

A Decision Tree Approach to Airway Management Pathways in the 2022 Difficult Airway Algorithm of the American Society of Anesthesiologists

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The American Society of Anesthesiologists' (ASA) Task Force on Management of the Difficult Airway has developed a decision tree tool that uses inductive assessments to guide the anesthesiologist's choice of pathway in the ASA's Difficult Airway Algorithm. The tool prompts the anesthesiologist to consider the risk of difficulty with laryngoscopy (direct or indirect) and tracheal intubation, facemask or supraglottic ventilation, gastric contents aspiration, and rapid oxyhemoglobin desaturation. For every airway management event, the approach integrates the anesthesiologist's unique combination of experience, expertise, patient anatomy and disease, equipment availability, and other contextual conditions into the decision process. Entry into the awake intubation pathway is encouraged when the patient is judged at risk of difficult tracheal intubation and one or more of the following: difficult ventilation, significant aspiration risk, and/or rapid oxyhemoglobin desaturation. The decision tree tool is anticipated to improve communication between anesthesiologists and others by clearly identifying those factors of concern and how decision-making is affected by those concerns. (*Anesth Analg* 2022;134:910–5)

GLOSSARY

ASA = American Society of Anesthesiologist

In 1993, the American Society of Anesthesiologist (ASA) first published *Practice Guidelines for the Management of the Difficult Airway*.¹ This work was a consequence of the Closed Claims Project initiated in 1984 and offered the first specialtywide, data-driven guidance for the critical art of airway management. Then President of the ASA, Ellison C. Pierce, Jr, MD, had initiated the Closed Claims Project in response to a disproportionate number of medical malpractice actions against anesthesiologist.² Analysis of these claims led to the production of several practice guidelines, the difficult airway recommendations being the first.

In the nearly 3 decades since this publication, national, international, and specialty-specific medical societies have produced dedicated airway guidelines.

Expert-opinion-based algorithms accompanied these guidelines, often including pathways that launched when a difficult airway was encountered. What remained important about the ASA's work was the allocation of a significant portion of their algorithm to the premanagement recognition of the patient at risk of airway management failure, though there was little guidance in how the anesthesiologist should use this information in formulating an airway plan.³

In August of 2019, the ASA reconvened the Task Force on the Difficult Airway with the intent of updating the thrice-published practice guidelines. The international group of ASA members included 12 physicians and 2 methodologists with a mission to incorporate recent primary source, evidence-based literature into the recommendations, as well as to consider a redesigned algorithm. As with the prior constructs, the algorithm was to include sequential and clear decision points.

Though prior iterations of the ASA Difficult Airway Algorithm had included 2 sequential management pathways (awake intubation and intubation after the induction of general anesthesia), there was no similar construct to guide in choosing between them. An effort was made to describe this choice using a decision tree tool that prompts the anesthesiologist to consider basic management problems within the context in which airway management will be delivered^{4,5} (Figure 1). Using a rational approach to making decisions is vital—critical decisions, arrived at through

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stepwise assessments, are difficult to reject for extrinsic reasons. For example, a plan to perform awake airway management, with the goal of reducing the likelihood of adverse outcomes, cannot be abandoned for convenience or other reasons (eg, the anesthesiologist’s skill set or the unavailability of capable aid) if that decision is arrived at using a sound strategy. Important to the process of making this decision are the unique experience and skills of the anesthesiologist charged with airway management and the particularities of each patient encounter. The intent of the tool is to provide a clear decision process for choosing between the 2 pathways of the ASA algorithm.

One of the current authors (W.H.R.) is a member of the ASA Task Force on Management of the Difficult Airway and an author of the decision tree tool.⁵ The following is an explanation of the use of this tool in the decision process.

Development of an airway management strategy involves the integration of contextual conditions (ie, nonpatient factors such as practice setting), patient factors, proposed surgical procedures, the devices and skilled aid that are available, and, most importantly, the anesthesiologist’s experience with each of these elements. It is impossible and impractical

to include all permutations of these variables in an algorithm. Each anesthesiologist will determine the risk of encountering difficulty with airway management based on their experience—the more extensive the experience, the more the “data” may be available to inform their inductive assessments, that is, assessments based on prior observation. In essence, the risk of difficulty or failure in each airway encounter is not absolute, and 2 anesthesiologists faced with the same clinical conditions may plan very different management strategies.

THE 4 ELEMENTS OF AIRWAY MANAGEMENT DECISION MAKING AND PLANNING

Is There a Risk of Difficulty With Laryngoscopy and Tracheal Intubation?

As reflected in all prior iterations of the ASA Difficult Airway Algorithm, fundamental airway management strategy development assumes the goal of tracheal intubation, though this may not be the eventual clinical plan.³ As has been repeatedly demonstrated, the bedside tests routinely used to determine the risk of difficulty with direct laryngoscopy and tracheal intubation suffer from poor sensitivity and only modest specificity.⁶ Characterization of the physical

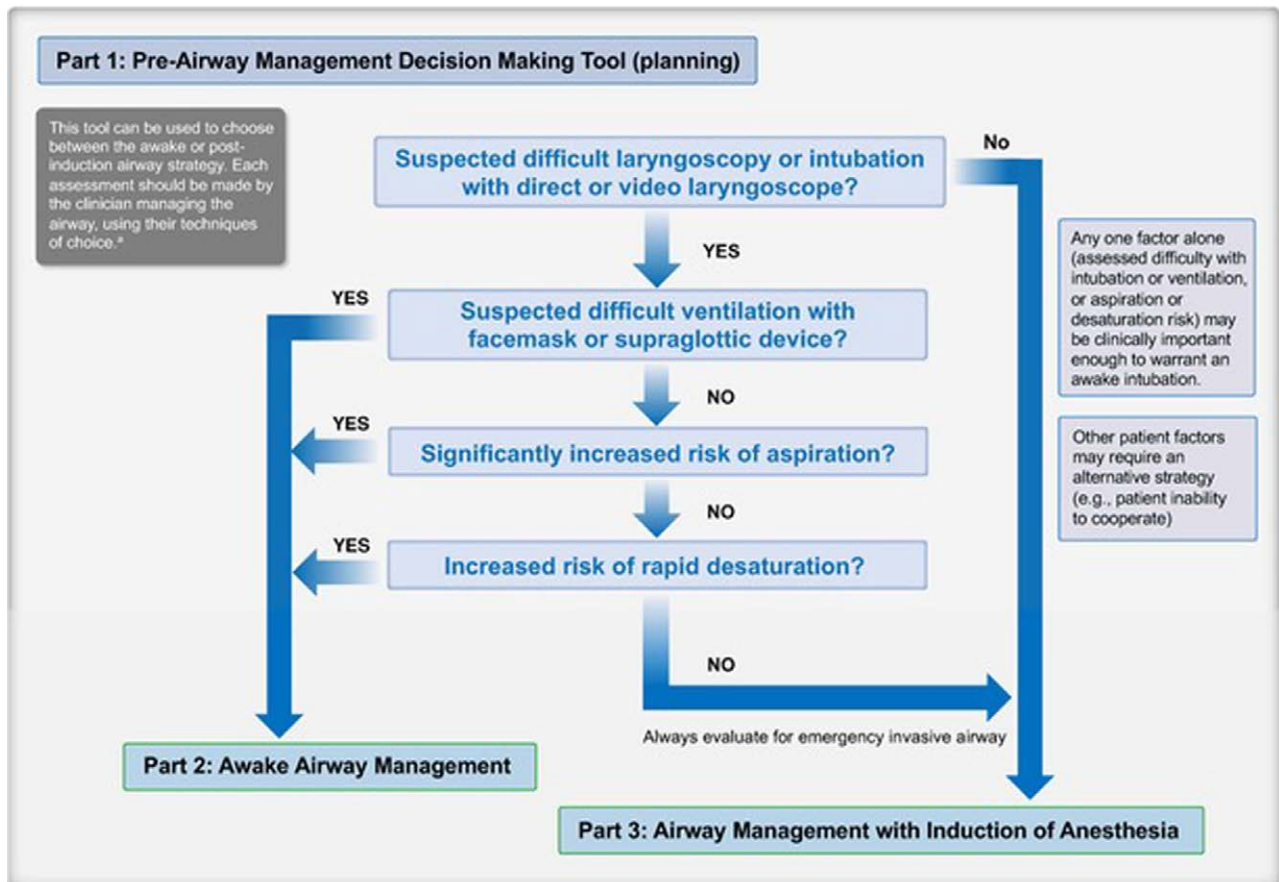


Figure 1. Part 1 of the 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway Adult Infographic.

examination findings that affect successful tracheal intubation with indirect laryngoscopy has been studied recently but has not been conclusive. Most of these studies have been complicated by the inclusion of multiple device designs, by the effect of operator experience, or both.^{7,8} Identification of the patient with the difficult-to-intubate larynx is an inexact science at best and is highly anesthesiologist-dependent.^{8,9} If the inductive assessment by an anesthesiologist leads to a judgment that achieving tracheal intubation will be straightforward, then a decision to proceed with airway management after the induction of general anesthesia can be considered—the anesthesiologist has determined that the archetypal airway management technique of tracheal intubation should be, with reasonable expectation, successful and they are free to consider how other patient factors or contextual conditions influence their general anesthetic, airway management plan (eg, the use of supraglottic airways, when appropriate)

Despite the inductive assessment by the anesthesiologist, unanticipated difficulty can occur, and for this reason, the ASA Difficult Airway Algorithm provides both emergent and nonemergent pathways. Therefore, though the pathway of airway management after the induction of general anesthesia has been chosen, the remaining components of airway evaluation should be assessed to determine not only an appropriate technique of induction (eg, rapid sequence induction when the patient is deemed at risk of aspiration) but also the elements of airway rescue in case unanticipated difficulties are encountered.

Can Facemask/Supraglottic Ventilation Be Used (for Rescue)?

If the anesthesiologist's inductive assessment leads to the judgment that tracheal intubation may not be straightforward, proceeding with airway management after the induction of general anesthesia may continue to be an option if other means of airway management are assessed as viable and safe. In this case, the ability to manage the patient's airway with facemask or supraglottic ventilation is considered. If the anesthesiologist believes that successful facemask or supraglottic ventilation may not be straightforward to achieve, a juncture has now been reached where the ability to use all standard, noninvasive means of airway management is in question, and awake intubation should be considered. The anesthesiologist who chooses to induce anesthesia and apnea in this situation is accepting the possibility that a cannot-intubate/cannot-ventilate situation may occur.

Is the Patient Free From Aspiration Risk?

Should the assessment be that facemask/supraglottic airway ventilation could straightforwardly

be achieved, the clinician now considers the risk of aspiration of gastric contents. If the anesthesiologist believes that there is a significant risk of aspiration, after having previously determined that there may be a delay to achieving rapid airway protection (ie, risk of difficult laryngoscopy and intubation), reason suggests entry into the awake intubation pathway.

If the anesthesiologist assesses that the patient is free from significant gastric contents (or other) aspiration risk, the management after general anesthetic induction pathway may be appropriate—though this patient may not be rapidly intubated, the anesthesiologist has assessed that facemask or supraglottic airway ventilation should be achievable without the added concern of aspiration.

Will the Patient Tolerate a Period of Apnea?

Finally, when developing a strategy, the clinician must consider the impact of a period of apnea. If the patient is unexpectedly difficult to ventilate, will apnea be tolerated until corrected? If, based on patient physiology (eg, shunt physiology, pregnancy, and morbid obesity), the anesthesiologist believes that the patient likely has a reduced safe apneic period, in the context of an assessed risk of nonstraightforward laryngoscopy and intubation, the strategy should favor the awake intubation pathway. The same considerations can be given to the patient who may not tolerate hypnotic agents or a rapid change to positive-pressure ventilation.¹⁰

Once an inductive airway assessment is concluded, other factors exogenous to the airway may disrupt the decision process. The ability of a patient to cooperate with awake intubation procedures, the expediency with which the airway must be secured (eg, unstable trauma patient), and other variables may foul a strategically derived plan. Thus, despite awake intubation being identified as the preferred approach, induction of general anesthesia may be required for airway control to be completed, and a variety of alternative approaches may be engaged (eg, rapid sequence induction with preparations for an emergency invasive airway). The particulars of the alternative plan will be context-driven and unique to the anesthesiologist. Importantly, each airway assessment elaborated above (ie, intubation, ventilation, aspiration, and apnea tolerance) will continue to inform the plan despite the diversion away from the strategically arrived at choice of awake intubation.

Failure of any plan may demand rescue maneuvers such as invasive access to the airway. As previously recommended by the ASA Difficult Airway Task Force, assessment of the surgical anatomy of the neck should be part of the airway evaluation process.³

As the anesthesiologist works through the decision tree tool, the assessments and choices made at each

step should be influenced by an appreciation of the possible sequelae, especially patient harm, that may be associated with each pathway. Figure 2 is a coarse outline of outcomes that may occur at each point when pursuing awake intubation or routine airway management after induction of general anesthesia. Included are pooled outcome data from multiple studies using different methodologies.^{11–16} Information from the National Audit Project of the Royal College of Anaesthetist and the Difficult Airway Society, and the ASA’s Closed Claims Database highlights the potential for harm associated with failed or delayed establishment of airway patency after the induction of general anesthesia (eg, hypoxemia, trauma from repeated or overzealous attempts, need for an emergent invasive airway, bleeding, and death). Recently, increased dollar costs associated with difficult tracheal intubation have been demonstrated.^{17,18} Of those patients who are assessed to be appropriate for routine airway management after the induction of anesthesia, 3% to 13% may prove difficult to intubate.^{14,19} As noted, this appears independent of whether direct or indirect laryngoscopy is used.²⁰ Though no injury may occur during an event of difficult or failed tracheal intubation (eg, the airway is managed by other means), in a small number of patients, morbidity and even death may occur. Upward of 1:10,000 patients will be impossible to intubate and facemask-ventilate, and a far lower number will be impossible to manage with tracheal intubation, facemask ventilation, and supraglottic airway ventilation—the cannot-intubate/cannot-ventilate situation.¹⁵ Unfortunately,

neglecting to attempt supraglottic airway rescue after failed tracheal intubation and facemask ventilation is not uncommon.^{18,21} The resulting need for an emergency invasive airway can be complicated by inability to identify an adequate and appropriate invasive entry site, nerve injury, bleeding, laryngeal and tracheal trauma, long-term sequelae (eg, subglottic stenosis), anoxic injuries, and death. Gastric content aspiration can also be a consequence of failed or delayed tracheal intubation in the at-risk patient, and may result in unplanned intensive care unit admission, prolonged intubation, long-term respiratory complications, and even death.

Though awake intubation is considered the safest pathway when assessment identifies a patient that might fail routine airway management after the induction of anesthesia, some negative consequences may present. Despite this and as discussed above, external consideration should not overshadow safe patient care. Overall complication rate during awake intubation may be as high as 18%, and can include hypoxemia, hypercapnia, cardiac arrhythmias, hypotension, or aspiration.²² These may result from oversedation, local anesthetic toxicity, the administration of other cardiovascular-active agents, laryngospasm, or other airway obstruction. Occurring in upward of 2% of cases, failure to achieve awake intubation may result in cancellation and rescheduling of a surgical procedure, expenditure of operating room time, requirement of rapid conversion to the induction of general anesthesia pathway (therefore incurring the risks outlined above), and other complications unlikely to

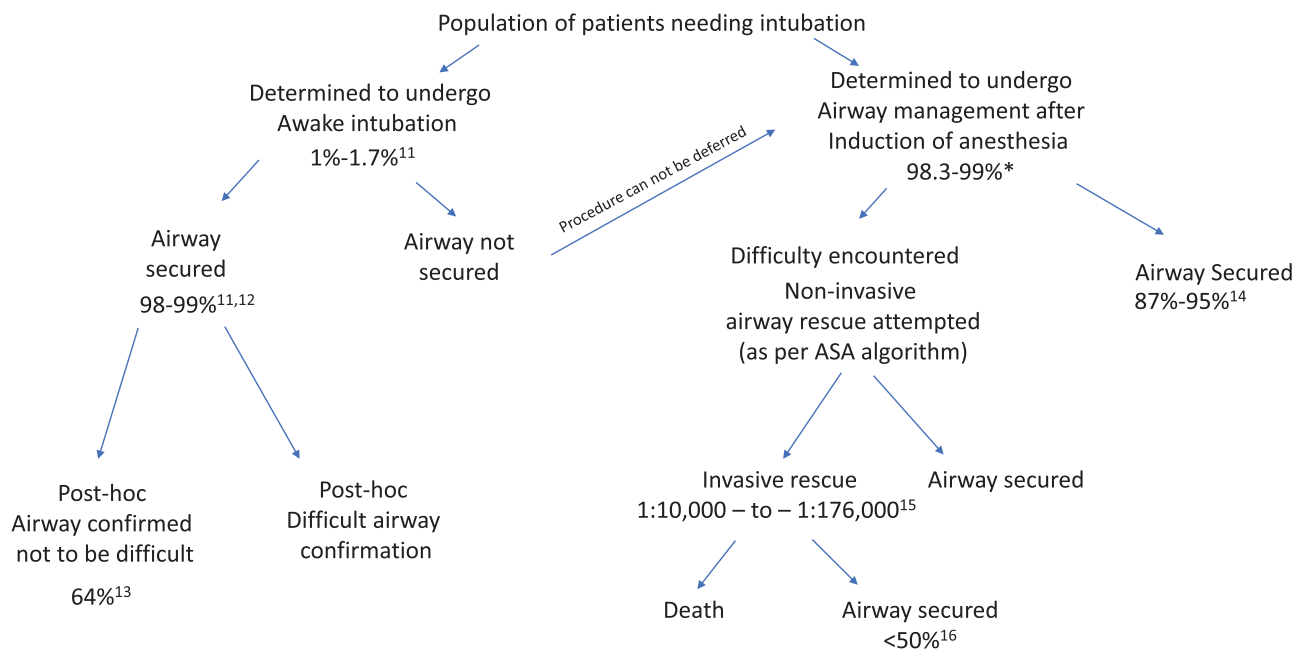


Figure 2. Proportions of patients that have or do not have difficult airway events for the population of patients receiving intubation, based on pooled data from multiple studies. *Data in the cited studies is principally derived from studies of patients in whom no difficulty with airway management was anticipated. ASA = American Society of Anesthesiologists.

be life-threatening.^{11,12} Even successful awake intubation may include drawbacks—for example, a modest increase in induction and airway management time.¹² Similarly, patients may be aware and disturbed by awake procedures, though there may be an exaggerated concern for this on the part of the anesthesiologist.^{23,24} For the anesthesiologist who is not confident in their awake intubation skills or who does not have the appropriate resources, deferment of the case would be appropriate, if possible. An alternative course would be consultation with another anesthesiologist to assist with an awake intubation. Up to 63% of awake intubations may, in hindsight, have been unnecessary, though most experts consider an overly sensitive process to be desirable.^{3,7,13} Prioritization of patient safety demands that external concerns, such as time, and inconvenience be demoted. As discussed above, the decision tree tool balances these interests against a rational choice, ranking patient safety foremost.

CONCLUSIONS

The choice of awake intubation versus airway management after the induction of general anesthesia has been a fundamental element of the ASA Difficult Airway Algorithm since its inception, and deserves strategic guidance. The decision tree tool integrates the most basic elements of airway decision-making: clinical context, the patient's history, physical examination, and assessment of ease of tracheal intubation, likely success of ventilation via facemask or supraglottic airway, aspiration risk, tolerance of prolonged apnea, and patient cooperation—all answered within the experience, capabilities, and resources of the singular anesthesiologist.

The call for a decision tree tool is twofold: to aid the anesthesiologist and other practitioners in understanding the process of airway management risk assessment and to assist them in plainly articulating their judgment process. This tool allows the anesthesiologist to use their subjective assessments of patient factors and contextual conditions to objectively guide decision-making in airway management. ■■

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decision tree tool, prepare the article for publication, and read and approve the article before submission.

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