Flexible fibreoptic intubation

Vera Sokolova

Dmitrijs Sokolovs

Abstract

Flexible fibreoptic intubation offers options of airway control in awake and asleep patients, in cases with limited or absent mouth opening and complex anatomy. It may be used as a first choice or a rescue technique. Despite its limitations, for example in situations with significant airway blood or secretions, and airway obstruction, it is a valuable core skill for every anaesthetist.

Keywords Airway management; airway topicalization; awake intubation; fibreoptic; tracheal intubation

Royal College of Anaesthetists CPD Matrix: 1C02, 2A01, 2A10, 3A01

Learning objectives

After reading this article you should be able to:

- define situations when use of flexible fibreoptic intubation (FFI) would be beneficial
- state advantages and disadvantages of nasal and oral FFI routes
- choose appropriate sizes of endotracheal tubes and flexible fibrescopes for different situations
- perform airway topicalization

The modern airway management arsenal includes a great variety of tools. None of them is a perfect, 'one-fits-all' solution for all possible situations. While some devices — like videolaryngoscopes — are easy to learn and provide help in many, if not the majority of, situations, other techniques require more time and effort to obtain the skill and maintain it, whilst having a narrower, more specific application. The latter is true for flexible fibreoptic intubation (FFI).

The technique has certain **advantages** over the alternatives, as follows.

1. Feasibility of intubating the trachea in an awake patient.

This allows preservation of spontaneous ventilation, maintenance of airway patency via natural muscle tone, better protection from aspiration, and more favourable larynx position (than after induction of anaesthesia, when it moves anteriorly).

2. Allows intubation of patients with very small or absent mouth opening via nasal route.
3. It is a very good aid for intubation via supraglottic airway device (SAD).
4. Ability to negate complex airway anatomy and anomalies in cases when alignment of nose/mouth and larynx in the same sagittal plane is not feasible (which is a prerequisite for both direct and videolaryngoscopy).

Disadvantages and limitations of FFI include the following.

1. Airway blood or secretions may obscure the view partially or completely, rendering the technique impossible.
2. It has limited use in airway obstruction.
3. It is a relatively slow technique, hence not ideal for rapid airway control.
4. Soft tissue swelling (which limits the airspace for orientation) and gross deviation of the laryngeal inlet may complicate or preclude FFI use.

Topicalization with local anaesthetic and flexible scope manipulation may cause laryngospasm or complete obstruction at the level of lesion. FFI should be used with extreme caution, if at all, and an awake surgical airway option discussed with ENT surgeons.

Indications for flexible fibreoptic intubation

Main indications are *known* or *anticipated* difficult laryngoscopy with or without difficult facemask ventilation.

The above mentioned includes a diverse group of conditions, such as small or absent mouth opening (e.g. temporo-mandibular joint ankylosis, wired jaws), receding/hypoplastic mandible, limited neck range of motion (rheumatoid arthritis, ankylosing spondylitis, prior cervical fusion), congenital airway anomalies, tracheomalacia, airway masses (malignancy of tongue, tonsils, larynx; large goiter, mediastinal mass), etc.[1]

FFI may also be used in the following cases:

- unstable cervical spine (minimal neck movement); may not be more advantageous than videolaryngoscopy with in-line stabilization
- trauma to face or upper airway (may be limited in presence of blood)
- difficult airway with risk of aspiration.

If laryngoscopy proves difficult, FFI may be used as a *rescue technique*, performed via natural airways or SAD. The former, given appropriate expertise, may complement Plan A of Difficult Airway Society 2015 unanticipated difficult intubation guidelines. The latter may follow a successful Plan B, if there is a need to proceed with surgery and tracheal intubation following SAD insertion.[2]

Contraindications

Absolute contraindications include an uncooperative patient or patient's refusal.

True allergy to local anaesthetics is a relative contraindication, as FFI may be attempted without airway topicalization using remifentanil, propofol or other agents/combinations.[1]

Equipment

There are several groups of equipment involved in FFI: flexible fibreoptic scope and its light source/battery; endotracheal tubes

Vera Sokolova *MD is a Specialty Doctor in Anaesthesia at Queen Elizabeth University Hospital, Glasgow, UK. Conflicts of interest: none declared.*

Dmitrijs Sokolovs *MD DESA is a Consultant Anaesthetist at Queen Elizabeth University Hospital, Glasgow, UK. Conflicts of interest: none declared.*

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(ETT); airways to facilitate nasal and oral approach; devices for topicalization; drugs.

Scopes

Choice of the correct scope and appropriately sized ETT are of major importance for FFI success.

Readers should learn the *specifications* of scopes available at your hospital, including outer diameter (OD) of their shaft and diameter of the working channel.

The majority of epidural catheters, used for 'spray as you go' (SAYG) topicalization during FFI, have external diameters of less than 1.1 mm (including B Braun Perifix® 19G and Portex 16G catheters). They would fit the majority of working channels, including Ambu® aScope 3 slim (3.8/1.2).

In cases of suspected or known *prion disease*, when the use of disposable endoscopes is precluded due to infection risk, single-use scopes (e.g. Ambu® aScope™) are a valuable alternative.

Aintree intubation catheter (AIC) has an external diameter of 6.5 mm and internal diameter of 4.7 mm. Choose a scope with shaft of outer diameter less than 4.7 mm and a 7.0 mm ID ETT.

Endotracheal tubes

For FFI it is best to choose flexible tubes that may be easily rotated during advancement and that follow the scope shaft without a 'pull out' effect (e.g. reinforced (armoured) ETTs).

'Hold up' at the right arytenoid is a feature of all left-facing bevel ETTs. In the authors' opinion, better features are offered by the LMA Fastrach™ ETT – its soft moulded tip aids atraumatic passage through the vocal cords. Parker Flex-Tip® ETT has a flexible, curved, centred and tapered distal tip that fits the scope shaft snugly and facilitates rapid atraumatic intubation.

With a non-reinforced ETT, rotation on advancement may not be possible without dislodging the scope; consider pre-emptive bevel orientation facing posterior commissure to avoid arytenoid 'hold up'.

The difference between scope shaft and ETT diameter is one of the main reasons for difficultiers with ETT advancement.

Too narrow ETT will not slide over the scope easy enough. With ETT notably wider than the scope shaft, the risk of arytenoid 'hold up' is increased, as well as 'pull out' effect (ETT hitting laryngeal inlet, bending, and pulling the scope out of trachea).

For *nasal* FFI 7.0 mm ID ETT is most commonly used in men and 6.0 mm ID ETT – in women. For *oral* routes, use of wider ETTs is possible, if necessary for adequate ventilation, but may increase 'hold up' risk.

Scopes with shaft OD around 5.0 mm are suitable for 6.0–8.0 mm ID ETTs; approx. 3.5 mm scopes – for 4.5–5.5 mm ID tubes.[3]

Airways

For the *nasal route*, a lubricated 6.0 mm (for women) or 7.0 mm (for men) nasopharyngeal airway (NPA), pre-cut along the longitudinal axis, may be inserted into the most patent nostril after applying topical anaesthesia and vasoconstrictor. This will aid passage via the nose, leading directly to the post-nasal space. Once the scope tip is above the carina, NPA is 'peeled off' the scope and the ETT railroaded.

For the *oral route*, several options exist.

Simple endoscopy *bite blocks* provide better protection for the scope, as they do not need to be removed prior to railroading the ETT. Some bite blocks may be removed once ETT is in place without the need to manipulate connector. However, bite blocks do not function as conventional oropharyngeal airways (OPA) and do not keep the tongue out of the way.

The *Berman airway* acts as a conventional OPA, keeps the tongue away from the endoscopy route, and facilitates quick passage of the scope towards the laryngeal inlet. This airway can be removed prior to ETT railroading or after that. In the former case, the scope is left unprotected; in the latter, the airway's removal may be difficult due to snug ETT fit.

The *LMA MADgic airway* combines conventional OPA with mucosal atomizer device for oral, oropharyngeal, hypopharyngeal and laryngeal inlet topicalization, and distal oxygen delivery. It seems to the author the most complete device for oral FFI available in the UK now (Figure 1).

Consent

An informed consent with explanation of the procedure and associated risks (nose bleeding for nasal route, airway trauma and infection[4]) is mandatory for awake *and asleep* FFI.

In case of awake FFI, it is necessary to make sure the patient understands he/she will remain awake for the procedure, but appropriate sedation will be provided.

Positioning, monitoring, oxygenation

In the UK, it is common to stand by the side facing the patient, who is positioned semi-sitting (awake) or slightly head-up (asleep). Such position uses gravity to assist endoscopy.

Outside the UK, it is not uncommon to stand at the patient's head end, facing in the direction of patient's feet. This way the anaesthetist may require a step, to ensure appropriate height above the patient's head.

Depending on the approach and handpiece lever position, orientation of larynx and other structures will differ by 180°. Whatever approach you choose, consistency is the key to ensure the most effective performance.

Position the *scope monitor* in the line of sight. An *assistant* can perform jaw thrust, chin lift, OPA medialization, and other useful manoeuvres.

Use standard Association of Anaesthetists of Great Britain and Ireland (AAGBI) *monitoring*, including ECG, SpO_2, non-invasive blood pressure, E_TCO_2 (cannula through the nasal sponge, needle removed) and respiratory rate. Consider arterial line placement prior to FFI for unstable patients to ensure adequate monitoring after ETT is in place and induction agents are administered.

Oxygenate adequately by means of a nasal sponge (nasal route), nasal cannulae and/or designated OPA port (oral route); consider oxygen insufflation down the scope suction port.

Route

The nasal route is more comfortable in awake patients (avoids gag reflex and scope biting), and is useful in cases with severely reduced/absent mouth opening or when free oral cavity is necessary for surgical access. This route is contraindicated in case of severe intranasal pathology, base of skull (cribriform

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