UCSD Department of Anesthesiology

Advanced Airway Rotation Syllabus

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Introduction/Goals and Objectives

Welcome to the Advanced Airway rotation! We think you’ll find this will be one of your most educational months during your entire residency. Anesthesiologists are expected to be "airway experts", and indeed the majority of patient airways will pose no problem to a competent anesthesiologist. However, there will always be a subset of patients in which establishing an airway can be significantly more difficult and dangerous. The techniques to establish an airway in these patients are often very different than conventional techniques, and many anesthesiologists in the general population themselves are not well versed in these skills.

The overall goal of this rotation is to ensure that UCSD residents are amongst the special group of anesthesiologists who can rescue difficult airways using a variety of techniques. Because of the central dictum of airway management, “patients do not die from not being intubated, patients die from not being ventilated”, we emphasize methods that maintain continuous ventilation while intubating the difficult airway.

Goals-

1. To become familiar with fiberoptic intubation techniques via a wide variety of conduits (e.g., enhancement of the natural airway via jaw thrust, pulling tongue out; Williams oral airway; LMA)
2. To become familiar with tracheobronchial anatomy down to subsegmental orifices of each lung
3. To become familiar with various techniques for one-lung ventilation and isolation
4. In-depth practice to facilitate virtuosity in the various procedures
5. To gain an understanding of the indications, risks and benefits of each procedure
Key Themes

A. Preparation is paramount

The key to any successful procedure is to be prepared, and to have all necessary equipment on hand and ready to go. Nowhere is this truer than with airway procedures. The small details can make a difference between success and failure.

All equipment should be prepared and tested beforehand (e.g., check cuffs, ensure fiberoptic scope is focused). Ideally, the FOB cart will be placed to left, with the IV pole closer to the surgical field to allow for unimpeded visualization when the drapes are raised. Similarly, have lubricant, a bronchoscopy elbow, glycopyrrolate and other necessary adjuncts on hand and administered ahead of time, if needed. Lastly, “mental preparation” may be the most important component - a thorough understanding of each step of the procedure, in order, will directly correlate with the success of the procedure itself.

B. “A little dab’ll do ya”

An appropriate amount of lubricant will greatly assist airway procedures. Any interface between equipment surfaces will need a small amount of Gyrus ACMI endoscopic instrument lubricant found on the cart (e.g., external surface of fiberoptic scope/internal surface of endotracheal tube, external surface of ETT/internal surface of LMA). Interfaces between equipment and the patient’s mucosa will benefit from an appropriate lubricant such as xylocaine ointment. Avoid getting any lubricant on the tip of the FOB as this will impair visualization.

With practice, you will learn just how much lubricant is necessary, and how to apply it judiciously and avoid a mess.

C. Practice, practice, practice

Initially, the multitude of steps with some of the advanced airway techniques can seem daunting. Focus on doing the procedure the same way, in the same order, every time. As the rotation progresses you will find yourself becoming demonstrably faster and smoother with each technique.

Accordingly, most of your practice should focus on the techniques which are most likely to be applicable and enable you to establish an airway while maintaining continuous ventilation- namely, intubating through an LMA or mask. While other techniques have their place (and you will learn these as well), if you can only gain mastery of a few techniques we’d prefer them to be the ones that are most likely to come up in clinical practice.
D. Be aware of the clinical situation and your surgical colleagues

Although UCSD is a teaching institution, patient care must come first. In addition, there will always be other important factors such as operating room efficiency and interpersonal relationships with our surgical colleagues. In general, our surgeons are very understanding of the need to teach and the inevitable minor delays that may result. We can maintain a good relationship by ensuring we have done everything we can to make the day as smooth as possible and minimize delay. The patient should be brought to the room as rapidly as possible, so briefing and induction can occur.

From a practical standpoint, what this means is- be prepared. We expect you to have done the preoperative evaluation on your patients beforehand, and have a good understanding of their medical issues. Certain patients (e.g., critical lung dz) may not be the best candidates for an advanced airway technique. Similarly, knowing your patient well before the anesthetic will allow you to be prepared and have the necessary equipment and plan already in place. Post-induction is NOT the time to figure out if the fiberoptic cart is plugged in, or to be fumbling around for equipment which should have been set up beforehand.

E. Test everything ex vivo

A good anesthesiologist should know his equipment like the back of his hand, but also checks everything before a procedure to ensure success. The FOB scope should be matched to the intended ETT, the ETT to the LMA, etc. Physically take every piece of equipment and make sure everything fits the way it’s supposed to, works the way it should, and so forth. You do not want to discover the ETT you grabbed won’t fit in the LMA you just placed to save a critical airway.

F. Match internal and external diameters between equipment as best as possible

When there is great disparity in diameters between pieces of equipment (e.g., pediatric FOB and 8.0 ETT), there is potential for equipment to get hung up and for the whole procedure to fail. This is due to the fact that diameter disparity will allow for various pieces of equipment to follow their own, erroneous path rather than the path you intend. It is for this same reason that guidewires (e.g., for central line placement) match the internal diameters of the catheter they are intended to guide- once the guidewire is in place, the catheter can only follow the same path as the wire.

This is one of the chief advantages of an aintree catheter- the internal diameter is very closely matched to an intermediate FOB, and in turn the external diameter of the aintree very closely matches the internal diameter of a 7.0 ETT. If you can
maneuver an intermediate scope into the trachea, you essentially guarantee you can then place an aintree, then a 7.0 ETT successfully.

IN OTHER WORDS, you would NOT use an aintree with a large FOB (won’t fit), nor would you use one with a 6.0 ETT. You will use an aintree often in this rotation, so the above combination bears repeating, and is a prototypical example illustrating the importance of matching diameters - intermediate scope WITH aintree catheter WITH 7.0 ETT.

G. Learn the pros/cons of each technique

There is no single, foolproof way to establish an airway. Some techniques will be better suited for certain situations but not others. While you learn a wide array of ways to establish an airway, you should also gain understanding of exactly WHEN a particular method is optimal.
Basic FOB Maneuvering

The ability to manipulate the FOB is both a basic and critical skill that can make the difference in speed and the overall outcome of the procedure.

Holding the FOB

The head of the FOB should be held partly in the fingers and partly in the distal palm. This will allow much easier and a much greater degree of rotation in the counterclockwise direction than if the head were held solely in the palm. One can achieve ~ 135 degrees of counterclockwise rotation and ~ 60 degrees of clockwise rotation in this fashion. The other hand should remain free to manipulate the shaft of the scope or other pieces of equipment. The thumb of the hand holding the scope will manipulate the lever for flexion/retroflexion.

The scope should be held with the arm extended enough such that the shaft of the FOB is straight. When the shaft is kinked or bent, it can be difficult to have the FOB “turn” (more discussion below). A step for the shorter practitioner may be necessary.
Any bend in the shaft will prevent the FOB from turning on its long axis.

**Translating motion of the FOB to the video screen**

Rotation of the wrist and flexion/retroflexion of the thumb lever will be the only manipulations of the FOB necessary. By combining those two elements, any image on the screen can be reached. The schematic on the following page shows the basic relationships.
90 degree counterclockwise rotation of the wrist causes 90 degree clockwise rotation of the view on the screen.

Pushing down on the thumb lever causes the image on the screen to move up.
The immediate target one is trying to get to should ALWAYS be kept in the middle of the screen. If the target is in the middle, one will always get there, and if it is in the corner one will never get there.

In the picture above, the FOB is in good position to enter the left mainstem bronchus (target is in center of screen) and poor position to enter the right mainstem bronchus (in the corner of the screen).
As mentioned, ushering down on the thumb lever will cause flexion of the FOB tip, allowing motion in the 12 ‘o clock direction. Pushing up will cause retroflexion, allowing motion in the 6 ‘o clock direction. In other words, DOWN with the thumb will cause the tip to go “UP”, while UP with the thumb will cause the tip to go “DOWN” (similar to airplane controls).

Turning the FOB along its long axis clockwise or counterclockwise will cause the shaft, and thus the view to rotate. The shaft must be straight for this to work as discussed above.

The following pictures illustrate the degree of rotation possible with a proper grip (FOB held between palm and fingers), along with the corresponding change in view on the FOB screen.
View correlating with a neutral wrist. A, P, L and R are anterior, posterior, left and right, respectively.

Clockwise rotation of the FOB causes the view to rotate. “A” has moved almost to the 9’o clock position, and “R” is now near 12 o’clock. ~ 60 degrees of rotation is possible.
90 degrees of counterclockwise rotation, a useful position that one will often find themselves in. “A” has moved to the 3 o’clock position, and “L” and “R” are perfectly positioned at 12 and 6 o’clock respectively, allowing access with flexion or retroflexion of the tip.

Counter-clockwise rotation of the FOB. “A” has moved to 5 o’clock. ~ 135 degrees of rotation is possible, making this the most important direction with the greatest maneuverability.
Therefore, to enter a lumen to the left or right requires two maneuvers-
1. Turn wrist to change orientation of the tip such that the desired lumen is at 12 o’clock
2. Flex or retroflex with the thumb to point the tip of the FOB to the desired lumen

These concepts are illustrated in the examples below.

View of the carina. 12 o’clock is anterior, 9 and 3 o’clock are L and R mainstem bronchi, respectively.
Clockwise rotation causes the view to rotate; 12 o’clock is now the R side of the patient, 9 and 3 o’clock are anterior and posterior, respectively.

Pushing down with the thumb causes the tip of the scope to flex up towards 12 o’ clock, and the scope is advanced into the R mainstem.
Once in the R mainstem, the wrist is can be left in the rotated position or returned to neutral as shown above. 12 o’clock is once again anterior.

With practice, one can become quite adept at maneuvering the FOB along a convoluted path, all while maintaining a good view of the desired structures.
Specific Procedures

Note- this section is intended to be a brief description of each technique; for more in-depth, visual descriptions, please refer to the videos for each method. All of these techniques assume anesthesia has been induced, including administration of muscle relaxant in the majority of cases.

I. Continuous ventilation and FOB intubation via a Cookgas LMA
   a. “Tube extender” method
   b. Aintree catheter

II. Continuous ventilation and FOB intubation via a mask

III. Intubation without continuous ventilation
   a. Intubating via other LMAs, special situations
   b. Intubation via Williams airway, jaw thrust, tongue manipulation (aintree or tube loaded on FOB)
   c. Intubation with direct laryngoscopy assistance

IV. Bronchial blockers
   a. General discussion
   b. Univent and Uniblocker
   c. EZ blocker

Intubation via a Cookgas LMA, tube extender method

Disposable Cookgas LMA with tube extender.
1. Place the LMA in standard fashion, attach circuit with bronchoscopy elbow
2. Ventilate using frequent, relatively small tidal volumes
3. Scouting view- maneuver 5.0mm OD ("large") FOB through the bronch elbow, visualize the glottic opening
4. Remove the 15mm adapter attached to the LMA
5. Place 7.0 ETT inside LMA to 17cm, attach circuit to 15mm adapter of ETT
6. maneuver FOB through the bronch elbow and ETT, into trachea down to carina
7. Disconnect 15mm from ETT, advance ETT until the proximal end of the ETT just protrudes from the LMA
8. Remove FOB and circuit
9. Use blue tube extender to apply gentle forward pressure to ETT while the LMA is backed out over the ETT - the goal is to maintain the position of the ETT while removing the LMA, NOT advance the ETT further. Alternatively, a smaller ETT can be used instead of the tube extender for this purpose.
10. As soon as feasible, reach into the mouth to “fix” the ETT, continue to pull the LMA out/the ETT all the way through the LMA. If the pilot balloon appears to be caught or stuck in the shaft of the LMA, ADVANCE the tube extender until the pilot balloon emerges (push forward, don’t pull LMA back)
11. At this stage, there should be an ETT without 15mm adapter in the trachea. Reconnect the circuit with the 15mm adapter still attached, ensuring 15mm is firmly seated in the ETT. Confirm ventilation, and visibly inspect the airway with the FOB

Intubation via a Cookgas LMA, aintree catheter method

Disposable Cookgas LMA and Aintree catheter.
1. Place LMA in standard fashion, attach circuit with bronch elbow
2. Ventilate using frequent, relatively small tidal volumes
3. Maneuver 4.0mm OD (“intermediate”) FOB with the aintree catheter as proximal as possible through the bronch elbow, LMA and into trachea down to the carina. Advance the aintree to the carina to allow as much tracheal “purchase” as possible
4. Remove the FOB while holding the catheter in place with your other hand
5. Secure the proximal end of the aintree while removing the LMA- the aintree MUST be secured during the entire process. As you remove the LMA, the aintree may need to be withdrawn slightly to maintain proximal control- do so GENTLY and MINIMALLY.
6. As the LMA emerges from the mouth, the aintree can now be secured distally at the mouth
7. Using one hand, slide a 7.0 ETT over the aintree catheter, securing the catheter in place distally at the mouth with the other hand
8. As the ETT approaches the mouth, the aintree may need to be withdrawn slightly to regain proximal control- do so GENTLY and MINIMALLY until proximal control is gained
9. With proximal control of the catheter in one hand, use the other hand to advance the ETT into the trachea blindly until at the usual depth
10. Remove the catheter and leave the ETT in place
11. Attach circuit, confirm ventilation and visibly inspect the airway with the FOB

**Continuous ventilation and FOB intubation via a mask**

A number of different masks can be used to both ventilate the patient and allow FOB intubation; some masks have been specifically designed with a side port large enough to allow passage of a FOB and ETT; however, most are poorly suited for this purpose. The first choice utilizes a standard bronch elbow, attached to the circuit and regular mask.
Mask, Williams airway, bronchoscopy elbow for FOB intubation via mask.

Via bronch elbow (aintree catheter must be used)

1. Place a Williams intubating airway (pink for male, yellow for female) in the oropharynx, ensuring the airway is in the midline
2. Immediately provide sustained jaw thrust and mask ventilate; IMPORTANT - from this point forward, jaw thrust must be maintained continuously - do not let up for an instant. If jaw thrust is let go, you may lose the well-seated midline position of the intubating airway.
3. Have a second provider assume mask ventilation and unbroken jaw thrust, utilizing straps/good mask seal
4. Maneuver the FOB through the bronch elbow, mask, Williams airway and into the trachea. Deposit the aintree into the trachea at the carina, remove FOB, mask and Williams airway, place ETT over aintree via previously described technique
Intubating without continuous ventilation, via other LMAs and special situations

It is entirely possible to intubate the trachea via a number of other supraglottic airways (e.g., classic LMA, King airway); while most of these will require a FOB, a notable exception is the FastTrach LMA. We will explore the technique to intubate via a FastTrach LMA and a King airway. It is beyond the scope of this course to describe the other existing techniques- instead, we will first explore general concepts which will facilitate intubation in these odd situations and prepare the practitioner such that airway mishaps are unlikely to occur.

General concepts-

1. **The length of the LMA should be shorter than the intended endotracheal tube, and it may be impossible to pass a shorter ETT into the trachea**

The prototypical example of this is intubating via a classic LMA- it can be done, but typically requires a nasal RAE tube (long enough to pass through the LMA and into the trachea). The general idea is selecting an ETT significantly longer than the intended conduit is a requirement (but not guarantor) of success. For instance, a 7.0 ETT can be advanced a further 12cm from the distal orifice of a 3.5 Cookgas LMA (the tip of the ETT is at the distal orifice when 18cm inside the LMA, and the total length of the ETT is 30 cm).

2. **The 15mm adapter on most devices will be the narrowest point, and the area most likely to cause hang ups**

If one inspects most devices designed to facilitate intubation (e.g., Cookgas LMA), one will note that the 15mm adapter is removable. By extension, any device where the 15mm is permanently fixed will be far more difficult to use at a minimum.

One example of this is the King airway- although it is possible (~50% of the time) to pass a FOB scope through the shaft and into the trachea, an ETT simply will not fit through the 15mm adapter (or distal outlet, for that matter). A NIM tube is an example of the same problem, but with the tube itself- because of the external wires and 15mm adapter that cannot be removed, the tube itself is unable to pass directly through a supraglottic airway.

In emergency situations, it can be possible to physically cut the 15mm adapter off the device in question. A “Tibble cap” can then be used when needed to re-establish a 15mm adapter, almost regardless of the internal diameter of the cut device (see figure). The Tibble cap acts as a universal adapter by virtue of the tapered end. We encourage the practitioner to mentally explore various
situations where the Tibble cap may be useful, in addition to physically experimenting with the devices themselves.

The “Tibble” cap.

3. **If possible, test EVERYTHING *ex vivo* prior to usage**

The value of prior testing cannot be overstated. Unsure if a particular tube will pass through a certain airway? Grab a spare and try it out. While the true emergency situation may preclude testing, it is far more common to encounter scenarios where time is available, and a test beforehand can be lifesaving.

Intubating via a King airway is a classic example; a test may quickly reveal the equipment on hand cannot accomplish the goal. Regardless, the airway itself is still functional and presumably oxygenation and ventilation can continue while an alternate plan is established- this is far better than finding out intubation cannot be accomplished in the process of eliminating oxygenation and ventilation.

Again, we encourage the practitioner to experiment and test all manner of combinations of devices *ex vivo* so as to gain intimate understanding. Knowing what cannot be accomplished is just as important as knowing what can.

**Intubation via Fasttrach LMA**

The Fastrach LMA is a unique device designed to allow blind intubation of the trachea. It has ~ 70% first pass success rate in the occasional user, with improvement to 90% success in the experienced practitioner. It can also be used for FOB intubation in similar fashion to the techniques already described. The following is the step-by-step method for blind intubation via the Fasttrach.
The Fasttrach LMA.

1. Place Fasttrach LMA in standard fashion, confirm oxygenation/ventilation
2. If tidal volumes/ease of ventilation are below what is “typical” for an LMA, consider replacing/reseating
3. Remove 15mm adapter from the special ETT and set aside. Lubricate ETT
4. Place ETT in shaft of LMA
5. Advance ETT through the LMA, first with your hand and then with the specific packaged pushing device
6. When ETT is almost completely advanced through the LMA, the tip should be in the trachea. Apply continuous forward pressure with the pusher while the LMA is backed out, in similar fashion to this step using the “tube extender” method and the intubating LMA, or removing an LMA or bronch elbow/mask combination with an aintree catheter
7. Remove LMA completely; the ETT should be in the trachea
8. Reconnect 15mm adapter and confirm tracheal placement

Intubation via a King airway

NOTE- this technique requires an Aintree catheter.
The King airway. Note single pilot balloon, dual cuffs and 60cc syringe necessary to inflate both cuffs.

Distal portion of King airway. The most distal port allows ventilation when the airway is in the trachea, and the anterior port allows ventilation when the airway is in the esophagus (more common).

1. Place King airway and confirm oxygenation/ventilation, or use existing King airway if already placed
2. Maneuver FOB through King airway with an aintree catheter preloaded; one must determine if the airway is in the trachea (uncommon) or in the esophagus (common)
3. If in the trachea- maneuver FOB into trachea, insert aintree catheter, remove FOB and King airway, place ETT over aintree as described previously
4. If in the esophagus- maneuver FOB through anterior ventilation port into the trachea, place aintree catheter, remove FOB and King airway, place ETT over aintree as described previously. NOTE- passing the FOB and aintree through the anterior port will be a tight fit and MAY NOT be possible 100% of the time

Intubating via Williams airway (tube or aintree loaded on FOB, will require breaking continuous ventilation)

1. Place a Williams intubating airway (pink for male, yellow for female) in the oropharynx, ensuring the airway is in the midline
2. Immediately provide sustained jaw thrust and mask ventilate; IMPORTANT- from this point forward, jaw thrust must be maintained continuously- do not let up for an instant
3. Have a second provider assume mask ventilation and unbroken jaw thrust, utilizing straps/good mask seal
4. Remove mask and circuit while second provider continues jaw thrust.
5. Alternatively, the Williams airway can be removed and the tongue can be manually pulled out of the mouth which may improve the view and natural airway
6. Maneuver the FOB scope through the Williams airway or oropharynx and into the trachea.
7. Aintree method- Deposit the aintree into the trachea, remove FOB and Williams airway, place ETT over aintree via previously described technique
8. Tube on FOB method- the 15mm adapter must be removed and set aside. The ETT should be secured at the most proximal point of the FOB possible using tape or a rubber band (see picture below)
9. Remove securing device, deposit the ETT into the trachea, visually confirm placement while withdrawing the FOB, remove FOB.
10. Keeping ETT in place, gently remove Williams airway. Reattach 15mm adapter and circuit.
“Rubber band” technique to secure an ETT to the FOB. Loop one end of the band around the ETT and through the other end (left picture). Gently tighten, then place the loop over the injection port of the FOB (right picture). The ETT will now be secure, but can be advanced free of the rubber band with minimal pressure.

FOB Intubation with direct laryngoscopy assistance

Occasionally, situations may arise in which FOB intubation can be greatly assisted with direct laryngoscopy to clear the airway and provide a path for the FOB. One not uncommon scenario is placement of a Nerve Integrity Monitoring (NIM) tube - a scenario may arise where a FOB is needed to place the NIM tube, but direct visualization of proper placement of the sensing strip between the vocal cords still requires direct laryngoscopy (+/- glidescope). You will become familiar with the indications for this technique - the general steps are below. Note that this procedure requires two providers - one to hold the laryngoscope and one to drive the FOB.

1. Perform a DL in standard fashion, obtaining the best view possible
2. A second provider will either maneuver the FOB, or the laryngoscope can be passed to an assistant (e.g., circulating nurse) who should hold the scope in the optimal, static position
3. Maneuver the FOB along the flange of the laryngoscope, attempting to visualize epiglottis and the glottic opening
4. Advance the FOB into the trachea, and intubate using either the aintree technique or with an ETT secured to the FOB as previously described
**Bronchial blockers and one lung ventilation**

Every anesthesiologist should be familiar with the indications for lung isolation and one lung ventilation. The practitioner is encouraged to learn the absolute and relative indications in detail.

### Table 9–1: Indications for Separation of the Two Lungs (Double-lumen Tube Intubation) and/or One-lung Ventilation

<table>
<thead>
<tr>
<th>Absolute</th>
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<tbody>
<tr>
<td>1. Isolation of one lung from the other to avoid spillage or contamination</td>
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<tr>
<td>A. Infection</td>
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<tr>
<td>B. Massive hemorrhage</td>
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<td>2. Control of the distribution of ventilation</td>
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<tr>
<td>A. Bronchopleural fistula</td>
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<td>B. Bronchopleural cutaneous fistula</td>
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<td>C. Surgical opening of a major conducting airway</td>
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<td>D. Giant unilateral lung cyst or bulla</td>
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<td>E. Tracheobronchial tree disruption</td>
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<tr>
<td>F. Life-threatening hypoxemia caused by unilateral lung disease</td>
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<tr>
<td>3. Unilateral bronchopulmonary lavage</td>
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<td>A. Pulmonary alveolar proteinosis</td>
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<table>
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<tr>
<th>Relative</th>
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<tbody>
<tr>
<td>1. Surgical exposure—high priority</td>
</tr>
<tr>
<td>A. Thoracic aortic aneurysm</td>
</tr>
<tr>
<td>B. Pneumonectomy</td>
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<tr>
<td>C. Thoracoscopy</td>
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<tr>
<td>D. Pulmonary resection via median sternotomy</td>
</tr>
<tr>
<td>E. Upper lobectomy</td>
</tr>
<tr>
<td>F. Mediastinal exposure</td>
</tr>
<tr>
<td>2. Surgical exposure—medium (lower) priority</td>
</tr>
<tr>
<td>A. Middle and lower lobectomies and subsegmental resections</td>
</tr>
<tr>
<td>B. Esophageal resection</td>
</tr>
<tr>
<td>C. Procedures on the thoracic spine</td>
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<tr>
<td>3. Postcardiopulmonary by-pass status after removal of totally occluding chronic unilateral pulmonary emboli</td>
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<tr>
<td>4. Severe hypoxemia caused by unilateral lung disease</td>
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*Indications for lung separation and isolation, adapted with permission from Benumof JL., Anesthesia for Thoracic Surgery*

Multiple devices exist which can provide for most of these situations. While the double lumen tube can be used for any of the above indications and is generally ideal, there are circumstances when another option would be better suited. Thus, it
behooves the anesthesiologist to be familiar with multiple different techniques and their indications.

The invasiveness of placing a DLT precludes routine practice on the airway rotation. We encourage the practitioner to obtain as much practice with DLTs as possible—during the airway rotation, you will use the Uninvent, Uniblocker and EZ blocker devices. There are four situations in which practitioners may find themselves using one of these devices. They are-

1. Attempt and fail to place a DLT, but a single lumen ETT can be placed
2. Lung isolation or one lung ventilation is indicated, a single lumen ETT is in place, and it is unsafe to change to a DLT (e.g., intraoperatively with possible airway swelling)
3. Lung isolation or one lung ventilation is indicated in a non-OR setting (e.g., hemoptysis in a patient on the wards)
4. Elective

One advantage of the aforementioned devices is their ease of use; a second is that only a single lumen, “standard” ETT need be placed, and a standard ETT can be converted for one lung ventilation via the Uniblocker or EZ blocker. Therefore, they are invaluable in the above situations when one lung ventilation or isolation is needed.

Disadvantages of these techniques include inability to suction while providing ventilation to the other lung, and inability to provide differential ventilation to either lung.
Placement and use of the Uniblocker

Tripod adapter - the FOB passes through the light blue port, and the connection to the circuit comes off 90 degrees (facing down in the picture). Note blocker pilot balloon and port on end of the blocker which can be used for O₂ insufflation, CPAP or egress of air.

1. Remove the various metal stylets and inserts from the blocker prior to insertion
2. Lubricate all moving contact points in standard fashion
3. Ensure the port at the proximal end of the blocker is closed otherwise a leak will occur; this port can be used to facilitate egress of air from the lung, insufflation of O₂ or CPAP

4. Place the tripod adapter that comes in the uniblocker package between the ETT and circuit- one limb will attach to the circuit, a second allows the uniblocker to pass/affix, and the third allows passage of the bronchoscope

5. Insert the Uniblocker approximately halfway down the lumen of the ETT, place the FOB until the Uniblocker balloon is visible

6. Advance both devices until they exit the ETT. Ensure the blocker does not exist the Murphy eye.

7. NOTE- if the ETT is too close to the carina, it can be difficult or impossible to maneuver the blocker into either mainstem bronchi. The tip of the ETT should be ~ 7 tracheal rings back from the carina- it may be necessary to back the ETT up upon visualization with the FOB.

8. Twisting the blocker on its long axis will allow rotation in either direction. To rotate left, twist counterclockwise. To rotate right, twist clockwise. Guide the blocker into the desired orifice.

9. Using the FOB for visualization, inflate the blocking balloon and confirm proper placement.

10. Secure blocker at the desired location

**Placement and use of the Univent tube**

![Image of Univent tube](image)

**The Univent tube.**

One will note that the Univent is simply an ETT with a Uniblocker already built in. The advantage of the Univent over the Uniblocker is the bronchial blocker is outside of the tube whereas the uniblocker must be placed inside an ETT, thereby decreasing ventilation. The Univent tube may be thus be easier to use and has less
independent parts. The chief disadvantage is its use assumes prior knowledge of the need for one lung ventilation.

1. Lubricate all moving contact points in standard fashion
2. Ensure the port at the proximal end of the blocker is closed otherwise a leak will occur; this port can be used to facilitate egress of air from the lung, O₂ insufflation or for CPAP
3. Place Univent tube in standard fashion. NOTE- if the ETT is too close to the carina, it can be difficult or impossible to maneuver the blocker into either mainstem bronchi. The tip of the ETT should be ~ 7 tracheal rings back from the carina- it may be necessary to back the ETT up upon visualization with the FOB.
4. Twisting the blocker on its long axis will allow rotation in either direction. To rotate left, twist counterclockwise. To rotate right, twist clockwise. Guide the blocker into the desired orifice.
5. Using the FOB for visualization, inflate the blocking balloon and confirm proper placement.
6. Secure blocker at the desired location

Placement and use of the EZ blocker

The EZ blocker.
Dual pilot balloons, 15mm adapter for O₂ insufflation/CPAP/egress of air, blue caps to cover blocker ports, and tripod adapter (port for the blocker, the FOB and to attach to circuit).

Distal end of the EZ blocker. Each blocker is intended to fit in a mainstem bronchus; selective inflation of either cuff will allow blockade of either lung.
The EZ blocker allows blockade of either lung with a single, proper placement.

1. Remove all stylets and the outer plastic covering from the blocker
2. Lubricate all moving contact points in standard fashion
3. Ensure the port at the proximal end of both blockers are closed otherwise a leak will occur; this port can be used to facilitate egress of air from the lung, O₂ insufflation or for CPAP
4. Insert the EZ blocker approximately halfway down the lumen of the ETT, place the FOB until the balloons are visible
5. Advance both devices until they exit the ETT. Ensure the blocker does not exit the Murphy eye.
6. NOTE- if the ETT is too close to the carina, it can be difficult or impossible to maneuver the blocker. The tip of the ETT should be ~ 7 tracheal rings back from the carina- it may be necessary to back the ETT up upon visualization with the FOB.
7. Advance the blocker to the carina, such that one balloon is seated in the left and one balloon in the right mainstem bronchi. Inflate the desired side as necessary

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Resources

1. Benumof JL. Anesthesia for Thoracic Surgery. A comprehensive resource of pulmonary anatomy, physiology, anesthetic technique and information that is relevant to the airway rotation

2. Thoracicanesthesia.com. A very useful website, with a “real time” simulator of tracheobronchial anatomy down to the subsegmental bronchi. The practitioner can virtually guide a bronchoscope through the tracheobronchial tree and familiarize themselves with the pertinent anatomy