Current Anesthesiology Reports (2022) 12:382–389
https://doi.org/10.1007/s40140-022-00529-x

AIRWAY MANAGEMENT (LC BERKOW, SECTION EDITOR)

Awake Intubation Techniques, and Why It Is Still an Important Skill to Master

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Accepted: 8 March 2022 / Published online: 30 March 2022

Abstract

Purpose of Review Awake intubation has been a staple of difficult airway management since the first American Society of Anesthesiologists difficult airway guidelines were developed in the 1980s. In current anesthetic practice, use of second generation supraglottic airways and video laryngoscopy are ubiquitous. The goal of this review is to examine the impact that these airway advances have had on the use of awake intubation and the need to maintain this skill.

Recent Findings Despite advancements, evidence suggests that the rate of awake intubation has changed little over the last two decades. Recent literature has focused on the use of alternatives to the flexible intubation scope, including awake intubation with video laryngoscopy, combined video laryngoscopy-flexible intubation, and combined supraglottic airway-flexible intubation.

Summary Awake intubation remains an essential technique in airway management. Future research should focus on determining the specific patient populations that would benefit from the variety of awake intubation techniques now described.

Keywords Awake intubation · Difficult airway · Flexible intubation scope · Video laryngoscopy

Introduction

Awake intubation has been a cornerstone of difficult airway management since its use was promoted in the first guidelines published by the American Society of Anesthesiologists (ASA) Task Force on Management of the Difficult Airway [1, 2]. The advantages of awake intubation were enumerated by the task force members — the conservation of oxygenation and ventilation, preservation of upper airway muscle tone, and the position of oral, pharyngeal, hypopharyngeal, and laryngeal structures, and the ability to abandon or change strategies while minimizing patient risk.

These early authors also noted disadvantages of awake intubation including the potential for patient discomfort and increased procedural time. It is also recognized that awake intubation can be complicated by airway obstruction during topicalization, as well as hypoxemia, hypercapnia, and cardiovascular compromise as a result of simultaneous administration of sedation [3••]. Furthermore, there have been numerous advances in airway management over the past several years, including the introduction of second generation supraglottic devices and the widespread availability of video laryngoscopy. Despite this, awake intubation continues to have a role in modern airway practice. A PubMed query for "awake tracheal intubation" reveals 276 publications in the previous 5 years suggesting that awake intubation remains an important component of airway management and of academic interest. In this review, we will provide a narrative overview of the recently published literature on awake intubation as well as an argument for why it is still an important skill to master.

Search Strategy

PubMed (National Center for Biotechnology Information) was queried using the term "awake tracheal intubation," and articles published in the English language since 2018

This article is part of the Topical Collection on *Airway Management*

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were included. Literature included original research articles (observational and randomized studies), review articles, case series, and guidelines. Additional publications were added by reviewing the references in included articles, as well as utilizing the "cited by" tool in PubMed to search for newer articles citing the included manuscripts. A few seminal articles related to awake intubation that were published prior to 2018 were also included.

Risk of Adverse Events During Airway Management

Airway management that is complicated by a "can't intubate, can't oxygenate" emergency can lead to death or permanent brain damage if not rapidly rescued [4]. Short of those most catastrophic outcomes, airway injury or gastric content aspiration can occur during repeated, prolonged, or challenging attempts at tracheal intubation. Most elective, as well as many urgent patient encounters that will require airway management involve patients who initially present with adequate or at least minimally adequate gas exchange. This reflects a level of physiologic homeostasis — the diaphragmatic and upper airway musculature is functional and conducting passages are patent. In the awake and/or spontaneously breathing state, the central nervous system is providing both static and phasic regulation of these faculties. The induction of anesthesia renders these systems dependent on the ability of the airway manager to sustain or return their function. Failure to do so may lead to catastrophic outcomes [4]. Therefore, the airway manager's evaluation of a patient's airway is aimed at determining the risk of failure.

Yet, airway evaluation is an inexact science. Reviews of the bedside exams used to determine the risk of difficulty with any of the standard modalities (tracheal intubation, face mask ventilation, supraglottic ventilation) have poor sensitivities and only modest specificities in their ability to identify the at-risk patient [5, 6••]. Studies of risk assessment when video laryngoscopy is planned have proven inconclusive in that many involve heterogeneity in both the design of device employed and the experience of the operator [7, 8]. Regardless of the planned technique or device, operator experience, the context in which management will occur, availability of instrumentation and skilled help should all be factored into the evaluation process. This is particularly true in the non-operating room environment, where poor outcomes, more likely to spur litigation, occur with higher prevalence according to the ASA's Closed Claims Database [4]. Advanced airway evaluation techniques such as preoperative endoscopy or virtual endoscopy are promising modalities to improve the risk-stratification process but definitive proof of their merits have yet to be seen [9, 10].

As such, it is the belief of these authors that an airway manager's threshold to perform awake intubation should be low when predictors of difficult airway management are present. The ASA task force on the management of the difficult airway 2022 guidelines highlights the need to consider awake intubation with the addition of a decision tree tool that aids the airway manager's pathway choice [6••]. The tool helps to identify patients who are at high risk for airway management failure after induction of anesthesia (Fig. 1) — patients who may not be rapidly intubated (for whatever cause) and present with one or more of the following: (1) assessed risk of difficult face mask or supraglottic airway ventilation, (2) assessed as being at increased risk of gastric contents aspiration, and (3) at risk of rapid oxygen saturation or hemodynamic deterioration if gas exchange is interrupted and cannot be corrected rapidly (i.e., "physiologically difficult airway." Clinical examples are presented in Table 1. The inclusion of aspiration risk assessment and the risk of the physiologically difficult airway when deciding whether to perform an awake intubation are highlighted with greater emphasis in the 2022 guidelines as compared to prior versions.

In An Era of Ubiquitous Video Laryngoscopy, Is Awake Intubation Obsolete?

The widespread availability of videolaryngoscopy has prompted the question as to whether awake intubation

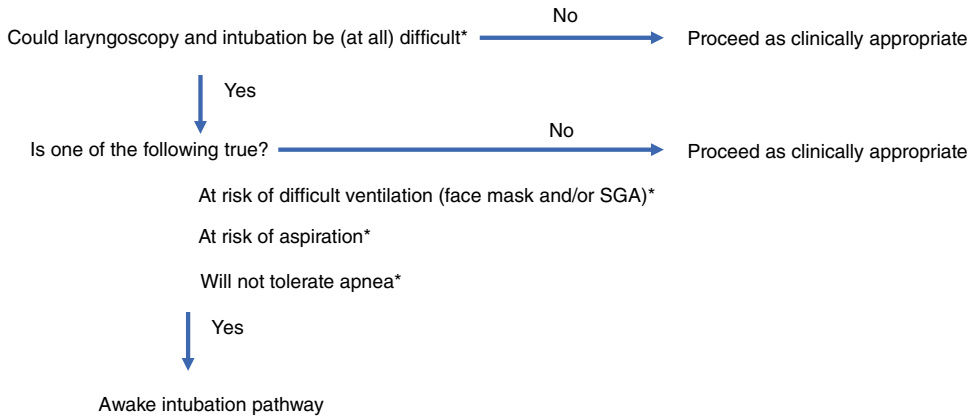

Fig. 1 Decision tree for choosing awake intubation based on the 2022 American Society of Anesthesiologists practice guidelines for management of the difficult airway [6••]

Table 1 Clinical and physical exam findings associated with difficult airway management. Patients with risk factor(s) for difficult intubation plus either ventilation, aspiration, or inability to tolerate apnea are most safely managed with awake intubation. BMI = body mass index, OSA = obstructive sleep apnea

Risk factors for difficult airway management		
Intubation		
• Mallampati 3–4		• Limited cervical mobility
• Mouth opening < 3 cm		• OSA
• Thyromental distance < 6 cm		• Congenital syndromes
• Neck circumference > 40 cm		• Prior difficult intubation
• Limited mandibular protrusion		
• Airway edema		
• Airway masses		
• Prior head/neck radiation or surgery		
Ventilation (facemask/SGA)	Aspiration	Inability to tolerate apnea
• Male sex	• Non-fasted status	• Pregnancy
• Advanced age	• Bowel obstruction	• Critical illness
• BMI > 30 kg/m^2	• Gastroparesis	• Sepsis
• Facial hair	• Opioid use	• Severe cardiac conditions
• Edentulous	• Uremia	• Lung diffusion abnormalities
• Prior head/neck radiation or surgery	• Intra-abdominal infection	• Obesity
• OSA	• Pregnant patient in labor	• Ascites
• Fixed cervical spine flexion deformity	• Uncontrolled severe GERD	

should remain a mainstay of difficult airway management. An unanticipated poor laryngeal view is obtained with direct laryngoscopy in up to 7% of patients [11], and the fact that this is greatly reduced with the use of hyperangulated video laryngoscopy is a potent basis for this argument [12]. In 2002, Ovassapian found that the principle cause of unanticipated difficult direct laryngoscopy was the presence of hyperplastic lymphoid tissue at the base of the tongue [13]. In that hyperangulated videolaryngoscopy bypasses the base of the tongue to create a view of the larynx, it is not surprising that these devices substantially reduce the unanticipated difficult intubation with direct laryngoscopy. Furthermore, significant lingual tonsil hyperplasia is not the only situation where hyperangulated video laryngoscopy excels at laryngeal visualization. The obese patient, the patient with a high Samsoon and Young grade view of the larynx, and other clinical situations are facilitated with the use of video laryngoscopy [7, 14].

In the opinion of these authors then, the question of whether awake intubation is obsolete is reduced to the question of what is a "difficult airway." Common vernacular applies this moniker to those patients who are not anticipated to be difficult to manage with tracheal intubation and/or mask/supraglottic ventilation, but then difficulty is unexpectedly encountered during airway management. This type of "difficult airway" has certainly been reduced with ubiquitous use of video laryngoscopy.

But other causes of difficult intubation, both anticipated and unanticipated exist. Video laryngoscopy will likely not be a device of choice in a patient with significant trismus, extremes of neck deformities, and masses of the tongue, pharynx, hypopharynx, and larynx that distort the line of axis from the mouth to the larynx. Likewise, in the patient with a history of difficult airway management with no obvious cause, other causes not amenable to video laryngoscopy management may exist.

Though some patients with anatomic lesions and deformities not amenable to intubation with video laryngoscopy can still be managed after the induction of anesthesia, several clinical examples serve to illustrate the likely longevity of awake intubation and the need for the clinician to maintain this skill set:

Limited oral access: When access for intubation is limited or impossible via the oral route (e.g., in trismus), few current tools in the modern airway armamentarium are readily applicable. Chief among these are the flexible intubation scope, though blind nasotracheal-intubation and video-stylet aided nasotracheal intubation have been reported [15]. Nasal intubation is associated with longer procedure times and a much higher incidence of airway soiling (i.e., with blood) [16].

Airway masses: In a study of patients with airway masses, 61% of patients had one or more airway management complications: 23% required multiple attempts at laryngoscopy, 68% experienced difficult mask ventilation, and 35% experienced oxyhemoglobin desaturation to less than 95% (including 4 of the 8 patients managed with awake intubation) [17]. Though all of the 44 enrolled patients were intubated, the authors cautioned that despite the modern armamentarium of airway management tools, techniques, and pharmaceuticals, this patient population remains challenging.

Neck pathology: Patients with limited cervical motion, neck scars, history of radiation, or neck masses are at increased risk for difficult intubation, and hyperangulated video laryngoscopy may not overcome these limitations [12].

As discussed above, the patient whose airway may not be reliably and quickly secured due to one or more of these clinical examples, and who may be difficult to

ventilate, may be an aspiration risk, or is at risk of rapid oxyhemoglobin desaturation or cardiovascular repercussions would most safely be managed with awake intubation.

There is some evidence that awake intubation is underutilized [18], possibly due to concerns over patient comfort [19] (though this tends to be exaggerated by the clinician) [20], or insufficient experience with the technique [21, 22]. Several studies have none-the-less demonstrated a consistent use of awake intubation techniques for patients who are evaluated to be at risk [23–25]. For example, there was a consistent 1.06% rate of awake intubation despite increasing adoption of hyperanguated video laryngoscopy over an 11-year period in a major Canadian teaching hospital [23]. Other centers have shown a remarkably similar 1.0–1.7% rate of awake intubation in both the USA [24] and the UK [25]. In the largest review of awake intubations, including more than 1000 events, common reasons for choosing awake intubation included trismus, reduced neck mobility, and previous difficult intubation [23].

Cervical Spine Instability

Consistent with the factors outlined in the ASA practice guidelines for management of the difficult airway, cervical spine pathology with risk of neurologic injury is another reason airway managers may choose awake intubation — all techniques of tracheal intubation and facemask or SGA ventilation pose risk to the unstable cervical spine. Traditionally, awake flexible intubation is the technique of choice for airway management with cervical spine instability due acute injury or degenerative pathology. This technique affords the benefit of minimal neck movement and the ability to perform a neurologic exam after intubation and prior to anesthetic induction [26]. However, the use of awake flexible intubation in the setting of cervical spine instability has likely decreased in recent years due to increased use of video laryngoscopy. In a single-center retrospective study including 252 patients with cervical spine injury at a level 1 trauma center, post-induction airway management predominated. Video laryngoscopy was used for 49.6% of cases, asleep flexible intubation for 30.6% of cases, and asleep combined video laryngoscopy-flexible intubation in 13.5%. Awake intubation with a flexible scope was performed in only 2.3% of cases [27]. There were no cases of neurologic injury attributed to airway management in this study. This suggests that in practice, awake intubation is not commonly performed for the indication of cervical spine instability, though this remains a topic of controversy. Evidence suggests that with the use of in-line stabilization, cervical spine motion is similar during intubation with video laryngoscopy compared to direct laryngoscopy [28, 29], but reduced with the use of a flexible intubation scope compared to video laryngoscopy (though this comparison was without in-line stabilization) [30]. Recommendations have been made for any technique in which the operator is experienced, provided manual-in-line stabilization of the cervical spine is employed [31]. Evidence for neurologic injury from airway management is limited to case reports, mostly following use of direct laryngoscopy without in-line stabilization [32–36]. However, one recent report described an iatrogenic C5-6 dislocation fracture leading to hemiparesis complicating intubation with video laryngoscopy with in-line stabilization in a patient with ankylosing spondylitis and a severe flexion deformity [37]. Given the rarity of neurologic injury related to airway management, a study of direct comparison between techniques is not possible. It is the opinion of these authors that awake flexible intubation remains an important technique in the setting of severe cervical spine instability.

In the Era of Sugammadex

The reduction in the need for the use of awake intubation techniques has been promoted as a consequence of the introduction of the neuromuscular blockade reversal agent, sugammadex. An argument was made that general anesthesia could safely be induced in patients believed to be at risk of difficult airway management if a non-depolarizing neuromuscular blocking agent was used that could then be reversed with the use of 16 mg/kg of sugammadex. This technique could result in a duration of neuromuscular blockade shorter than found with the use of succinylcholine [38]. Though limited, case reports have demonstrated successful rescue using this strategy [39]. However, there are multiple considerations that render this approach inadequate. First, the duration of apnea from routine hypnotic agent induction is longer than that from rocuronium-sugammadex neuromuscular blockade and reversal [38]. Second, the determination that a cannot-intubate/cannot oxygenate situation has occurred may delay the decision to reverse neuromuscular block. The preparation of 16 mg/kg of sugammadex may add more than 6 min to the period of apnea. Third, variation in adequacy of preoxygenation, patient safe apneic period, and the physiologic tolerance of apnea may place some patients at high risk (e.g., obese patients and pregnant patients) [38].

What About Awake Video Laryngoscopy?

The flexible intubation scope is the most common device used for awake intubation, but alternative techniques including video laryngoscopy, optical stylets, intubation through a supraglottic airway, and combined techniques (video and flexible laryngoscopy) have been described with increasing frequency.

Meta-analyses have been performed in attempt to guide decision-making when choosing a device to perform awake

intubation [40, 41]. Overall these studies have concluded that video laryngoscopy and optical stylets have the advantage of modestly faster intubation time compared to use of a flexible intubation scope, with similar overall success rates. However, the trials are heterogenous in terms of inclusion criteria and risk factors for difficult intubation, limiting the utility of pooled analysis. It is important to carefully examine the patient and operator population studied to determine if the results apply with regard to the specific intubation device used for a given patient.

Notably patients with limited mouth opening were excluded from nearly all studies comparing awake video laryngoscopy with awake flexible intubation[42–46] and few patients with oropharyngeal masses were included [44, 45]. Therefore, the results of pooled analysis of these trials cannot be applied to these clinical scenarios. Furthermore, given that the overall success rate of awake intubation is 98–99%, even a meta-analysis with 355 participants [41] is not large enough to detect a difference between failure rates for awake intubation with a flexible intubation scope versus video laryngoscopy or other techniques.

What About Awake Combination Techniques?

Combined Video Laryngoscopy and Flexible Intubation Techniques

Case reports have described successful awake intubation with combined use of video laryngoscopy and a flexible intubation scope when each failed when used independently [47, 48]. This combination may be useful for the most challenging of circumstances by taking advantage of the ability to displace soft tissue with the video laryngoscope and create a path for, as well as direct the flexible intubation scope.

Awake Supraglottic Airway-Guided Flexible Intubation

Successful awake supraglottic airway–guided flexible scope intubation was described in a case series of twenty patients with morbid obesity plus 3 risk factors for difficult airway management (i.e., 3 of the following: Mallampati class 3 or 4, neck circumference ≥ 40 cm, thyromental distance < 6 cm, limited cervical mobility, limited mouth opening, receding mandible, missing teeth, beard, or history of snoring) [49]. Another case series of ten supraglottic airway–guided flexible scope intubations included patients with a history of difficult intubation, head and neck pathology, and/or limited cervical movement [50]. The proposed benefit of the supraglottic airway in this regard is splinting open of the upper airway and clearing a path from secretions and blood. Authors of these case series propose that further studies should be done to determine if this technique improves upon the first-pass success rate of flexible scope intubation of 93- 96% [23, 25]. Disadvantages of this technique could include trauma with supraglottic airway insertion complicating further attempts at airway management, requirement for adequate mouth opening, and inability to use for nasal intubation. It is the opinion of these authors that further research is needed prior to choosing awake supraglottic airway–guided flexible intubation as a primary technique in routine circumstances. Advantages and disadvantages of the awake intubation techniques described are presented in Table 2.

Table 2 Advantages and disadvantages of described awake intubation techniques. SGA = supraglottic airway

Awake intubation technique	Advantages	Disadvantages
Flexible intubation scope	• Flexibility to move around fixed tissue/masses • Minimal tissue trauma • 98–99% success rate across studies [23–25]	• Requires technical expertise that must be gained and maintained • Blood/secretions can limit view • Blind "railroading" of tube into trachea
Video laryngoscopy	• Can displace soft tissue • Observation of tube passing through larynx	• Little data • Requires adequate mouth opening • Inability to move around fixed tissue/large masses
Combined video laryngoscopy-flexible intubation	• Can displace soft tissue • Flexibility with flexible intubation scope • Observation of tube passing through larynx	• Sparse data • Increased equipment costs/environmental impact
Combined supraglottic airway-flexible intubation	• Can displace soft tissue • Provides conduit for flexible intubation scope	• Sparse data • Not compatible with nasal intubation • Requires adequate mouth opening • Possible trauma from SGA insertion complicating further intubation attempts • Increased equipment costs/environmental impact

Gaining and Maintaining Skills in Awake Intubation

An international survey of anesthesiologists ($n = 4948$, 61 countries) revealed that reported self-confidence, on an 11-point numerical rating scale, was lower for awake flexible scope intubation than for other airway management techniques (median confidence score 7 [4–9], versus 9 [9–10] for direct laryngoscopy, 9 [9–10] for video laryngoscopy, and 8 [5–9] for asleep flexible scope intubation) [21]. In another survey study, the most senior anesthetic trainee at each UK NHS hospital performed self-assessment regarding various airway competencies. Of the 149 responses, 138 (93%) said they were able to perform independent video laryngoscopy, 102 (68%) were able to perform independent asleep flexible scope intubation, and 49 (33%) were able to perform independent awake flexible scope intubation [22]. Future research should focus on how to ensure anesthesiology trainees gain the necessary skills to perform awake intubation as well as maintain the skills once in practice. Advanced airway training fellowships are growing in number throughout North America and Europe, though advanced training will not be the answer for the majority of airway managers. Simulation [51] and virtual reality gaming systems[52, 53] as well as elective asleep intubation with a flexible scope can improve technical skills, though lack the opportunity for practice in airway analgesia techniques and the non-technical skills required to successfully perform awake intubation. Peer coaching among faculty has shown promise in the emergency medicine literature for improving self-assessed competency in performing and teaching awake intubation [54].

Is It Safe to Perform Awake Intubation in the COVID-Era?

The first case report of awake intubation in a patient with suspected COVID-19 was published online in early May 2020 [55]. This group described conscious sedation with target-controlled propofol and remifentanil infusions to minimize coughing, followed by topicalization of the nasopharynx with 2.5 ml co-phenylcaine spray and the oropharynx with lidocaine 10% via a mucosal atomizer device. Two other case reports followed with alternative methods of topicalization described [56, 57]. In October of 2021, the Society of Airway Management published a statement regarding difficult airway management in patients with COVID-19 [58•]. Awake tracheal intubation was discussed in this statement, with a recognition that the increased time and complexity of awake intubation may increase the risk of oxygen desaturation for the patient and infectious agent exposure risk for the team performing the intubation. They therefore recommend that a provider experienced in advanced airway techniques determine whether awake intubation is necessary. If determined necessary, an antisialogogue should be administered, followed by judicious sedation to decrease cough during topicalization. The topicalization techniques most familiar to the operator should be used, possibly favoring topical gels. Further recommendations include single use flexible intubation scopes when available, suction through the working channel over oxygen insufflation, and oral intubation when feasible. Of note, these recommendations are based on expert opinion as opposed to high levels of evidence, but they provide practical guidance for awake tracheal intubation in the hazardous setting of the COVID-19 pandemic.

Conclusion

Despite the advent of new airway devices and techniques, the literature remains replete with descriptions of the use of awake intubation for the management of the difficult airway patient. The criteria proposed by the 2022 ASA guidelines leads the individual airway manager to consider the awake intubation pathway based on their own experience and the context in which they are practicing. Two clinicians, each with distinct skill sets and experience, may rightly choose divergent paths. Awake intubation with a flexible intubation scope is successful in 98–99% of cases and remains a reliable method for airway management in the case of trismus, oropharyngeal masses, and neck immobility. Newer techniques, including awake video laryngoscopy, combined video laryngoscopy-flexible intubation scope, and combined supraglottic airway-flexible intubation scope have been described in the literature in the last several years. More research is needed to determine the patient populations and settings best suited for these techniques.

Compliance with Ethical Standards

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Conflict of Interest Jaime B. Hyman declares no conflict of interest. William H. Rosenblatt is a consultant for Teleflex (Morrisville, NC) and Ambu (Copenhagen, Denmark) Corporations and is owner of AOD LLC.

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