Fiberoptic Intubation

Robert Naruse, MD
Director of Neuroanesthesia
Cedars-Sinai Medical Center

Assistant Clinical Professor of Anesthesiology
USC/Keck School of Medicine

Fiberoptic Intubation is an often misunderstood, poorly taught procedure for securing of an airway, which, traditionally, has been reserved as a "last resort" for placement of an endotracheal tube. This approach, which is commonly applied in anesthesia, is misguided at best if you believe philosophically that "your best chance is your first chance." Essentially, it is a flexible bronchoscopy performed for the purpose of intubation of the trachea. You will note that experienced Pulmonologists can often perform bronchoscopy in less than one minute. This is not an unreasonable expectation in the properly prepared patient.

Much like batting instruction in baseball, you don't just "hand the kid a bat and tell him to swing."

The Basics of the Equipment

In traditional instruction there is often little or no discussion devoted to the principles and design behind the equipment used in this procedure. This is a major mistake. It is the one of the reasons why you will see so many practitioners struggling and handling the instruments in many different and often incorrect ways. The bronchoscope was engineered to be "ergonomically correct" for the right-handed practitioner, which is why the suction port and light input port are on the left side of the scope. The scope is intended to be held and controlled by the right hand while being advanced / withdrawn by the left hand.

Mastering fiberoptic intubation requires a thorough understanding of the equipment, which includes:

1. Knowledge of Optical Principles--Recognition of the fact that, like all endoscopic procedures, we are using 2D images to do perform a procedure in 3 dimensions. Convex lens (used at the distal end of the scope) allow us to expand the visual field BUT at the cost of optical distortion at the periphery. The clinical impact is that you must constantly manipulate your scope to keep your intended target in the center of the image as you advance the scope. If you fail to do this, you will find that your intended target will rapidly disappear from your view.

2. Engineering of the Bronchoscope--working channel, function/use of the valve, importance of keeping the shaft FULLY extended at all times.
3. Correct hand / finger placement on the scope controls/valve.
4. Correct manipulation of the controls needed to achieve the desired results-ROTATION of the right wrist to achieve lateral movement of the scope tip. Insufflation of O2 helps prevent collapse of tissues in the asleep patient.
5. Preventing damage to the scope--by NOT twisting the shaft with the left hand, this results in damaged glass fibers(black dots). Limiting O2 flow to <4 l/m to prevent damage to the channel.

The Basics of Airway Anatomy

The most common fallacy in teaching bronchoscopy / fiberoptic intubation is that airway simulators can ACCURATELY represent what is actually seen during a procedure on a real patient. This does not even remotely approach reality. Airway simulators have no secretions and do not simulate the dynamic (often changing) state of a live patient's anatomy. The study of actual video intubations with freeze frame capability is much more realistic and useful in learning fiberoptic intubation. A mastery of oropharyngeal and nasopharyngeal anatomy seen through actual video intubations is essential to the performance of fiberoptic intubations. Rapid recognition of airway anatomy is the key to making the correct decisions which will enable rapid fiberoptic intubation. If you do not recognize key structures, you will not be able to make the correct decisions about what to do next and consequently will be delayed in your ability to perform the procedure successfully. This knowledge is also essential to prevent airway trauma which can seriously impair the procedure and injure the patient.

Key anatomic structures in orotracheal fiberoptic intubation:

1. Nose
2. Front teeth (#8 and #9)
3. Tongue
4. Hard Palate
5. Soft Palate
6. Uvula
7. Tonsillar Pillars
8. Base of Tongue
9. Valecula
10. Epiglottis
11. Arytenoids(and posterior commissue)
12. Vocal Cords
13. Trachea
14. Carina

Key anatomic structures in trans-nasal fiberoptic intubation:

1. Nares
2. Nasal septum
3. Turbinates
4. Adenoids
5. Base of Tongue
6. Valecula
7. Epiglottis
8. Arytenoids
9. Vocal Cords
10. Trachea
11. Carina

Details of Asleep Oral Fiberoptic Intubation

Treatment with an antisialogogue at least 20 minutes prior to the procedure is mandatory to prevent secretions from obscuring your view. Following application of standard monitors, the patient is rendered unconscious . Ability to mask ventilate the patient is confirmed and then a neuromuscular relaxant is administered to relax the vocal cords. After the relaxant is given ample time to work, an assistant uses a cotton gauze to retract the tongue. The fiberoptic scope is then introduced into the oral cavity with a slight anterior curvature so the scope will follow the natural curvature of the oropharynx. The shaft of the scope is extended fully to maintain “true” movements of the tip of the scope in the anterior-posterior plane. The shaft of the scope is braced against the 2 front teeth, which in most patients will maintain the scope in the midline. Once in the back of the throat (approx 10-12 cm), visualization should reveal the uvula, tonsillar pillars laterally, the base of the tongue anteriorly and the tip of the epiglottis caudally. If the tissues are collapsed at this point a gentle jaw lift will usually be helpful in revealing the tracheal inlet. Because the tracheal inlet is anterior to the esophagus, an anterior deflection of the tip is usually needed to advance the bronchoscope into the tracheal inlet. In fact just as the vocal cords are passed, the tip of the scope will usually visualize the anterior commissure of the vocal cords and anterior tracheal wall just caudal to the vocal cords. Once this has been achieved, and the vocal cords have been passed by the scope, the tip is deflected posteriorly and the scope advanced until the carina is visualized. The ET tube is then advanced into the trachea and the scope removed. It is not uncommon to encounter difficulty in advancing the tube over the scope. Often the ET tube gets caught on the right arytenoid cartilidge. This can be often overcome by a clockwise twisting motion as the tube is advance such that the bevel of the tube passes the vocal cords posteriorly at its widest point.

Details of Asleep Trans-nasal Fiberoptic Intubation.

Again, I cannot stress enough the importance of the antisialogogue. Additionally, the nose must be evaluated for septal deviation by manual

examination and seeing which nares allows for the greatest airflow. Both nares are then prepared with a mucosal vasoconstrictor like *Oxymetazoline x2*, five minutes apart. Once this has been done, the 5% *Lidocaine, water soluble ointment* is applied to the nasal mucosa using nasal airways or Q-tip applicators. Following induction of general anesthesia, the bronchoscope is introduced into the nares and care is taken to traverse the crevices BETWEEN the turbinates and septum. Trauma to either structure can result in substantial bleeding. Navigating between the turbinates and following the natural caudal curvature of the nasal cavity will eventually lead to the posterior pharynx with the tracheal inlet visualized in the distance. The remainder of the procedure is not unlike that described above for oral intubations, with the exception that the uvula may not be well visualized since the scope, once it leaves the nasopharynx, will enter the posterior pharynx in very close proximity to the uvula.

Reasons for Problems commonly encountered during fiberoptic intubation:

1. Failure to properly prepare the patient by not giving an antisialogogue in a timely manner.
2. Failure to control the scope properly.
3. Failure to keep the scope in the midline. Keep the shaft of the scope braced on the front teeth at all times. The tracheal inlet is NOT lateral unless there is a real problem. The scope's convex lens means that even though you may see the target, if it is not in the middle of the image, advancing the scope will NOT take you to the target.
4. Failure to recognize anatomy, which may result in getting "lost in space" or resulting in the dreaded "pink screen." This means the scope tip is up against soft tissue. The remedy is NOT to try to advance the scope but rather to withdraw the scope to where you last visualized something recognizable. Collapsed tissue may also be a cause…remedy-use tongue retraction, jaw thrust.
5. Failure to use anatomic maneuvers-tongue retraction, and jaw lift for maximizing anatomic exposure.
6. Prior Anterior cervical fusion(esp at C2-C5) may leave the patient with hardware protruding into the soft tissues of the posterior pharynx which can prevent the scope from lying in the midline and may necessitate special maneuvers.
7. Abnormal anatomy secondary to prior surgery(i.e. radical neck dissection) / congenital abnormality.

In summary, fiberoptic intubation is an underutilized technique for placement of endotracheal tubes. Careful preparation and attention to detail can enable rapid visualization of the vocal cords and intubation which can be nearly as fast as that which can be achieved with direct laryngoscopy. Like any other technical skill, it must be practiced to acquire and maintain proficiency.