Awake videolaryngoscopy versus fiberoptic bronchoscopy

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Purpose of review
The difficult airway remains an ongoing concern in daily anesthesia practice, with awake intubation being an important component of its management. Classically, fiberoptic bronchoscope-assisted tracheal intubation was the method of choice in the awake patient. The development of new generation videolaryngoscopes has revolutionized the approach to tracheal intubation in the anesthetized patient. The question whether videolaryngoscopes have a place in the intubation of the difficult airway in the awake patient is currently being addressed.

Recent findings
Randomized controlled trials and their meta-analysis have shown that videolaryngoscopes provide similar success rates and faster intubation times when compared with fiberoptic bronchoscope intubation in awake patients with difficult airways.

Summary
Videolaryngoscopy is a valid technique that should be considered for difficult airway management in the awake patient.

Keywords
awake intubation, difficult airway, fiberoptic bronchoscope, videolaryngoscope

INTRODUCTION

The awake intubation

There are situations when the safest method to secure an airway is to place an endotracheal tube in an awake and spontaneously breathing patient [1]. This may be required when the patient's cervical spine is unstable and documentation of neurological status is required after intubation [2]. It is also indicated when management of the airway is predicted to be difficult. The loss of spontaneous respiration associated with the induction of general anesthesia provides limited time to initiate effective manual ventilation. Any delay because of airway difficulties can lead to hypoxia that may result in catastrophic neurological injury or death. The *Fourth National Audit Project* (NAP4), a year-long survey of airway complications in the United Kingdom [3▪▪], concluded that more than 25% of airway complications were associated with neurological injury or death. Analysis of these cases found that in spite of predicted airway difficulties, an awake intubation was rarely performed. This led the NAP4 to recommend more frequent use of awake intubation techniques, with the aim to minimize the risk of creating a 'cannot intubate-cannot ventilate' scenario in an apneic patient.

The *Difficult Airway Society* has published guidelines on how to manage a cannot intubate- cannot ventilate situation [4▪]. Of primary importance is the routine performance of a detailed airway assessment. A well performed airway assessment often predicts airway difficulties and allows planning for an awake approach [5]. Even though airway management difficulty may be predicted, some anesthesiologists are still reluctant to perform awake intubations. This can be because of fear of failure and time concerns in a busy operating room [6▪]. However, in several large reviews, awake intubation failure rates are only 1–2%, and the time taken was minimal [7,8]. In addition, the use of awake

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KEY POINTS

- To minimize severe complications, awake intubation should be routinely considered when faced with the difficult airway.
- The use of the videolaryngoscope to assist with the awake intubation provides faster intubation times than with the fiberoptic bronchoscope.
- The use of videolaryngoscope to assist with awake tracheal intubation is a valid first line technique for the management of the difficult airway.

intubation has not been shown to be disruptive even in busy fast-track surgery settings [9].

Preparation for the awake intubation

Anesthesiologists may also be reluctant to perform awake intubations because of concerns over patient comfort. Awake intubation is an advanced airway skill that is composed of three main components: effective local anesthesia, judicious sedation, and the actual placement of the endotracheal tube. The airway can be anesthetized through the use of blocks, including the glossopharyngeal and superior laryngeal nerve, transtracheal techniques, or through topical application of local anesthesia [10▪▪,11]. Sedation can be provided with opioids, benzodiazepines and alpha adrenergic receptor agonists [12]. The ideal regimen for airway anesthesia and sedation is unknown [13▪], and depends on patient characteristics and clinical factors. Therefore, each provider should be comfortable with several techniques.

Fiberoptic bronchoscope and videolaryngoscope-assisted awake intubation

Once the patient has been adequately prepared for the intubation, the clinician must decide on the technique that will be utilized for the placement of the endotracheal tube. The two main choices are the use of a fiberoptic bronschoscope or a videolaryngoscope.

The use of a flexible fiberoptic scope to assist tracheal intubation was first described in 1967 [14▪▪]. Its ability to maneuver through the difficult airway has made it the 'Gold Standard' technique for awake intubation [15▪]. Classically, after the scope is 'loaded' with an endotracheal tube, it is passed through the nasopharynx or oropharynx, potentially with the help of a guide, such as the Ovassapian or supraglottic airway. With appropriate manipulation, the tip of the scope can then be advanced into the trachea, and the tube positioned by pushing it along the shaft of the scope.

In contrast, the use of the videolaryngoscope has only recently been introduced into the airway management. In spite of this, it has revolutionized clinical practice. At the start of the 2000s, new generation videolaryngoscopes were developed that incorporated semiconductor-based video imaging systems at the tip of the blade [16▪▪]. This design provided significant improvement from previous videolaryngoscopes that utilized rigid fiberscope technology [17▪]. As these new video laryngoscopes placed the camera at the end of the scope with a slight upward angle, they provided improved laryngeal views when compared with conventional laryngoscopes [18], and high rates of success in the difficult airway [19▪]. These devices have become extremely popular, with some advocating for their use as the first line intubating technique [20]. The success of the videolaryngoscope in the anesthetised prompted the exploration of its use in the difficult airway in the awake patient. Early case reports [21▪▪] and series [22▪] demonstrated its acceptability and success in the management of the difficult airway in the awake patient. Initial resistance to awake intubation with the videolaryngoscope [23,24] has changed, with some advocating for it to be the new primary technique for awake airway management [6▪,15▪].

The technique for awake videolaryngoscope-assissted tracheal intubation is very similar to the asleep technique. After sedation and airway anesthesia, the video laryngoscope is inserted in the midline of the oropharynx and advanced until a view of the laryngeal opening is obtained. The endotracheal tube can then be placed with guidance by the video image.

WHICH TECHNIQUE SHOULD BE USED?

There are many challenges associated with the placement of an endotracheal tube in the awake patient, and the fiberoptic bronchoscope and the videolaryngoscope each have differing abilities to deal with them. Both techniques, however, must be able to overcome the reasons the airway is considered difficult. These include limited mouth opening, the presence of excess tissue, tumor masses, abundant secretions, compromised neck mobility or anatomic characteristics that make direct laryngoscopy difficult.

Small mouth opening makes tracheal intubation difficult by impairing the visualization of the larynx by direct laryngoscopy and limiting the space for airway equipment. Fiberoptic bronchoscopes may have an advantage over videolaryngoscopes in patients with minimal mouth opening. They are thinner than even the most low-profile

videolaryngoscopes, especially when pediatric bronchoscopes are used. In addition, the fiberoptic scope can be passed through the nasopharynx into the trachea when the mouth opening is severely limited or impossible. However, the video laryngoscope still has a place in situations of decreased mouth opening [25]. A recent randomized control trial compared the use of a CMAC videolaryngoscope with fiberoptic bronchoscope nasal intubation for mouth openings as small as 1.3 cm [26]. Both groups had a failure rate of 2% and similar levels of patient and anesthesiologist satisfaction. The videolaryngoscope group did have faster intubation times, however.

Where the videolaryngoscope is superior to the fiberoptic bronschoscope is in the presence of excess tissue, blood or secretions in the airway. The videolaryngoscope is rigid, and can much more easily displace anything obstructing the airway [27–29]. This is in contrast to the fiberoptic scope, which is flexible and must manuever around obstructions, which makes it prone to 'redout' or obstruction of view [30]. In addition, the patency of suction channel in fiberoptic scopes is easily overwhelmed by blood and secretions [6▪].

Anatomic characteristics that lead to difficult direct laryngoscopy are also well handled by the videolaryngoscope. The wider angle of view and upturned direction of the camera can allow a larger visualization of the glottic structures, and better spatial orientation [30], which makes it particularly helpful for the management of the anterior larynx or malformations, such as Pierre Robin [31]. In fact, after a failed direct laryngoscopy, rescue with videolaryngoscopy was much more successful than rescue attempts using a bronschoscope [32▪].

As mentioned previously, unstable cervical spine is a reason for awake intubation, and excess neck mobility must be avoided during airway management. Direct laryngoscopy can result in significant movement of the neck, and requires in line stabilization. Compared with fiberoptic bronchoscopy, videolaryngoscopy seems to result in more neck movement in patients when manual stabilization is not in place [33,34]. However, when manual stabilization is utilized, the use of a videolaryngoscope does not increase neurologic injury [2], making it a viable alternative for the unstable cervical spine.

EQUIPMENT MAINTENANCE AND TRAINING CONSIDERATIONS

There are practical aspects related to both instruments that also affect their suitability for clinical use. The fiberoptic bronchoscope is an instrument that is more complicated and expensive than the videolaryngoscope. In addition, sterilizing the working channel in fiberoptic bronchoscopes makes cleaning more complicated and labour-intensive [23]. Bronchoscopes are also more fragile and difficult to maintain. These challenges often result in bronchoscopes not being available [6▪]. In contrast, videolaryngoscopes are more robust and readily available in over 90% of UK anesthesia departments [35].

The ability to acquire and maintain competence with the equipment is also a major consideration. It has been estimated that an anesthesiologist would need to perform 25 fiberoptic-assisted intubations to become competent with this technique, as opposed to six with video laryngoscopes [6▪]. This impediment to acquiring competence is also found in maintaining competence. The technique for videolaryngoscope intubation is very similar for both the awake and the anesthetized patient. Frequent use of the videolaryngoscope in asleep patients, therefore, allows clinicians to remain familiar and comfortable with its use. The use of fiberoptic bronchoscopy is a unique skill unlike any others in anesthesia. As the fiberoptic scope is expensive and difficult to maintain, it is less likely to be used even semiroutinely in the asleep patient. Further limiting opportunities for practice is the paucity of departmental training courses for fiberoptic intubation [36]. Clearly, anesthesiologists have more chances to be familiar with the videolaryngoscope, and in a high stakes situation of awake intubation, will be drawn to use the instrument with which they are most comfortable.

OTHER CONSIDERATIONS

It must be acknowledged that there are a large number of types of videolaryngoscopes, with different blade and camera designs. Broadly, they differ by the degree of angulation of the tip of the blade and can be divided into those with or without a channel for passing the endotracheal tube. The strengths and weakness of each device in the context of difficult airway management have not been fully assessed, leading to individual preferences and variety between departments [37]. In contrast, fiberoptic bronchoscopes share a fairly uniform design.

Another strength of videolaryngoscope is that, in contrast to fiberoptic bronchoscope intubations, it allows a much wider choice of endotracheal tube size. Fiber optic bronchoscope intubations can only use a tube that fits over the scope. Flexibility in tube size is extremely important when laser safe or jet ventilation tubes are required [30].

A recent advance in difficult airway management is the use of Transnasal Humidified Rapid-

Insufflation Ventilatory Exchange (THRIVE) with high-flow cannula during airway manipulation. This technique is thought to increase the time a patient may remain apneic, but only when the airway remains patent [38]. The use of THRIVE in awake intubation settings may also be beneficial [39]. Although presently unknown, it appears likely that the use of highflow oxygen will be more effective with videolaryngoscopy, as the blade ensures larger mouth opening, and better oxygen delivery.

COMPLICATIONS

One of the most common complications of either technique is failure to place the endotracheal tube. Failure is often because of difficulty in the passing of the tube at the level of the vocal cords. It is well known that the endotracheal tube can get hung up on the vocal cords [8] as it is usually pushed blindly over the scope. This problem is not shared with the videolaryngoscope, which provides a direct view of tube and cords. However, manipulation of the tracheal tube into the glottic opening can be difficult even in the presence of an ideal view of the vocal cords [40]. This remains true even with videolaryngoscopes offering a tube channel, which typically require a grade 1 glottic view for successful endotracheal intubation [41].

Fiberoptic intubation has been shown to be associated with oxygen desaturation, multiple attempts, and failure, often because of secretions and blood in the airway [39,42]. Videolaryngoscopy has been described to result in pharyngeal trauma, but only when used in the anesthetized patients [16▪▪]. Although serious complications with its awake use are not well described, gagging sometimes occurs [43]. This problem, however, seems to be related to any awake intubation technique [8], and comparative analysis between fiberoptic and videolaryngoscopy have not been performed for this complication.

RANDOMIZED CONTROL TRIALS

The use of videolaryngoscsope versus fiberoptic bronchoscopes for awake intubation has been compared in several randomized trials, first by Rosenstock [44] in 2012. They have since been compared for awake intubations using the oral [45▪▪] or nasal route [26], and in the obese [46], and patients with an unstable neck [34]. There have been two recent meta-analyses of published trials [47▪▪,48]. Unfortunately, all studies are relatively small and their quality is limited by the inability to truly blind the procedure. However, based on observations made in almost 500 patients, awake intubation assisted with the videolaryngscope is faster than that assisted by fiberoptic bronchoscopy, results in the same rates of success, and provides similar patient and clinician satisfaction levels.

COMBINED USE OF VIDEOLARYNGOSCOPY AND FIBEROPTIC BRONCHOSCOPE

Videolaryngoscopy and fiberoptic bronchoscope assisted awake intubations each have strengths. It is important to remember that since both techniques require the same sedation and airway topicalization strategies, they are not mutually exclusive. In fact, they can be performed simultaneously. There are many case reports of videolarygnoscopy and fiberoptic bronchoscopy being used simultaneously [49,50]. This approach allows the user to leverage the beneficial effects of both techniques, especially when managing the most challenging airways.

CONCLUSION

Recent advances in airway management have clearly shown that videolaryngoscopy for awake intubation is a useful and valid approach when difficulties are predicted. There are many proven and potential benefits to this technique, and it is entirely justifiable for awake videolaryngoscopy-assisted intubation to be the initial management strategy when approaching the anticipated difficult airway.

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Conflicts of interest

There are no conflicts of interest.

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- ▪ of special interest
- ▪▪ of outstanding interest

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