A problem based approach to awake flexible optical intubation

“Everything you always wanted to know, but were afraid to ask...”
Inhoudsopgave

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Summary

Awake flexible optical intubation (AFOI) for airway management is a valuable technique, which has undergone several technical improvements and adaptations over time. Despite this technique being advocated by anaesthesia and airway management expert groups around the world as a gold standard for management of the expected difficult airway, many anaesthesiologists are not comfortable using the technique. This may be because of a lack of experience, expertise or inappropriate equipment. There may also be deficiencies in training and clinical AFOI practice opportunities.

In this book advice and tips will be given to improve the intubation success rate and satisfaction of airway management with AFOI. We think that this book will help improve the AFOI experience of both the clinician and the patient and ultimately lead to improved airway management using AFOI. We will summarize both the frequent and rare causes for failure of AFOI. Do not be afraid to ask things that you always wanted to know.

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Introduction

Enthusiasm among anaesthetists to undertake an AFOI ranges from “scared to death” through “reluctant” to “hopeful”, with a small number of colleagues in the “confident” group. This may be due to the lack of the initial and intensive training required to acquire this skill, lack of skill maintenance or poor equipment. Inappropriate patient selection, difficult pathology, inadequate preparation of equipment or patient, or failure to recognize contraindications and potential complications of AFOI are some of the other factors that may lead to failure of the AFOI technique\textsuperscript{1-3}.

These difficulties are frequently encountered and are the reason AFOI still has a failure rate of 0.5-13\%\textsuperscript{4-7}. It is the opinion of the authors that all physicians who manage patient airways need to be good at AFOI, because they will someday in their career encounter a patient that cannot be safely intubated by other techniques. This review is not another article from ‘airway management mavericks’ for ‘airway management dummies’, but a sharing of our experiences with AFOI.

We think that many problems faced during AFOI can be prevented. We have encountered many of these problems ourselves during our anaesthetic practise at major cancer centres, public and rural hospitals and university medical centres in the Netherlands, Germany, South Africa, Canada, Australia and India and during numerous worldwide airway training sessions with trainees and colleagues. We will focus on potential problems that can be encountered during AFOI. We have tried to document these problems as thoroughly as possible, with a literature search and, where applicable, photo documentation. We have also tried to give tips that can be applicable in medical centres in any part of the world. It is our hope that these tips may
help the anaesthetic community to embrace an airway management technique that can be life saving with confidence.

We think that this book is unique as to our knowledge there is not a single document available that addresses all these problems related to performing AFOI whilst at the same time offering practical solutions.

introduction to AFOI
Video 2

basic techniques
Basic Principles

We will use the term awake flexible optical intubation (AFOI). An AFOI can be performed with a flexible fibreoptic scope or with a flexible videoscope with a “chip in the tip”. New hybrid scope techniques are also used that combine flexible opticals and video. The most commonly used term in the literature is awake fibreoptic intubation. We think AFOI is more appropriate nowadays. The following basic principles of AFOI have been developed for and are routinely used in our teaching and training programs\textsuperscript{8-9}. It cannot be stressed often enough that these basic principles should be carefully observed and adhered to.

• Prepare thoroughly and discuss the planned procedure with the patient and other co-workers.

• Ensure that the patient fully understands the procedure and is fully cooperative.

• Always try to do an AFOI procedure with two experienced doctors.

• Make sure the indication for the awake procedure is sound (Fig. 1).
**Indications for awake flexible optical intubation**

- Anticipated difficult laryngoscopy on physical examination
- Anticipated difficult mask ventilation
- Previous history of difficult intubation and/or mask ventilation
- Previous awake flexible optical intubation

**Contraindications for awake flexible intubation**

- Patient refusal
- Inexperienced anesthesiologist
- Massive haemorrhage in the mouth
- Most children
- Severe upper airway narrowing, critical airway obstruction
- Critical clinical condition, not enough time

- Share your thoughts of your plan with a colleague.

- Ensure that AFOI is not contra indicated whilst ensuring that the patient and pathology are suitable for AFOI (Fig 2).

- Know exactly how to assemble your equipment and check that it is functioning.
• Keep practising AFOI for conservation of your skills over time.

• Topicalise the upper airway in an effective, safe and easy way.

• AFOI should never be performed in a hurry as this will greatly decrease the chance of successful tracheal intubation.

• If you are not very experienced with AFOI stand behind the patient. Doing a procedure from behind the patient makes the procedure easier. Standing behind the patient is: safer (no close contact with the patient who will cough or spit into your face if you are unlucky), and easier (left is left, right is right) and you can simultaneously watch the monitors and surroundings. We recommend standing behind the patient, but also teach the “face to face technique”, because in some situations standing or sitting in front of the patient may be the only way to proceed, for example in severe respiratory distress when the patient cannot lie down.

• Ensure that you have a contingency airway management plan, should AFOI fail; have a plan B and C available for emergency airway management, and make sure all team members are briefed before you start the procedure.

• If you think AFOI, perform AFOI

• Do a time out procedure with your team and do a final checklist before you start the AFOI procedure (see Fig 3).
Memorize the basic FFFFIberoptic intubation principles to guide you through the procedure (see Fig. 4).
**Fiberoptic intubation principles**

*Method developed and used at VU University Medical Center, Amsterdam*

Find and identify the nose, if you cannot find or use the nose, find the mouth.

Find and identify the epiglottis, if you cannot find the epiglottis, find the vocal cords.

Find and identify the vocal cords, if you cannot find the vocal cords, find the carina.

Find and identify the carina, if you cannot find the carina, find tracheal rings.

If you cannot find and identify tracheal rings, start again and find the nose.

If not successful after three attempts, ask for help.

It is not necessary for a successful intubation to identify all airway structures.
During clinical practice you will observe that entry in the trachea may be perfectly possible without having identified the epiglottis.

Fig. 4
Photo 1

difficult intubation trolley

Photo 2

storage box closed
Photo 3
storage box open

Photo 4
size of tracheal tube too big in relation to fibroscope
Photo 5
flexible scope tip movement 1

Photo 6
flexible scope tip movement 2
Photo 7
flexible scope tipmovent 3

Photo 8
flexible scope tipmovent 4
Scope Handling

More than 80% of scope manipulation comes from flexing and extending the wrist and thus rotating the scope handle. This handle rotation must translate to the tip of the scope. The remaining 20% of scope movement is achieved by flexing or extending the scope tip (achieved by moving the thumb lever on the scope handle up or down) and by scope insertion (inserting the cord of the scope). The scope cannot be rotated from the tip or the cord, which is exposed at the patient’s mouth or nose. The scope must be rotated from the handle. The tip of the scope is the part in the patient’s airway and hence the true “eye” of the scope, the image of which is then projected on the eyepiece or screen if a camera is used. For the movement in the handle to fully translate to the tip, the cord must be straight at all times. Any bend or loop in the cord, which is easy to do and overlook in clinical endoscopy, will cause a less than equal translation of handle movement to tip movement. The handle movement needs to be coupled to tip movement in a one to one ratio, not less. This will frustrate the endoscopist’s ability to drive and accurately direct the scope. The second crucial technique in scope driving is, as already described above, having the next “target” (the airspace on the way to the larynx, the laryngeal inlet, the centre of the trachea, whichever is the next target in the endoscopy sequence at the time) centred in the viewfinder or screen. To constantly keep the target in the centre of the viewfinder the endoscope should be driven in three distinct phases known as “Stop, Centre, Move” (Fig. 5). Methods used at the Royal Melbourne Hospital, Australia and at VU University Medical Centre, Amsterdam, The Netherlands.
Video 3

face to face intubation
“Stop, Centre, Move” scope handling method

With training, this adjustment happens so rapidly and efficiently that it is no longer perceived by the casual observer as three separate phases but rather as one fluent motion. All necessary steps need to be optimal to enable a smooth intubation procedure. During AFOI numerous incidents can happen easily and swiftly. Unfortunately, there are times when several events may happen simultaneously during the same procedure. Therefore, the margin of safety should be as large as possible to limit the potential for adverse outcomes or results.

After insertion of scope:
First, no forward movement at all - Stop.
The cord is held still while using the handle/wrist with small movements on the thumb lever for tip up/down, the target is centred in the viewfinder – Centre.
This is followed by cautious forward movement with the target centred – Move.
With forward movement and as the target falls away from the centre of the viewfinder, Stop and repeat the sequence.

Fig. 5
Photo 9

Olympus™ MAF-scope screen
Photo 10

Storz™ Telepack monitor screen
Photo 11

mobile lightsource
Overview

Incidents and problems may occur in different ways: the most common problems can be categorized in any of the following categories:\textsuperscript{4-7, 10,11}:

A problems with visibility B technical problems C problems with advancement of the tracheal tube D inadequate upper airway topicalisation E bleeding problems F oxygenation problems during AFOI G anatomical problems H problems with sedation I poor patient cooperation J problems with flexible optical scopes in combination with another airway device K ventilation or oxygenation problems after intubation L logistic problems M extubation problems
A Problems with visibility

1. There is complete white-out of the lens or on the monitor screen

• When an AFO is done with a camera or video bronchoscope, a white balance must be performed before you start.

• Decrease the light intensity manually to prevent light scatter from illumination of saliva

• Only use clear water soluble lubrication or silicone lubrication on the fibre-optic scope making sure that the lens tip has been wiped clean before proceeding.

2. Fogging of the lens

• This is caused by differences in temperature between the cold bronchoscope and the warm patient. This can be prevented by:

  • Preheat the scope in warm
water before starting the procedure, or have the scope on for a few minutes before starting the procedure.

• Wait 10 seconds after introducing the scope through the nose.

• Try to touch the buccal mucosa gently with the tip of the scope to speed up temperature equilibration.

• Use anti-fog spray or soap water to clear the lens.

• Never spray the tip of the bronchoscope or tube with lubricant spray - spray the insertion cord only.

3. There is no visibility at all or a red blush on the monitor

• Remove the camera from the scope, sometimes this may be a problem related to the camera and not the bronchoscope itself.

• You may have caused bleeding with the insertion cord.

• Try another bronchoscope if available.

• Use new batteries or a new light source.
red blush image caused by blood during AFOI

Video 4
use of the Berman™ airway

4. Secretions or mucous obscures visibility
• Patients should be given an anti-sialogogue medication at least 15 minutes prior to procedure. We recommend glycopyrrolate 0.2-0.4 mg iv for adults.

• Attach O₂ at 1-2 L/min through the working/suction port of scope. This works better at eliminating and mobilising secretions from field of view than suctioning and has the added benefit of providing some oxygen to your patient during the procedure. We have found suctioning secretions in this situation highly unsatisfactory.

• Instead of repeated scope withdrawal, we suggest gently approaching and brushing the tip and thus the lens against mucosa in the hypo-pharynx. This will rapidly clear the image.

5. Field of vision appears too small

• For AFOI, choose an adult fibre-optic scope diameter of 5.0, 5.1 or 5.2 mm. Smaller flexible optical scopes are usually used for nasal endoscopy, checking double lumen tubes and paediatric practice and will give you a
reduced field of vision, inadequate or no suction ability, reduced • manipulation ability and difficulty in “rail-roading” a tracheal tube (TT) during the procedure. Smaller scopes are also more prone to damage when used for an AFO.

• Check if the camera can be zoomed in or out, this may

• increase the field of vision

6. Image blurred on monitor

• Many cameras can be focussed: your camera may be out of focus!

• Adjust the scope focus before the procedure by holding the scope tip two cm away from print on a white background while looking into the eye-piece or on screen and rotating the scope focus dial. Once in focus, the print being viewed should be readable.

7. After passing the vocal cords with the bronchoscope vision is acutely lost.

• This may be due to several causes, e.g. mucous, or poor navigation. Have you run into a tumour blindly? Have you just run into the tracheal wall, again failure to navigate?

• Try to restore visibility for example by moving back the scope a little, do not
sedate the patient at this point!

- Remove the scope and do not advance it further if this is tolerated by the patient and clinically feasible and clean the lens.

- Connect the capnogram sampling line to the working channel of the scope before removing it and see if you can detect CO₂ repeatedly if visibility does not improve.

- Try to feel that the bronchoscope cannot be advanced further or that tracheal rings are encountered. Do this very gently to prevent damage. The scope may have entered a small bronchial lumen. Retract the scope carefully.

B Technical problems

8. Your Department of Anaesthesia has finally bought a brand new videobronchoscope and nobody knows how to operate it

- Do not start before you know the equipment, or somebody else knows exactly what to do.

- Ask for another flexible scope that you are familiar with.

- Get an in-service contract.
9. Suction is not working

• Most common – suction channel blocked with secretion. Solution: high pressure (i.e. small syringe) saline wash through.

• The suction tubing may be kinked, disconnected or is leaking somewhere.

• Alternatively, give oxygen through the working channel 1-2 litres/min to clear the airway from mucous or blood, this works much better. Do not use a large oxygen flow\textsuperscript{10}.

• Have a second separate suction from the surgical “southside” and attach a Yaunker suction tip to it.

10. Loss of light source

• This may be due to power failure, a technical problem or empty batteries.

• Try to find another battery driven light source, such as the light source from surgical colleagues (laparoscopy equipment, headlight power source etc).

• Use a flashlight and apply the light directly to the anterior neck just below the thyroid cartilage.

• When urgent intubation is required, insert a laryngoscope or video laryngoscope and use these light sources to guide the bronchoscope.

• If you use a video bronchoscope with a monitor and many cable connections, make sure all the correct buttons are engaged and cables attached.
C Problems with advancement of the tracheal tube

11. The tracheal tube cannot pass the nose after the insertion cord of the flexible scope has successfully passed the vocal cords

• Use a nasopharyngeal airway to dilate the nostril carefully. This really should ideally be done prior to inserting the scope. Try to avoid the surprise of ‘oops, now the tube won’t go through the nose.’

• Longitudinally cut an appropriately sized nasopharyngeal airway, lubricate it and insert it into the nares. Pass the scope through the split nasopharyngeal airway (SNPA) and after entering the trachea, pull the SNPA out and peel it off the scope. Then thread the tracheal tube off the scope. [photo 14, see split SNPA]

• Use a second bronchoscope through the other nostril if vocal cords were difficult to visualize and use the other flexible scope as a guide.

• Use a smaller tube, insert this tube through the nose first and then the scope, beware not to cause epistaxis.
nasopharyngeal airway inserted in left nostril and split nasopharyngeal airway (SNPA) inserted in right nostril of manikin with insertion cord of flexible optical scope inserted through SNPA. Technique used at The Ottawa General Hospital, Ottawa, Canada

12. Poor control of the ETT, tube keeps slipping down scope

• Tape the tube connector to the base of the flexible scope [photo 15]
13. Unable to manoeuvre the endoscope towards the desired target – “won’t go where you want it to go”.

- Use a guide wire or hollow intubating catheter.\textsuperscript{12-14}

- Use an upper airway guiding device, for example a Berman\textsuperscript{TM} or a laryngeal mask airway, as a conduit for the flexible scope

14. Scope sticking to tracheal tube

- Lubricate the insertion cord of the scope before endoscopy with spray.

- Do not use KY Jelly\textsuperscript{TM}, EMLA\textsuperscript{TM} crème or the like – this dries too quickly and becomes sticky.

- Do not use a petroleum based lubricant which may damage the scope.

- Use either eye lubrication such as Lacri-Lube\textsuperscript{TM} or a medical grade silicone lubricant spray.

- Never push the scope against resistance when it’s within a tube. Although it probably won’t harm the patient, it will damage the scope. Stop, withdraw and lubricate.
15. The tube cannot be passed through the glottis after introduction of the bronchoscope through the vocal cords

• Normally this is caused by laryngeal impingement on the arytenoids or the epiglottis, which can be prevented by using a tube that fits snugly around the insertion cord of the scope.

• When the tube cannot be advanced, turn the blue radio opaque lining on the backside of the ETT from the “6-o’clock position” into the “1-o’clock position” (clockwise or counter clockwise is okay). Or rotate the tube 360 degrees. In this manner the bevel of the tube will turn away from the arytenoids.

• This may also be caused by impingement of the bevel of the tube on the anterior tracheal wall. Turning the blue line of the tube from the 6 in the “1 o-clock position” normally solves this problem. The research here and our
own experience shows that bullet silicone tip tubes, or the intubating laryngeal mask airway tubes or the “bird beak tubes” (ParkerTM) have significantly less hang up at the laryngeal level.

16. Tip of the flexible optical scope cannot be flexed back because of a break in the steering cable

• This is a rare technical complication.
• Remove tube and bronchoscope as a whole and use a different scope.
17. The distal insulation rubber protection of the insertion cord is curled up and makes advancement of the tracheal tube very difficult

- Make sure before you start that the ETT is inspected and not damaged.
- Use a larger diameter ETT.
- Use a different flexible optical scope.
- If you cannot move the scope forward or backward, the scope and tube should be withdrawn simultaneously.

18. The nasal RAE™ tube is too long and the tip of tube already touches the nose, before the tip of the insertion cord has passed the vocal cords

- Remove the connector of the tube, which will enable the tube to be advanced 1.5 cm higher on base of the scope.
- Use a smaller size tube, which normally is shorter.
- Shorten the length of the tube and reinsert the tube connector. Only do this if no other option is available, because you may be hold personally liable for inadvertent use of a medical product.

19. The bronchoscope is inadvertently passed through
the Murphy’s eye of the tube

• Try to retract the scope very carefully; this may be difficult because the tip of the scope will probably be wedged in between the ETT and tracheal wall. If this is not possible remove the scope and the tube simultaneously\textsuperscript{15}.

![Photo 18](image)

Tip of flexible optical scope Olympus\textsuperscript{TM} LF TP, passed through Murphey’s eye of Mallinkrodt tube 6.0

20. After correct intubation of the trachea with the tip of the scope, the tube inadvertently passes into the oesophagus

• Always advance the flexible optical scope far enough, almost as far as the carina, to prevent this event!
• Make sure the space between the tip of the insertion cord of the scope and the tracheal tube is small, so use a tight fitting tracheal tube that fits snugly around the insertion cord.

• Use an Aintree intubating catheter[TM] [Photo 19]

• Advance the insertion cord almost as far as the carina into the trachea, before railroading of the tube.

• Keep watching the carina while advancing the tube.

Photo 19

Video 4

face to face AFOI with topicalisation using a De Vilbiss™
21. Cannot advance the tube during oral intubation

- Use a Berman™ or William™ airway to guide introduction of the flexible scope. When inserted properly these devices will lift the epiglottis and base of tongue\textsuperscript{16}.

- Make sure you use the correct size Berman as it may be too big and guide your scope directly into the oesophagus.

D Problems with topicalisation of the upper airway

22. The patient has a laryngeal spasm after introduction of the scope.

- This is a potential life threatening situation.

- Stop the procedure, give oxygen with positive pressure ventilation and wait several minutes before you make another attempt!

23. Inadequate topicalisation
• There are many ways to topicalise the upper airway of a patient for AFO. The most popular of these are: nebulised (via a nebulising Hudson™ mask), aerosolised (via a Mucosal Atomising Device (MAD™) or a De Vilbiss™ type atomiser). Nerve blocks (blocking the super laryngeal block) or trans tracheal injection can also be used. Most patients do not appreciate nerve blocks. The nebulised and atomised lidocaine modalities are short acting. It is important to start the AFO at the instant topicalisation has finished and by the 10 minute mark the patient should be intubated and asleep. That time frame implies a high degree of organisation (patient, equipment, theatre logistics, staff, sedation to mention a few) prior to starting topicalisation. If for local anaesthesia nasal gauzes with cocaine or tetracaine are used, more time is available to perform the procedure.

24. The airway is not anaesthetized at all and is too reactive

• It is difficult to topicalise mucosa which is covered with secretions. Ensure that an anti-sialologue is administered first.

• Too much time has expired between patient preparation and intubation. Try to topicalize the upper away again, or use the “spray-as-you-go-technique” or trans tracheal injection of lidocaine. Be careful here, do not give a toxic dose of local anaesthetic. A reasonable dose for lidocaine for topicalisation is 7-9 mg/kg.

25. The patient experiences an acute upper airway obstruction after topical lidocaine has been applied.
• This is a potential life threatening situation, the cause is not completely clear; it may be a combination of a reaction to the lidocaine and severe upper airway narrowing.

• Intubate the trachea immediately or stop the procedure, remove the scope and give supportive therapy. If necessary do not hesitate to perform a cricothyroidotomy.

• Always anaesthetize the upper airway in a room with access to airway management equipment and cardiovascular emergency medication

• If a patient presents with an inspiratory stridor, be very cautious with topicalisation, because the upper airway diameter may be severely narrowed.

26. “Spray-as–you-go” (SAYGO) technique not adequate

• If you use suction on the working channel, stop suctioning, this will suction the lidocaine into the suction tubing as well. This is often forgotten.

• Use lidocaine with air in a syringe, not just lidocaine, you will “drown” your patient with fluids. Bottom line is this total dose of topicalisation needs to be 7-9mg/kg. No more!

• Use a commercially available alternative for topicalization during SAYGO to improve the quality of the local analgesia.

27. The patient has an known allergy to lidocaine yet still requires topicalisation of the upper airway
• Use alternative local analgesia for topical anaesthesia e.g. cocaine gauzes for the nose and use an intra tracheal regional block with mepivacaine or ropivacaine 2 mg/ml if not allergic to these medications.

28. Almost total airway occlusion occurs repeatedly when the insertion cord of the scope is passed through the glottic opening

• Remove the scope and try to use “spray as you go” for better upper airway analgesia.

• Use a smaller scope.

• Make sure there is not a very severe airway narrowing, or unnoticed subglottic obstruction. If there is a subglottic obstruction, reconsider your airway management technique.

• You could use a video laryngoscope in combination with the flexible scope if tolerated by the patient: this is called a videolaryngoscopy assisted flexible optical intubation (VAFOI)\textsuperscript{20}. It may still be problematic to pass the videolaryngoscope with the insertion cord.
Photo 20

Lidocain spray 10%

Photo 21

mucosal atomisation device
Photo 22

Xylometazoline HCL nose drops
E Bleeding problems

29. The mucosa or intraoral tumour starts bleeding after introduction of the scope

• Try not to touch oral, nasal or pharyngeal tissue with the scope, always try to position the scope in the centre of the upper airway. Don’t insert and / or move the scope forward blindly. Always watch the monitor while moving the scope.

• Use a suction system that is attached to the scope.

• Alternatively use oxygen flow through the working channel to blow away the blood and improve your visual field.

30. Epistaxis directly after introduction of the flexible optical scope

• Remove the scope whenever possible and attempt to stop the bleeding and use the other nostril. Prepare the nose with a vasoconstrictor, for example oxymethazoline which is used as a decongestor.

• Use an adapted nasopharyngeal airway (see SNPA and Photo 14) before passing the bronchoscope through the nose to prevent damage to the nasal passages.
F Oxygenation problems during AFOI

31. Patient desaturates before or shortly after the start of AFOI

- Give oxygen by oxygen prongs or mask outside the OR, while preparing the equipment or interviewing the patient.
- Give 0.5-1 liters/min oxygen through the working channel of the flexible scope or use a full face mask.
- Stop the procedure and pre-oxygenate for 3 minutes by mask with 100% oxygen.
- Adapt immediately the sedation; if only opioids are used (recommended) make sure to cooperate with the (still) awake patient by asking him/her to breath in and out (“commando-breathing!”)
- Use a small cannula, f.e. 14 gauge or a Ravussin needle™ through the cricothyroid membrane to give oxygen 1-2 liters/min, this will increase saturation to a safer level.
32. A large supraglottic mass or the epiglottis prevents a good view at the laryngeal inlet

- Try to pass a guide wire through the working channel and pass this through the vocal cords. Advance the bronchoscope over the guide wire before the tube is railroaded.

- Try to use a laryngoscope or video laryngoscope simultaneously to enable intubation of the trachea with the scope.

- Use the awake fibrecapnic intubation technique\textsuperscript{12,13}.

- Change patient position: patient head up!

- Use gentle chin lift to open up the airway, or manipulate the tongue.
33. It is not possible to find and identify the glottis due to anatomical abnormalities

- Consider an awake fibrecapnic intubation, a hollow suction catheter is advanced deeply into the airway to find consecutive capnogram tracing and this catheter can be used as a guide wire to railroad the bronchoscope into the trachea.\textsuperscript{12,13}

- Ask the patient to take a deep breath. Often times you will notice air movement (bubbles).

- Do a VAFOI: videolaryngoscopic assisted flexible optical intubation. Try to visualize the larynx with a videolaryngoscope and advance the bronchoscope with guidance of the video image\textsuperscript{20}. An epiglottis may be severely distorted or even missing because of prior radiotherapy.

- As an alternative you could do a retrograde guide wire flexible intubation, the guide wire is advanced retrogradely through the glottis and the guidewire is passed through the working channel of the bronchoscope\textsuperscript{21}.

- Consider to insert an intubating laryngeal mask airway in the awake patient after topicalisation and use the itubating laryngeal mask airway (ILMA) as a guide for the bronchoscope to find the glottis\textsuperscript{22}.

- Always reconsider if AFOI is really the most appropriate technique for your patient.
Photo 24

fibreoptic scope with fibrecapnic catheter

Video 5

AFOI through ILMA
34. The mouth opening is less than 2.5 centimetres and the nose cannot be used to introduce the flexible scope.

- If it is anticipated that mouth opening will be greater after induction of anaesthesia, use a thin bronchoscope and MLT tube, and use a general anaesthesia with spontaneous breathing.

- Consider an awake tracheotomy under local anaesthesia.

- Consider retrograde bronchoscopy assisted intubation\textsuperscript{21}.

35. The larynx is deviated anteriorly, which makes insertion of the flexible scope passed the vocal cords impossible despite a good and clear view

- Advance a guide wire through the working channel of the bronchoscope that is used to railroad the scope into the trachea\textsuperscript{12,14}.

- Change the approach to a nasotracheal AFOI as the axis of nasopharynx may align better with an anterior larynx.

36. It is not possible or contra-indicated to intubate through the nose
• Perform an oral awake flexible optical intubation as most of the AFOI can be done orally; consider an intubation aid, for example a Berman\textsuperscript{TM} airway.

• If an appropriate sized Berman airway\textsuperscript{TM} or Ovassapian airway\textsuperscript{TM} is not available insert an regular Guedel oral airway as a biteblock and proceed with the AFOI, with the insertion cord next to the Guedel. Alternatively use a dental bite block.

37. Cannot get intravenous access, but have to do an AFOI

• Get another pair of hands.

• Put in a central line, if needed with ultrasound guidance, before starting the AFOI.

38. The airway diameter appears to be too narrow to accommodate the insertion cord of the flexible scope

• Stop the procedure and try to review a recent CT-scan or MRI of the head and neck to see if this may be correct. Use a supraglottic airway or do a tracheotomy. Sometimes supraglottic jet ventilation is an alternative in this situation, however the risk at barotrauma is high.
• Use a videolaryngoscope to estimate if airway diameter may indeed be too narrow. Sometimes it is very difficult to tell if airway diameters are too small, because of the augmentation or zoom of the camera.

39. It is impossible to pass the base of the tongue with the flexible scope

• Use a gauze and a Magill forceps to protrude the tongue.

• Use a mandibular manoeuvre, such as chin lift, to lift the jaw.

• Use a suction tube (YankaurTM) to pull the tongue by applying it to the tip of the tongue; be careful not to cause bleeding.

• Move the patient to an almost sitting position, gravity will work to your advantage.
H Problems with sedation

40. The patient is unconscious

- Stop the procedure and all sedation.
- Give reversal medication.
- Use only short acting medication, not more than two different classes simultaneously. A good combination in experienced hands is remifentanil for analgesia and propofol for sedation and amnesia, however there is a relatively high incidence of apnoea when used in combination. Remifentanil alone is well published and well supported but has the disadvantage that is does not cause amnesia. If you start practising AFOI it is probably wise to start sedation with short acting opioids only to prevent complications with sedation.

41. The patient becomes apnoeic during the procedure

- Ask the patient to take a deep breath and instruct a colleague or anaesthetic nurse to monitor the patient, use reversal medication or wait and see if this is possible and give supportive therapy. Consider stopping all sedative medication.
I Problems with patient cooperation

42. The patient is aggressive

- This is a contra-indication for an awake procedure.
- Try to understand the problem, reconsider the need for awake intubation.
- Try more sedation or sedate with another class of medication and ask for help.
- Consider a mask induction using volatile anaesthetic.

43. The patient starts vomiting during AFOI

- Aspiration is normally not a big worry, because the patient still has most or part of their protective reflexes, however, visibility will probably be poor: stop the procedure and consider inserting a gastric drain if at all possible or starts anti-emetics.
- Consider an AFOI “face to face technique” with the patient lying on the side.

44. The patient is sneezing continuously after the nose has been anaesthetized with lidocaine
• Stop the procedure, wait 5 minutes or do an oral fiberoptic intubation. We have seen this phenomenon occasionally.

45. The patient bites on the insertion cord during oral AFOI

• Use a Berman™ intubating airway or a bite block to prevent this from happening.

46. The patient refuses an awake intubation

• This is a contraindication for AFOI. Patient consent is needed before AFOI is performed!

• If already started stop the procedure and do an alternative technique.

• Has proper sedation been tried after the patient consents to AFOI?
J Problems with flexible optical scopes in combination with another airway device

47. It is impossible to pass the fiberscope through the intubating laryngeal mask airway (Fasttrach\textsuperscript{TM})

- This is probably caused by the epiglottis lifting bar; if possible insert the ILMA anew or use the ETT to lift the bar and then pass the scope beyond. This will protect the scope.

- Try to manoeuvre with the tip of the bronchoscope underneath the epiglottis lifting bar.

- Perform the “Chandy manoeuvre”, this will probably align the device with the glottic opening to enable passage of the flexible scope. For a description of this manoeuvre we refer to the original article\textsuperscript{23}.

48. It is impossible to advance the ETT through a laryngeal mask airway
• Make sure the tube fits through the laryngeal mask first during preparation.

• Remove the bars with a pair of scissors prior to insertion of the LMA, or use a supraglottic device without bars. Make sure there are no sharp edges that can damage the upper airway.

• This may be problematic in some pediatric cases or in small people. Always try before starting to ensure that the ETT and laryngeal mask are compatible.

Photo 25

laryngeal mask airway 3.0, paediatric tube 4.5, Olympus™ DP fibrescope prepared for paediatric intubation
Photo 26

thyroid tumor with massive neck enlargement
Photo 27

swelling floor of the mouth because of allergic reaction

Photo 28

glottic and supraglottic neoplasm left vocal cord pre treatment
Photo 29

glottic and supraglottic neoplasm left vocal cord post laser treatment
48. It is impossible to advance the ETT through a laryngeal mask airway
• Make sure the tube fits through the laryngeal mask first during preparation.

• Remove the bars with a pair of scissors prior to insertion of the LMA, or use a supraglottic device without bars. Make sure there are no sharp edges that can damage the upper airway.

• This may be problematic in some pediatric cases or in small people. Always try before starting to ensure that the ETT and laryngeal mask are compatible.
49. The tracheal tube can pass the LMA but is not long enough to be able to withdraw the LMA safely

- Put in an Aintree™ catheter first, remove the LMA and then advance the tracheal tube over the Aintree™ airway catheter™

50. Your plan is to perform an oral flexible intubation but oral airway is not available in the correct size
• Use a bite block or normal oropharyngeal airway next to the insertion cord in stead of the more optimal devices.

• Use gentle chin-lift, jaw-thrust manoeuvres with an oral bite block or normal oropharyngeal airway in situ to prevent the patient from damaging the scope with the teeth.
K Ventilation or oxygenation problems after tracheal intubation

51. After visual correct placement of the tube it is not possible to ventilate the patient

- Do a careful inspection of the trachea. Are there any obstructions below the level of the tip of the ETT? Look for tracheal stenosis, or airway tumours.
- Also consider a severe bronchospasm!
- Is the tube really still in the trachea? If it is not possible to display consecutive capnograms it is highly likely that the tube is not in the trachea.

52. After intubation with an MLT tube it is not possible to reconnect the connector adapter

- Use a Magill forceps to push back the tube and hold it in place during which the connector is reconnected.
- Do not disconnect the adapter before you do an AFOI. This is not necessary when a proper size flexible optical scope is used. Sometimes it is necessary when a videoscope is used because the computer chip is positioned in the tip, which increases the diameter of the insertion cord.
53. After AFOI and the use of a RAE nasal tube, the tube is kinked during ventilation

- When using a RAE nasal tube around a bronchoscope, the site where the tube is bent, to straighten the tube when it is attached to the flexible scope becomes a weak spot. Try to stabilize this site with tape or better use a MLT tube if the surgeons concur.

54. After visual guided flexible intubation of the trachea it is not possible to display a capnogram on the monitor

- First ensure you are able to ventilate the patient. If unable, your “can’t ventilate sequence or routine” should be enacted immediately.
- Clear the capnograph tubing from fluids or mucous.
- Insufflate more air in the pilot balloon of the tube cuff.
- The tube may have become blocked with mucous or matter after retraction of the bronchoscope and advancement of the TT. Introduce the bronchoscope again and check for any obstruction. Tube obstruction by intranasal polyps or pieces of nasal conchae after intubation have been described.
- The cuff of the tube may have been damaged after passage through the nose. Are there any signs of cuff rupture (for example air leakage)? Exchange the tube over an TT exchange catheter.
- It is possible that the tube has caused a false-route or rupture of the tracheal
wall or and has ended up in the oesophagus or mediastinum. Perform a careful inspection with the bronchoscope.
L Logistic problems

55. I cannot stand behind the patient because I am too short

- Use a bench to stand higher, lower the operating table. Try to prepare your procedure as comfortable as possible.
- Do a “face-to-face technique”, either in the sitting position or with the patient lying on their side. Remember that this will affect the orientation of the images that are displayed. These are not displayed in the way you are used to. You will find the epiglottis in the lower field of view.

56. The head and neck surgeon has not yet arrived at the hospital and the patient with an anticipated difficult airway needs to be intubated urgently

- Prepare for an emergency cricothyroidotomy as a plan B or C and start the awake intubation procedure. Not only palpate but also mark the cricothyroid membrane on the skin of the patient with a marker, so you know where to go in an emergency. Remember proper positioning of the patient for this procedure.
- Consider a trans-cricoid cannula secured in place before you start the AFOI (with an oxygen flow no greater than 1-2l/min). This will oxygenate the
patient and you could use this catheter as a landmark to identify the trachea under low visibility conditions.

57. During the AFOI your presence is urgently required at another side of the hospital

- If possible abort the procedure. If in a rush, chances of failure increase dramatically.
- One patient at a time and your responsibility is with the current patient. However, an AFOI can be done within 30 seconds, so if you are experienced just finish the procedure.

58. There are not enough patients in my surgical population to practice AFOI routinely

- Try virtual flexible optical teaching task trainers.
- Consider training on DexterTM (Replicant Medical Simulators, New Zealand) for dexterity. It has scientifically been proven that flexible optical scope handling is greatly improved by training a couple of hours on this nonanatomical device8
- Do as many flexible intubations in patients under general anaesthesia via the oral route.
59. During the advancement procedure of the tube through the glottis during AFOI it is noted that somebody has forgotten to put an ETT around the flexible optical scope

• Start again. Never start without checking all the equipment. Never induce general anaesthesia before correct tracheal tube placement has been confirmed. Remember: this procedure is called AFOI (intubation) and not just bronchoscopy.

• Do a checklist before the start of the AFOI. (See fig. 3).
M Extubation problems

60. The AFOI was very difficult and it is not clear if extubation is safe

There are generally three safe options:

- Use an airway exchange catheter (f.e. Cook airway exchange catheter\textsuperscript{TM}) and leave this catheter in the trachea after extubation. Most patients will tolerate this catheter.
- Postpone extubation and bring the patient postoperatively to PACU or ICU.
- Ask your surgical colleagues to perform a surgical airway before extubating to protect the airway\textsuperscript{24,25}. 
Discussion

The gold standard for the management of the expected difficult airway is considered an AFOI in the awake patient\textsuperscript{26,27}. The fact that the patient is awake is both a significant advantage and a potential draw-back. To make things complicated, the patient is doing all the things he normally does: breathing, moving swallowing, sneezing, and talking. The question is: why is a technique that is considered the gold standard not universally used even when clearly indicated? One of the answers: maintenance of the skills that are necessary to master this technique is too challenging to master if training or clinical practice is limited, or insufficient which, sadly, is in many countries worldwide the norm rather than the exception to the rule. AFOI can be considered as a highly complex task that requires sound technical and medical knowledge, dexterity, good communication skills, leadership and the ability to work under pressure. In the ideal world every anaesthetic unit should have personnel that can confidently perform an AFOI.

In inexperienced hands, AFOI is often performed with old equipment under stressful conditions which is not a good formula for success. Indeed, AFOI may certainly be very easy if upper airway anatomy is normal, the patient is cooperative and upper airway analgesia is good. However, often an AFOI will be accompanied by various challenges. For these reasons anaesthesiologists sometimes try to avoid performing an AFOI although clearly indicated.

A brief word on the psychology of AFOI

AFOI can be an extremely threatening and invasive procedure from the patient’s point of view. Not having the patient’s confidence from the first meeting to the procedure itself will result in poor conditions for the endoscopist, a bad experience for the patient and the theatre staff and future
reluctance of both parties to repeat this procedure, however clinically indicated. Key is to engage the patients from the first moment, gain their confidence, reassure at all times and never lose contact with them until they are asleep. Contact especially during the procedure must be maintained by silencing the unnecessary noise and chatter in the theatre and focusing your patient on your voice. During the procedure the voice of the primary endoscopists must not only be the only audible voice but must also never fall silent. It’s in the silence that the patients mind is allowed to build demons or worst case scenarios and the endoscopists’ risks rapidly losing the patient’s cooperation. The content of the endoscopists “chatter” during the procedure is not that critical. The overall goal is to calm and comfort the patient, to compliment him on cooperating and last but not least to estimate the level of sedation. It is critical that the endoscopists chatter to the patient during the procedure, while the scope is in the patients airway, is not constructed in such a way that the patient feels the need to talk back or answer – this will dynamically change the airway geometry, cause loss of view and add time plus complexity to the procedure. Questions such as “how you doing?” with a scope in the airway, are neither helpful nor productive.

Sedation is a complex area. The intent of sedation for AFOI is to increase patient comfort and provide some degree of amnesia. Change of sensorium is sometimes to be discouraged especially with the potentially threatened airway. Rapidly reversible drugs are far preferable over those that do not provide the “get out of jail” option. Having tried most options for many years including (Fentanyl, Midazolam, Fentanyl and Midazolam, Propofol TCI, Propofol and Fentanyl, Dexmedetomidine), we have found them to be mostly unsatisfactory because the onset time of the drugs is not fast enough when a somewhat deeper level of sedation is required during the introduction of the ETT through the nose or glottis. Patients are generally over-sedated and occasionally inadequately sedated. The over-sedated patients do not reverse their level of sedation quickly enough to make any of these drugs really safe in this setting. The drug which for us comes closest to our needs for this setting is Remifentanil. An advantageous side-effect of Remifentanil in this setting, as with all opiates, it that it is an antitussive. Even at higher levels and should the patient become over sedated, they remain voice responsive and the infusion can then be reduced or stopped with rapid return to pre-sedation sensorium. Remember that Remifentanil alone does not provide amnesia for the procedure, a side-effect that is sometimes beneficial, for example during prolonged and difficult intubation procedures. We
recommend adult Remifentanil infusion doses of 0.07–0.1 micrograms/kg/min. The single use of remifentanil is probably the best supported drug for this purpose in the literature, however it is not within the scope of this article to discuss all the drugs\textsuperscript{28,29} The dosage of remifentanil needs to be reduced for the elderly or the systemically unwell patient. Insure that the Remifentanil infusion is low concentration – say 20 micrograms per ml in a 50 ml syringe. With this concentration there will be a more constant drug delivery from the syringe driver. Start the Remifentanil infusion 5 minutes before the actual endoscopy. Remifentanil can be administered in combination with propofol in experienced hands, both given as infusion. These drugs are short acting or rapidly reversible and give good analgesia, sedation and amnesia. However there is, as stated previous, a relatively high incidence of apnoea when used in combination. AFOI seems for many clinicians to be a very complex task. It is very difficult to simultaneously watch a moving target through a flexible scope, monitor and talk to a patient and sedate him as well and coach all the other people in theatre who rather would immediately start their surgical list. Why don’t we then, for example, perform an AFOI with two anaesthetists as a routine whenever feasible? This is not common practice in many hospitals. Only a few of us are such skilled technicians and communicators that they can do an AFOI confidently alone. How many of us working at general hospitals perform more than 5 AFOI a year? And how many of us take regular training sessions in a full-scale medical simulator to retain the skill or recertify?
Photo 31

Dexterity trainer

Photo 32

Dexterity trainer components for scope training
Photo 33

ORSIM™ medical simulator
Conclusions

In conclusion, do not let these incidents discourage you from doing an AFOI or spoil your AFOI experience. Most incidents or complications are preventable. Why don’t you try to become one of the doctors who can perform an awake flexible intubation confidently? As described in this book, for almost all problems there is a solution and most problems can be prevented.

Finally, and this may be a very humbling experience, do not forget that some patients cannot be intubated, not even by the world’s best airway managers. Remember oxygenation will save a patient’s life, not intubation.
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