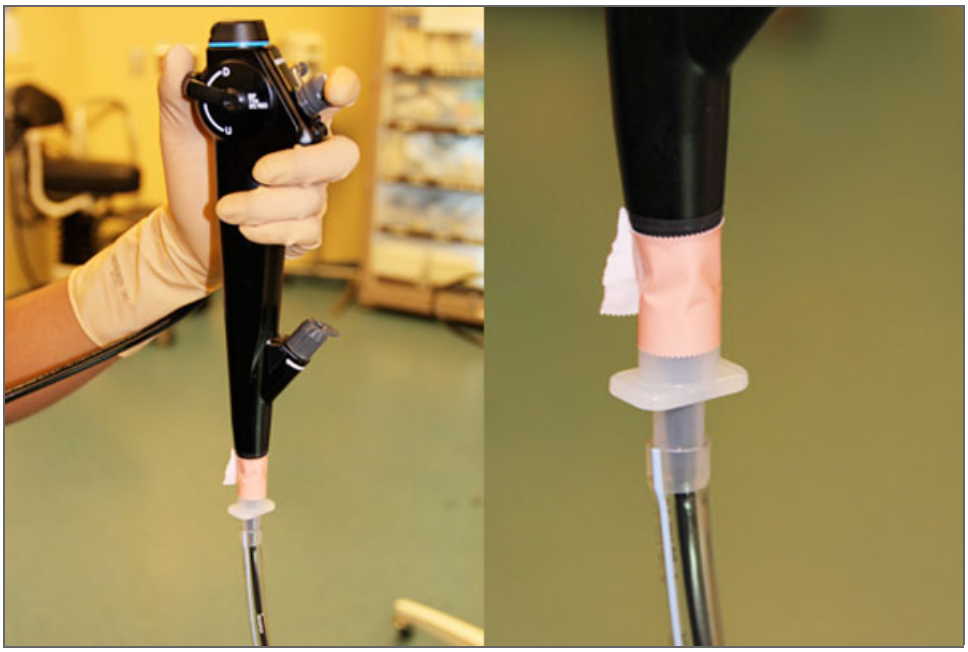
Module 5: Procedure

Introduction

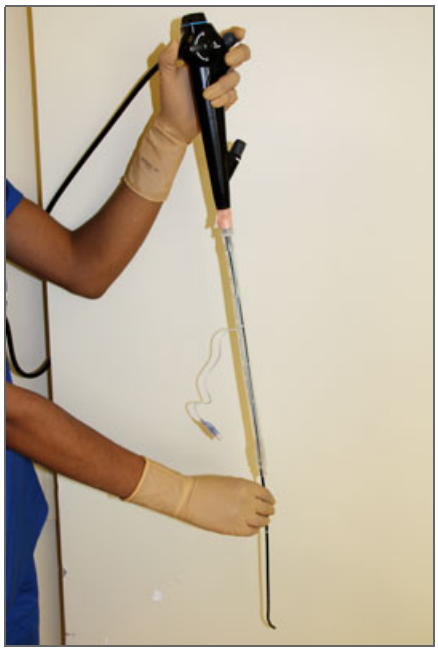
This module covers the process of bronchoscopic intubation, commencing once the patient is adequately topicalized and sedated and finishing when ETT placement is confirmed in the trachea.

Ten-Step Plan

1. Position the patient, monitor and yourself so that everyone is comfortable.
2. Railroad the chosen ETT onto the bronchoscope and secure it with a piece of tape.



3. Hold the bronchoscope in your left hand, using your thumb to manipulate the lever. Suctioning can be performed with the index finger. The right hand should be close to the nose or mouth ensuring that the insertion cord is straight at all times (for a right handed operator).



4. Orient the scope to ensure that the image is being correctly displayed. Ensure that white balancing and focusing have been performed and that an anti-fog spray has been applied or the bronchoscope has been pre-warmed.

5. For an oral intubation, place the oral intubating device in the mouth (Berman, Williams or Ovassapian airway).
6. Insert the bronchoscope into the nose or oral intubating device and follow the patent passage until the epiglottis comes into view. Identify the vocal cords.

   Video: Viewing the epiglottis and vocal cords.

7. Maintain vocal cords in the center field of view.
8. Advance the bronchoscope into the mid trachea and firmly hold it in position.

   Video: Advancing the bronchoscope.

9. Insert the ETT into the nose or oral airway and advance the ETT over the bronchoscope into the trachea.
10. Position the tip of the ETT 3–4cm above the carina using the bronchoscope (touch the carina with the bronchoscope, withdraw to the end of the ETT and measure the distance). Confirm position of the ETT using capnography before inducing general anesthesia.

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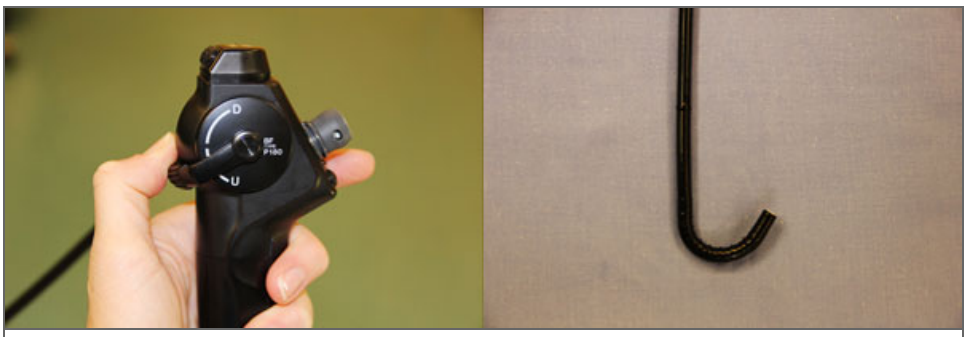
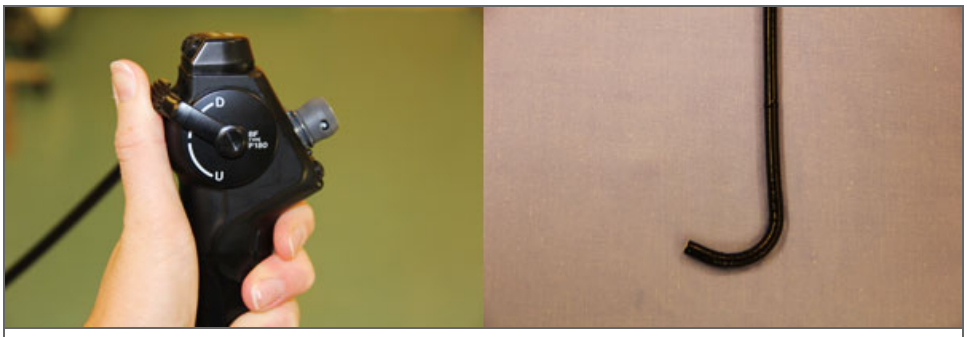
Bronchoscope Manipulation

Bronchoscope manipulation starting position.



Moving the lever down causes the tip to point up.



Moving the lever up causes the tip to point down.

Rotation of the handle causes rotation of the insertion cord.

Keep the insertion cord straight by keeping tension on the cord, so that proximal manipulations are effectively transmitted to the tip.