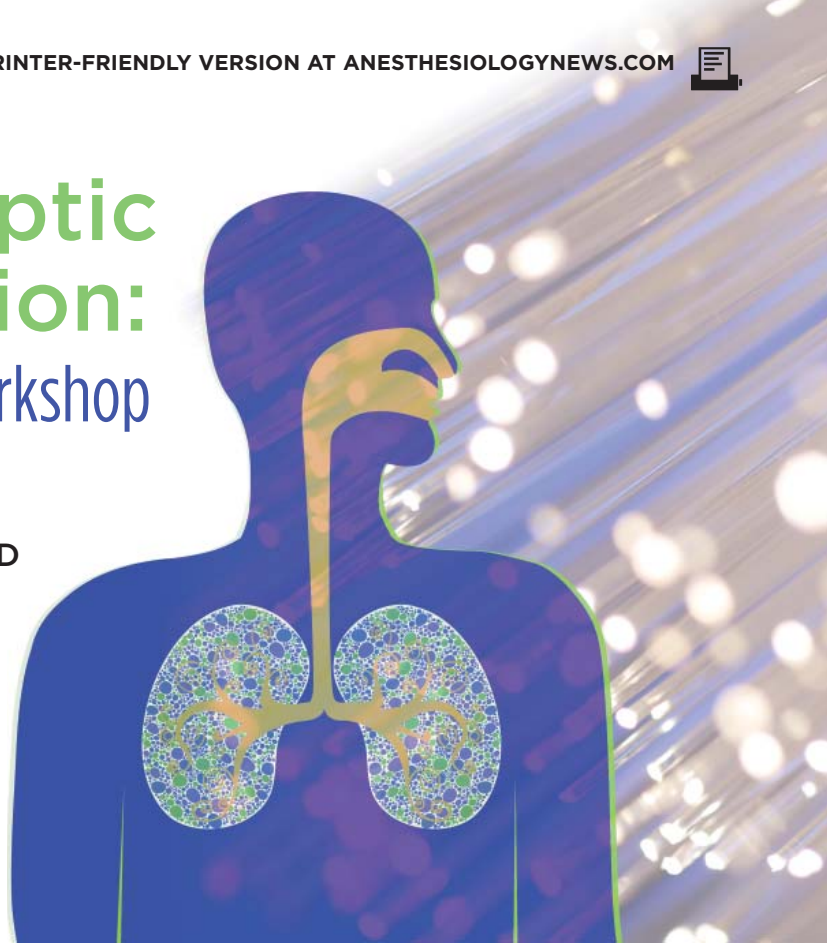
Fiber-Optic Intubation:
Tips From the ASA Workshop



Katherine S. L. Gil, MD

Northwestern University Feinberg School of Medicine
Chicago, Illinois

Dr. Gil moderates the Basic Adult Fiberoptic Laryngoscopy Workshop on fiber-optic intubation at the annual meeting of the American Society of Anesthesiologists. The following article uses material derived from her instruction there and at other workshops, as well as from her accumulated experience with fiber-optic bronchoscopes—which, she estimates, she has used on more than 3,000 patients. Dr. Gil has no relevant financial disclosures.

When faced with airway abnormalities, every anesthesiologist must be prepared to deal with the possibility of difficult intubation (5.8%), "cannot intubate" (≤0.35%), or "cannot intubate–cannot ventilate" (≤0.02%) situations.[1-3] Flexible fiber-optic intubation (FOI) should be a viable option in the armamentarium of every airway management specialist. The safest and best airway care must be provided to patients in order to avoid morbidity and mortality. Achieving this standard requires a concerted effort never to deny FOI, a truly lifesaving technique, on the basis of inexperience.

Still, some anesthesiologists are reluctant to use FOI. Why? After 7 years of teaching fiber-optic intubation, and 3 years moderating the fiber-optic intubation workshop at the annual meeting of the American Society of Anesthesiologists, I believe there are 3 likely answers to this question. The first involves a sort of clinical application of Occam's razor: Given a choice, take simplicity over complexity. Some clinicians have become so sclerotic in their routines that they assume they can intubate any patient with the easiest method available. Fiber-optic intubation, this (mistaken) thinking goes, is airway overkill, an unnecessarily tricky maneuver that offers few, if any, advantages over simpler techniques.

For other clinicians, lack of familiarity with FOI explains their avoidance of this approach. And for a third group, preoccupation with careers, business, and networking preclude taking the time to develop and maintain a key skill. The goal of this review is to provide a rebuttal to these wayward perceptions, as well as to offer a set of shortcuts and tips that can improve one's success with FOI.

Is Fiber-Optic Intubation Necessary?

Advantages of FOI are obvious in high-risk patients with cervical spine pathology,

Table 1. Comparison of ETT and Intubating Oral Airways for FOI; Plus Practical Tips for Developing FOI Expertise[10,11]

PVC, silicone, wire ETT	Silicone-tipped ETT may have a benefit even over bevel-down ETT.[12,13]
 Berman	Channel to allow passage of ETT ≤8.5 mm. Side slit for breakaway ETT removal. • Better lead to the glottis, if kept midline and as long as length is appropriate. • Sometimes difficulty removing ETT from it. • If periglottic ETT impingement, maneuvering out may be difficult.
 Patil-Syracuse	Aluminum, with no channel to insert ETT. Lateral open channels for suction passage. • Central groove for FOB passage. • Middle distal opening allows FOB tip movement. • After FOB is in trachea, airway must be removed to allow passage of ETT.
 Ovassapian	Proximal half has channel to allow passage of ETT ≤9 mm. Posterior channel walls flexible with opening for easy ETT removal. • Flat, wide, curved lingual distal half surface keeps tongue, tissues away. • Easier ability to stay midline, FOB movement, and maneuvering impinged ETT. • Use a marker to draw a line down middle to aid orientation of FOB passage.
 Williams	Proximal half has channel to allow passage of ETT ≤8.5 mm. Distal lingual curved half has opening to allow FOB movement. • Best lead to glottis, if kept midline and as long as length is appropriate. • If size incorrect, visualization may be difficult.
 No IOA	• Less worry about interfering with passage of ETT. • Better if small mouth opening does not permit IOA entry. • No FOB protection, no lead FOB to glottis, no airway help compared with IOA.
More safety, little time (Consider morbidity, time spent on difficult DL)	• Cook et al review: hemodynamic stability, less morbidity with FOI.[14] • Johnson, Erb,[15] and Smith et al[16]: 1.53, 1.58, 1.31±<0.76 min—times to complete FOI, respectively, by novice residents after only 10 patients each.
Optimize expertise (Surgeons and nurses rarely perform blind techniques, so why should one be blind in airway management?)	• Attend workshops, practice on mannequins, make a 5-min dexterity model, read before you practice, contact FOB reps and enlist them and experienced colleagues for OR assistance. Delay is unlikely if FOI equipment is prepared. • Initially, choose healthier, younger patients—short apnea periods tolerated best—with a distant surgical site; use anesthetic techniques so patients do not move. • Make safety an issue constantly (eg, direct-vision ILMA insertion, SGA etc). • Get surgery, etc involved in watching video and appreciating what you do.
Simpler methods (Sleeping patients may be spontaneously breathing or have muscle relaxant)	• Via in situ ETT use an FOB swivel adapter to see anterior rings, posterior membranous trachea, carina, bronchi; troubleshoot SpO_2, airway pressure, etc. • Examine airway via endoscopy mask or by SA in SGA. • Under direct-visual use an FOB to assist in insertion of an SGA.
More interesting FOB use in asleep cases (100% O_2 maintains good oxygenation[6])	• FOB insertion of ETT via ILMA (had a high success rate and was not blind).[17] • FOB insertion of ETT via any SGA-AirQ, Ambu Curved, LMA,[18] Cobra PLA, Ambu, iGel, and SLIPA; use second ETT as pusher rod for SGA removal. • When ready, perform FOI of trachea through an endoscopy mask. • Finally, perform asleep FOI after mask ventilation on 100% O_2.
One use of FOB per week	• 10 wk = the half-life ability = one-fifth Ovassapian number of 50.[6]
Save money	• Train staff on proper FOB care, keeping straight. FOB may equal better patient care.

DL, direct laryngoscopy; **ETT,** endotracheal tube; **FOB,** fiber-optic bronchoscope; **FOI,** fiber-optic intubation; **ILMA,** intubating LMA (LMA Fastrach, LMA North America); **IOA,** intubating oral airway; **OR,** operating room; **PVC,** polyvinyl chloride; **SA,** swivel adapter; **SGA,** supraglottic airway

Table 2. Fiber-Optic Intubation All-Purpose Tips

If awake, inform patient	Increases cooperation, decreases sedative need, decreases psychic trauma.
Indications	Any intubation/airway insertion, difficult airway, cervical spine risk, one-lung isolation, Aintree placement for post-op, ETT exchange, tracheo-bronchoscopy.
Contraindications	Lack of training, (if awake) lack of patient cooperation, any significantly distorted airway anatomy, secretions, or blood making success very unlikely.
Fiber-optic cart	Should contain FOB, light source, video, power cord, IOA, bite guards, FOB swivel adapter, local anesthetic paste, etc.
No FOB in department?	Borrow one from thoracic surgery, pulmonology, ICU.
FOB Day!	Pick a particular day each week to use the FOB to develop a routine, eliminate surprise. Explain to clean-up assistants the advantages of FOB experience to avoid the mess and multiple devices used during a difficult DL situation.
Look knowledgeable	Read ahead. Come early to check all equipment. Explain plans to others.
Dry patients	If allowed, antisialogogue to improve view; for awake FOI, local anesthetic works best.
Treat FOB like a baby	Thousands of 8- to 25-µm diameter glass fibers (human hair is 20 µm). To clean, brace device very near its end and wipe gently in air with alcohol pad. No bending, tossing, poking, or brushing tip on linens or sponges. Do not turn one hand in one direction unless the other moves similarly. Good care will reduce repair costs.
Lubricant	Viscous lidocaine gel, Neosporin ointment, Cetacaine spray are better than some water-based lubricants; lubricate ETT/FOB when going through devices.
Secretions	Preemptive suctioning down toward glottis is important before FOB insertion.
New school	Dominant hand performs finer, complex movement of aiming tip in correct direction, rotating tip, and moving FOB-insertion tube deeper or backing it out. Moving control lever up or down and depressing suction valve is not complex.
Old school	"Controls" were taught to be in dominant hand. Acceptable—if one is used to this.
FOB through SGA, similar devices	Test connector-less ETT passage through ILMA or related device (size depends on brand); if FOB in trachea, push in ETT, remove FOB, use small ETT to push ETT further. Oropharyngeal-squeezed SGA may only allow small or microlaryngeal ETT. An SGA that is "too small" may bend, distorting FOB view of anatomy (eg, epiglottis).[19]
FOB swivel adapter	Attach to pre-existing ETT. Patient can ventilate while one inspects with FOB.
	Before insertion of the FOB, measure the distance from the corner of the mouth to the ear; should be equal to the distance from the mouth opening to the glottis. After 5 to 10 attempts, you should be able to insert the FOB into the trachea within 10 to 20 sec.[20] Keep straight and follow the midline of the hard palate, past the uvula, while inserting FOB to the measured length, then search for epiglottis, etc.
Centered—avoid hazard	Keep desired objects in center of view. Avoid secretions, other obstacles.
Secretions or blood?	During FOB viewing can use FOB suction and/or insert Yankauer. Clean tip as necessary.
Fogging in patient	Touch buccal or other mucosa to clear it.
Combos	If needed, second operator moves tissues with DL, video laryngoscope, etc.
Unable to intubate?	Alternate plan: mask ventilate and try again or use other technique, such as DL.
Be wary of 0_2 via FOB	High O_2 flow in small airway or if FOB tip is in unknown body area can result in pneumothorax or gastric rupture. Know what you see and where you are!

DL, direct laryngoscopy; **ETT,** endotracheal tube; **FOB,** fiber-optic bronchoscope; **FOI,** fiber-optic intubation; **ICU,** intensive care unit; **ILMA,** intubating LMA (LMA Fastrach, LMA North America); **IOA,** intubating oral airways; **SGA,** supraglottic airway

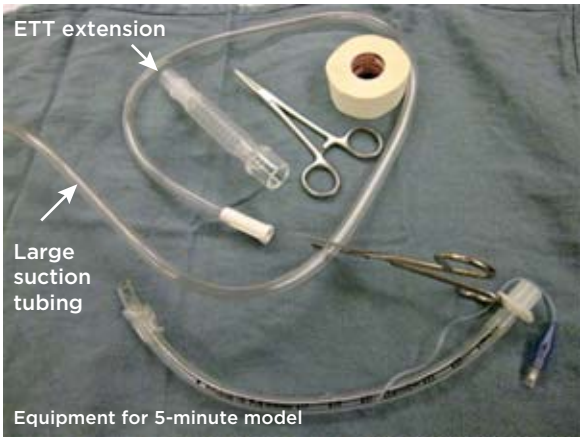


Figure 1. Equipment for a "5-minute" model.

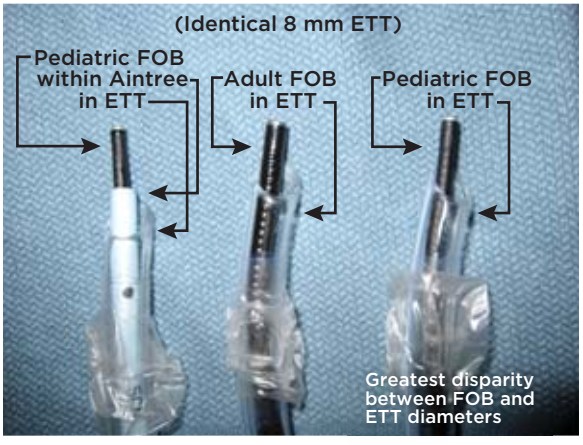


Figure 2. Improving fiber-optic bronchoscopy and endotracheal tube diameter disparities.

Figure 3. Passage of a fiber-optic bronchoscope through a swivel adaptor on a mask.

airway abnormalities, and sleep apnea, but the technique is being chosen increasingly for overweight and obese patients for whom other methods of intubation, by contrast, lose effectiveness. A study by Shiga et al found that the incidence of difficult intubation by direct laryngoscopy (DL) increased 3-fold, to 15.8%, in patients with a body mass index (BMI) above 30 kg/m^2, the cutoff for obesity.[1] In 2005-2006, the U.S. Centers for Disease Control and Prevention reported that 34.3% of adults in the United States had a BMI above 30 kg/m^2.

To be sure, a fiber-optic bronchoscope (FOB) is visually intimidating. Yet, that is largely a reflection of unfamiliarity with the device. Imagine if we had trained with FOI instead of DL; perhaps the latter would be intimidating.

In this technologic age, a 50-year-old device simply cannot be particularly complex to handle. The instrument is essentially unchanged since Shigeto Ikeda developed the first flexible FOB in 1966.[4] And that was 71 years after Gustav Killian performed the first therapeutic bronchoscopy to remove a piece of pork from a farmer's lungs (2 years after the first DL by Alfred Kirstein).[5] Using an FOB is like learning to drive a car with a manual transmission—not an experimental jet fighter.

Andranik Ovassapian, MD, once observed that residents seemed to require 50 cases, from airway evaluation to awake intubation, with an FOB—a figure echoed in the literature on colonoscopy—to use the device with confidence upon leaving a program and starting in practice. A study by Johnson et al revealed that novice residents reached a "half-life" in ability after only 10 attempts at FOI.[6] With practice, mean time to intubation decreased from 4±2.91 to 1.53±0.76 minutes by the 10th patient, with a success rate of 95% for first attempts. No hemodynamic changes occurred and no oxygen saturations (S_pO_2) were less than 91%. Heidegger et al analyzed 1,612 patients undergoing awake or asleep FOI (nasal or oral) by anesthesiologists.[7] After 25 patients, the time to successful FOI was no more than 3 minutes in 93.9% of cases.

So do we need FOI? A survey by McNarry et al showed that 94% of responding delegates from 23 medical

Table 3. FOI Technique Tips *(Common to all Patients; Unique to Awake Patients)*

If FOI-inexperienced	• Practice on a simple 5-min dexterity model for 10 min beforehand.
Antisialogogue	• Glycopyrrolate 0.2 mg or atropine 0.4 mg by IV ≥20 minutes pre-FOI.
Request assistant	• Enlist knowledgeable help, able to hold face mask on asleep patients correctly.
Pre-check equipment	• Gather FOI cart: Plug light source to electrical outlet. • Choose FOB with diameter as close as possible to ETT. • Plug FOB into light source, turn on, and follow adjustment instructions. • Test controls; very clear focus on written object; black notch @ 12 o'clock. • Use defogger or put FOB-ETT in warm irrigation bottle.
Check patient status	• IV, EKG, BP, RR, SpO_2. • Assistant keeps track of time spent during FOB use.
Optimize position	• Bed low as possible ± neutral head position; supine if no respiratory distress. • Sitting if indicated (eg respiratory distress)—facing patient→inverts FOB view.
Administer sedation	• Choices: midazolam, fentanyl, dexmedetomidine, ketamine, remifentanil. • Goal: respiratory rate >9 per min, SpO_2 ≥92%, patient cooperation as needed.
If SpO_2 <~92%-93%	• Give O_2. Otherwise, use SpO_2 drops to 93%-95% as indicator of sedation level.
Anesthetize airway	• See LA section; spray-as-you-go, won't need testing. • Injecting LA via 0.5-1 mm diameter working port or epidural passed through working port, sprays jet ahead and causes less reactive movement next to FOB tip.
Test local anesthetic **For oral FOI**	• Insert Yankauer or soft suction midline toward glottis—clears secretions/blood. • Pull tongue, protect FOB; assistant holds tongue out gently, with one gauze. • Insert IOA or bite guard; if awake use lidocaine paste on the ventral side. • If patient reacts, supplement with local anesthetic (± add minimal sedatives).
ETT on FOB	• Place lubricated ETT high on insertion tube.
FOB handling Keep scope straight Rest control hand on shoulder	• Attach suction to FOB; if time allows, be diagnostic, not just technically skilled. • If needed, assistant gives jaw thrust or chin lift while keeping IOA midline. • Nondominant hand has FOB controls by shoulder; ETT syringe in little finger. • Thumb controls angulation lever with index finger ready for suction valve. • Dominant hand holds distal FOB insertion tip between thumb and 2 fingers. • Always keep FOB straight (shoulder to hand), even if stepstool is needed.
Keep hand braced Small, slow movements Black notch @ 12 o'clock Avoid "pink out" and getting lost	• Insert distal tip of FOB through IOA or in center of mouth; brace on cheek/IOA. • Advance FOB very slowly, while keeping recognized objects in middle of view; use lever to look up/down, turn BOTH hands and use lever to look sideways. • **Keep centered in FOB view:** IOA/pink tissue juncture, uvula, epiglottis, etc.
For nasotracheal FOI	• Follow nostril past turbinates, always going toward dark passage until uvula.
Asleep and reactive to FOB	• If reacting to tip, assistant injects 0.5-1 mL 2% lidocaine fast via FOB port, prn.
Find carina	• Advance FOB to 3 rings above carina; NB: touching carina provokes coughing.
Position ETT correctly	• Hold FOB immobile. Keep ETT bevel posterior or anterior (less preferred).[19]
Look at ETT cm length	• Advance ETT; when near larynx, ask patient to inhale deeply; insert quickly.
Use FOB to see ETT pass	• Advance ETT until 2-3 cm above carina under visual control of FOB.
Inflate ETT cuff	• Stabilize ETT with one hand and inflate cuff.
Remove FOB	• Remove FOB while holding ETT immobile and hand FOB to assistant.
Attach ETT to 100% O_2	• Attach ETT to Ambu-bag or ventilator.
Check $PetCO_2$	• Observe $PetCO_2$ waveforms while hand ventilating.
Troubleshooting	• If ETT meets resistance near larynx, withdraw 1-2 cm, rotate 90 degrees counterclockwise and advance;[19] repeat prn. If awake—insert on deep inhalation. • Plan B: cricoid pressure, jaw thrust, flex neck, sometimes use release jaw thrust. • Plan C: tapered tip/flexible ETT, laryngoscope aid, FOI in Aintree in ETT.

BP, blood pressure; **EKG,** electrocardiogram; **ETT,** endotracheal tube; **FOB,** fiber-optic bronchoscope; **FOI,** fiber-optic intubation; **IOA,** intra-oral appliance; **LA,** local anesthesia; **RR,** respiratory rate

Table 4. Tips for Local Anesthesia and Vasoconstrictors For Fiber-Optic Intubation

Supplemental oxygen prn, unless respiratory compromise likely	• Many recommend nasal cannula or oral supplement only if needed. Experts often gauge depth of sedation with patients on room air by carefully monitoring SpO_2 (decreases ≥92% acceptable).
Antisialogogue	• 15-60 min before FOI, glycopyrrolate 3-4 mcg/kg (if no contraindication).
Optimize position	• Patient supine (or sitting if dyspneic). • Extend neck for transtracheal (if no cervical contraindication, can inject through collar).
Nasal FOI techniques	• Apply drugs bilaterally unless contraindicated; duration usually 20-30 min.
Asleep nasal pre-FOI	• 0.5% phenylephrine; 0.05% oxymetazoline (2 sprays per side) while sitting—avoid supine toxicity.
Awake nasal pre-FOI anesthetics/vasoconstrictors	• Maximum dosages: 4% cocaine (3-4 cc, ≤1.5 mg/kg)—avoid toxicity; 2%-4% lidocaine (3 cc) mixed with 0.5% phenylephrine (1 cc) or with 0.05% oxymetazoline (1 cc).
Application	• Apply a soaked cotton tip applicator gently, circumferentially to naris entrance. • Advance until resistance noted and stop; insert another similarly; repeat on other side. • Duplicate advancing cycle until loss of resistance found in posterior nasopharynx.
Optional method	• Vasoconstrictor spray can be followed by local anesthetic using a MADgic atomizer (Wolfe Tory Medical).
Optional method	• Use bayonet forceps to gently insert soaked pledget toward posterior nasopharynx.
Oral FOI techniques	• 2%-5% lidocaine (liquid, viscous, or ointment); 10% cetacaine spray—maximum use ≤2 sec to avoid methemoglobinemia.
Glossopharyngeal nerve block: bilateral applications	• Employ a tongue depressor on lateral surface to shift tongue medially. • Spray local anesthetic in tonsillar fossa while patient inspires deeply, for ≤1 sec. • After each spray, ask patient to gargle and swallow to maximize anesthetic spread.
Optional method	• Touch applicator, pledget, or gauze in tonsillar fossa for 5 sec (lidocaine).
Uncommon method (painful; may result in hematoma; highly vascular area with increased possibility of toxicity)	• Ask assistant to pull tongue anteriorly with gauze-padded finger and thumb. • Use light source to visualize tonsillar fossa and rub 4% lidocaine ointment preinjection. • Use 22- or 25-gauge spinal needle with a stopper 0.5 cm from needle tip. • After negative aspiration for blood, inject posterior-inferior tonsillar fossa submucosally with 1% lidocaine and 1:200,000 epinephrine (2-5 cc) to decrease bleeding and detect unintentional vascular injection.
Combined pharyngeal, periepiglottic, periglottic anesthesia	• 1-in dollop of 5% lidocaine ointment on both sides of one end of a tongue depressor. • Place "lollipop" midline on tongue as far posterior as tolerated. • Ask patient to bite on blade and not suck on drug. • Let ointment melt for ≥10 min.
Optional method	• Atomize or squirt 2%-4% lidocaine solution or gel (10 cc) on the palate, tonsillar fossae, vallecula, epiglottis, and larynx.
Optional method	• Instruct patient to gargle viscous lidocaine (4 cc) intermittently for 5 min; then swallow or spit out. • Slurry: sweetener added to shaken foamy solution of 2% lidocaine viscous (2 cc) and liquid (7 cc).
Optional method	• Instruct patient to inhale 5 cc of nebulized 4% lidocaine for ≥15 min; if not administered by mask, must inhale orally to prevent dilution of anesthetic, **not** nasally (best method to avoid coughing?).

Table 4. Tips for Local Anesthesia and Vasoconstrictors For Fiber-Optic Intubation *(continued)*

Optional method	• Tessalon perle: let dissolve in mouth for 10 min; bite if necessary, but let dissolve.
Superior laryngeal nerve block: bilateral applications (aseptic technique)	• Identify hyoid cornu, keeping a finger nearby; assistant pressure on opposite cornu feels impact. • Use 10-cc syringe (6 cc 1% lidocaine) dart-like to hit hyoid cornu with 22- or 23-gauge needle. • Brace needle; after negative aspiration for blood; inject lidocaine (3 cc).
Optional method (aseptic technique)	• Insert needle until it hits hyoid cornu; pressure on opposite cornu aids to stabilize injection site. • Walk off anteriorly and caudally (0.1-0.4 cm) through the thyrohyoid membrane (feel click). • Brace needle, and after negative aspiration for blood, inject lidocaine (2 cc).
Uncommon method	• Apply 4% lidocaine-soaked gauze attached on curved clamp to pyriform fossa for ≤5 min.
Transtracheal anesthesia (patient should cough with injection)	• Identify cricothyroid area, keeping a finger nearby or place digits on either side of trachea. • Use 10-cc syringe containing 4% lidocaine (3-4 cc) dart-like to pierce cricothyroid membrane (aim posteriorly) with 22-gauge needle or 20-gauge angiocatheter; if blood enters syringe, discard it. • Aspirate while advancing to avoid vocal cords until air bubbles freely enter syringe. • Brace needle system securely; rapidly inject on end exhalation (so drug is inhaled); remove quickly. • Otherwise, insert catheter 1 cm; attach syringe to catheter; aspirate for air and inject similarly.
"Spray as you go" anesthesia (make sure no concurrent suction)	• Rapid injection via FOB working port 2%-4% lidocaine (1 cc) prn q5-30 sec for areas requiring anesthesia (whether as primary entire-airway technique or as supplement).
Optional method	• Insert epidural catheter down working port, extending 1 cm beyond FOB tip (tape it proximal)–decreases visual disturbance of view, secondary to patient's reaction to spray.
Clear airway/test blocks	• Use Yankauer or soft suction to clear route to larynx; test for reaction (gag, cough).
Aspiration-risk patients	• Avoid transtracheal and perhaps superior laryngeal block; "spray as you go" may be safer.

FOB, fiber-optic bronchoscope; **FOI,** fiber-optic intubation

schools believed FOI was a core skill for which competence should be achieved during residency.[8] To quote *Benumof's Airway Management*: "The single most common cause of failure of FOI is lack of training and experience."[9]

Is "practice" ethical? McNarry and colleagues found that 82.7% of delegates surveyed felt it was ethical to perform FOI in asleep patients for whom intubation was required.[8] The majority of respondents thought no discussion with patients was necessary, including those undergoing an FOB airway examination. (Awake patients, of course, did not fall into this category.)

In summary, it is true that practice makes perfect. Clinicians should strive to develop self-confidence through experience, so that they are considered the "go-to" specialists for difficult airway cases. See the FOI tips in Tables 1-4. In other words, scope it out!

References

1. Shiga T, Wajima Z, Inoue T, Sakamoto A. Predicting difficult intubation in apparently normal patients: a meta-analysis of bedside screening test performance. *Anesthesiology*. 2005; 103(2):429-437.
2. Crosby ET, Cooper RM, Douglas MJ, et al. The unanticipated difficult airway with recommendations for management. *Can J Anesth*. 1998;45(8):757-776.
3. Benumof JL. Difficult laryngoscopy: obtaining the best view. *Can J Anesth*. 1994; 41(5 Pt 1):361-365.
4. Ikeda S, Tsuboi E, Ono R. Flexible bronchofiberscope. *Jap J Clin Oncology*. 1971;1:55-65.
5. Burkle CM, Zepeda FA, Bacon DR, Rose SH. A historical perspective on use of the laryngoscope as a tool in anesthesiology. *Anesthesiology*. 2004;100(4):1003-1006.
6. Johnson C, Roberts JT. Clinical competence in the performance of fiberoptic laryngoscopy and endotracheal intubation: a study of resident instruction. *J Clin Anesth*. 1989;1(5):344-349.

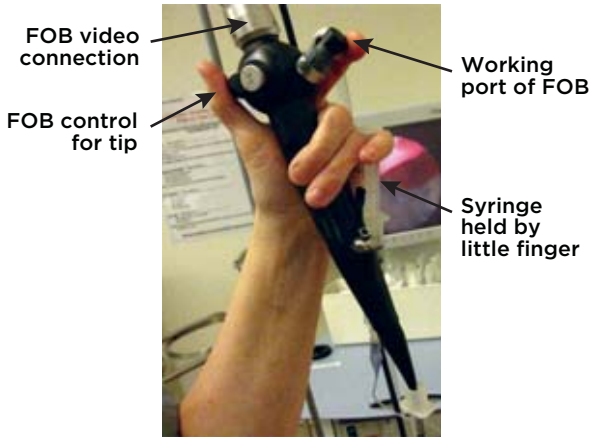


Figure 4. Nondominant hand position on a fiber-optic bronchoscope.

Figure 6. View of trachea through fiber-optic bronchoscope.

Figure 5. Fiber-optic bronchscope-facilitated endotracheal tube passage through supraglottic airway.

7. Heidegger T, Gerig HJ, Ulrich B, Schnider TW. Structure and process quality illustrated by fibreoptic intubation: analysis of 1612 cases. *Anaesthesia*. 2003;58(8):734-739.
8. McNarry AF, Dovell T, Dancey FM, Pead ME. Perception of training needs and opportunities in advanced airway skills: a survey of British and Irish trainees. *Eur J Anaesthesiol*. 2007;24(6):498-504. Epub 2007 Jan 8.
9. Wheeler M, Ovassapian A. Fiberoptic endoscopy-aided techniques. In: Hagberg C, ed. *Benumof's Airway Management: Principles and Practice*. 2nd ed. Philadelphia: Mosby Elsevier; 2007:428.
10. Randell T, Valli H, Hakala P. Comparison between the Ovassapian intubating airway and the Berman intubating airway in fibreoptic intubation. *Eur J Anaesthesiol*. 1997;14(4):380-384.
11. Atlas GM. A comparison of fiberoptic-compatible oral airways. *J. Clin Anesth*. 2004;16(1):66-73.
12. Joo HS, Viren N, Naik VN, Savoldelli GL. Parker Flex-Tip are not superior to polyvinylchloride tracheal tubes for awake fibreoptic intubations. *Can J Anesth*. 2005;52(3):297-301.
13. Greer JR, Smith SP, Strang T. A comparison of tracheal tube tip designs on the passage of an endotracheal tube during oral fiberoptic intubation. *Anesthesiology*. 2001;94(5):729-731.
14. Cook JR, Ramsay C. Using the literature to quantify the learning curve: a case study. *Int J Technol Assessment in Health Care*. 2007;23(2)255-260.
15. Erb T, Hampl KF, Schürch M, Kern CG, Marsch SC. Teaching the use of fiberoptic intubation in anesthetized, spontaneously breathing patients. *Anesth Analg*. 1999;89(5):1292-1295.
16. Smith JE, Jackson AP, Hurdley J, Clifton PJ. Learning curves for fiberoptic nasotracheal intubation when using endoscopic video camera. *Anaesthesia*. 1997;52(2):101-106.
17. Joo HS, Rose DK. The intubating laryngeal mask airway with and without fiberoptic guidance. *Anesth Analg*. 1999;88(3):662-666.
18. Benumof JL. Use of the laryngeal mask airway to facilitate fiberscope-aided tracheal intubation. *Anesth Analg*. 1992;7(2):313-315.
19. Asai T, Shingu K. Difficulty in advancing a tracheal tube over a fibreoptic bronchoscope: incidence, causes and solutions. *Br J Anaesth*. 2004;92(6):870-881.
20. Asai T. Tips and tricks: a shortcut to the glottis. *The Airway Gazette: The Official Publication of the Society for Airway Management.* 2009;3(1):14.