

Review Article

Awake Flexible Fiberoptic Bronchoscope Aided Endotracheal Intubation- Anatomico Anesthetic Considerations: A Review

Dr. Ishrat Hussain Mir¹, Dr. Basharat Ahad², Dr. Ashfaq Ul Hassan^{3*}

¹Consultant Anesthetist, Sheri Kashmir Institute of Medical Sciences Medical College Hospital, Bemina, Srinagar, Kashmir, India

²Consultant, Sheri Kashmir Institute of Medical Sciences Medical College Hospital, Bemina, Srinagar, Kashmir, India

³Consultant Anatomist, Sheri Kashmir Institute of Medical Sciences Medical College Hospital, Bemina, Srinagar, Kashmir, India

*Corresponding author

Dr. Ashfaq Ul Hassan

Email: ashhassan@rediffmail.com

Abstract: Awake flexible fiberoptic bronchoscope aided intubation (AFOBI) has revolutionized the ability of the anesthesia provider to safely care for difficult airway management and help prevent associated adverse side effects while dealing with a difficult airway like arterial hypoxemia, hypoventilation, aspiration. The flexible fiberoptic bronchoscope (FOB) is presently a critical tool available in scenario of anticipated or proved difficult airway. It should also be the first option while dealing with airway in patients with unstable cervical spine fractures. AFOBI enables a patent patient airway and makes tracheal intubation possible without loss of control of patient's airway.

Keywords: Awake intubation, Difficult Airway, Failed Intubation, Fiberoptic Bronchoscope

INTRODUCTION

The Skeleton of the larynx consists of thyroid cartilage, cricoids cartilage, the arytenoids, corniculate and the cuneiform cartilages with the Adams Apple forming the laryngeal prominence. The Cricothyroid joint and the Cricoarytenoid joints are both Synovial types of joints.

The technique of FOB intubation was first performed using a choledoscope, by Murphy *et al.* in 1967, in a patient with Still's disease [1].

Rosenblatt *et al.* indicated that FOB intubation was then available with 99% of surveyed ASA members in united States [2].

By late 1980s it was recognized that use of FOB represent such a significant advancement in the management of patient with difficult airway that experts stated that no anesthesiologist can afford to be not well familiar with the technique [3].

With the advancement in medical technology and availability of better quality instrument, and familiarity of more and more anesthesiologist with the art of FOB intubation, the latter has become a golden standard in the management of difficult airway.

Indications

AFOBI is most frequently indicated in a patient who has a proved or anticipated difficult airway. The technique is suitable to the situation as it can be performed before inducing general anesthesia, thus eliminating the risk of failed tracheal intubation in an anesthetized patient.

AFOBI is also recommended in a patient with unstable cervical spine as is very common in trauma patients. The technique is beneficial as it doesn't require movements of the patient's neck during the procedure and can be performed before induction of general anesthesia, thereby allowing for evaluation of patient's neurological function after tracheal intubation and surgical positioning.

Contraindications

Contraindications to AFOBI are relative and include:

- Inability of the patient to cooperate
- Allergy to local anesthetic drugs
- Bleeding from upper and lower airway not relieved with suction

Elements of FOB

The FOB is fragile device with optical and non optical elements. The fundamental element consists of a glass fiber bundle. Each fiber is 8 to 12 microns in diameter and is coated with secondary glass layer.

There are two lenses, the objective lens and the eye piece lens. The light is reflected at a rate of 10,000 times per meter, as it moves from objective lens to eye piece lens in the operator's handle. The insertion cord of a typical FOB is 60 cm long, is water impermeable and contains 10,000 to 30,000 optical fibers. The fibers are allowed to rotate over each other throughout the length of the cord, though they are fused at the two ends in a coherent pattern.

The insertion cord of a FOB contains an up to 2mm diameter lumen, the working channel, which travels from the distal tip to the handle. It can be used for instillation of lavaging fluids or drugs (directly or through an epidural catheter). In general, FOB of less than 2 mm in external diameter doesn't have a working channel. The entire cord is protected in a metal wrap except at the distal tip to allow free movements of the tip.

The distal tip can be moved in one plane (sagittal) by the control lever in the handle. Movements in a perpendicular plane (coronal) can be accomplished by combined use of control lever and rotation of FOB from handle to the distal end.

The light source element of FOB is provided either by a universal cord that emerges from the handle and is inserted into an endoscopic light source, or may be provided by a battery operated light source in the handle.

Technique of AFOBI

AFOBI is generally performed in through a nasal approach as it is better tolerated by awake patient. It can also be accomplished through oral route if nasal approach is not feasible, as in a patient with deviated nasal septum and hypertrophied turbinates, wherein nasal approach may be difficult and may cause significant trauma and bleeding which may render the procedure difficult. Nasal intubation is also not suitable in patients who have contraindication to use of vasoconstrictor agents such as patients with pregnancy and with heart diseases [4].

The procedure should be explained to the patient and he or she should be assured that he or she will be made as comfortable as possible during the procedure. Use of antisialagogues, like glycopyrrolate 5 mg/kg, is recommended to inhibit formation of secretions that can obscure FOB visualization.

The nasal mucosa must be anesthetized and vasoconstricted, which is achieved with either 4% cocaine solution, or a combination of 3% lidocaine and 0.25% phenylephrine. Local anesthetic (LA) solution can be applied o soaked cotton tipped swabs [4].

Tongue and nasopharynx can be anesthetized by 4 puffs of 10 % lignocaine spray, 2 each side. Alternatively bilateral block of glossopharyngeal nerve can be achieved by injecting 2ml of 2% lidocaine at the base of each anterior tonsillar pillar at a depth of 0.5 cm using a spinal needle.

The larynx and trachea can be anesthetized by using topical local anesthetic solution or nerve blocks. LA solutions may be sprayed, aerolized or nebulized into the airway. We use 4% lignocaine solution instilled through a 18 G epidural catheter that has been passed through the working channel of insertion cord of FOB and whose tip lies 1 to 2cm distal to the tip of the cord. It is important that total dose of LA solution doesn't exceed the maximum recommended dose (9 to 10mg/kg based on lean body weight) when used topically.

The patient is placed in supine or preferably in slight recumbent position. A pillow below shoulder can be helpful. Standard monitoring is attached keeping all resuscitation equipment and drugs ready. For sedation, numerous choices are available like propofol, medazolam, dexmetomedine.

Whatever agent is used, it is very important to titrate the depth of sedation so as not to lose spontaneous respiration and control of airway.

The FOB is held in non dominant hand, the thumb over the control lever and the index finger over the working channel valve. The dominant hand will be used to steady and held the insertion cord as it is slowly advanced into the airway. The insertion shaft is lubricated with a water soluble lubricant. The endotracheal tube (ETT) is also lubricated when a nasal approach is used. The ETT is threaded over the shaft of the insertion cord. An appropriate size ETT must be used. A larger tube used may result in 'Hang Up'.

Hang Up occurs when the ratio of internal diameter of ETT and external diameter of the insertion cord is more, and there exists a cleft between these two devices. It may involve entrapment of epiglottis, corniculate or arytenoids cartilages, the aryepiglottic folds, or the vocal folds [5].

The tip of the FOB is gently guided in through the nose, which is already anesthetized, or mouth, if oral approach is used. While advancing the FOB cord, LA solution is instilled through the epidural catheter already inserted through the working channel. Suction can be effectively applied through the FOB, whenever desirable, to make visual field clearer. The successful advancement will be determined by the coordinated movements of the tip of the cord and rotation of FOB while advancing keeping the target in the center. Once in trachea, one can unmistakably see the tracheal rings. From here, FOB is gently advanced further till carina is

visualized. If the patient coughs excessively and becomes distressed while the operator attempts to negotiate the vocal cords and enter trachea, it is better to wait for a while, reassure the patient, instill more LA solution or slightly deepen the sedation. Induction of anesthesia should be accomplished only, when endotracheal tube is secured I trachea and its correct position confirmed by ET_{CO}₂ tracing, as tracheal intubation may not always be possible following successful advancement of FOB in the trachea. If there is resistance while advancing ETT, rotating the ETT and advancing proves successful most of times. Some clinicians prefer to use an intubation oral airway to keep the FOB in the midline and prevent biting of the insertion cord by the patient.

Failed AFOBI

The common factors that can lead to failure of AFOBI are

- Lack of experience
- Failure to adequately dry and anesthetize patient airway
- Nasal cavity or upper airway bleeding
- Inadequate sedation
- Hang Up
- Fogging of FOB

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