Practice Guidelines for Management of the Difficult Airway

An Updated Report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway

PRACTICE Guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints and are not intended to replace local institutional policies. In addition, Practice Guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice Guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open-forum commentary, and clinical feasibility data.

This document updates the "Practice Guidelines for Management of the Difficult Airway: An Updated Report by the Task Force on Difficult Airway Management," adopted by the ASA in 2002 and published in 2003.*

- What other guideline statements are available on this topic?
  - These Practice Guidelines update the "Practice Guidelines for Management of the Difficult Airway," adopted by the American Society of Anesthesiologists in 2002 and published in 2003*
- Why was this Guideline developed?
  - In October 2011, the Committee on Standards and Practice Parameters elected to collect new evidence to determine whether recommendations in the existing Practice Guideline were supported by current evidence
- How does this statement differ from existing Guidelines?
  - New evidence presented includes an updated evaluation of scientific literature and findings from surveys of experts and randomly selected American Society of Anesthesiologists members. The new findings did not necessitate a change in recommendations
- Why does this statement differ from existing Guidelines?
  - The American Society of Anesthesiologists Guidelines differ from the existing Guidelines because it provides updated evidence obtained from recent scientific literature and findings from new surveys of expert consultants and randomly selected American Society of Anesthesiologists members

Methodology

A. Definition of Difficult Airway

A standard definition of the difficult airway cannot be identified in the available literature. For these Practice Guidelines, a difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both. The difficult airway represents a complex interaction between patient factors, the clinical setting, and the skills of the practitioner. Analysis of this interaction requires precise collection and communication of data. The Task Force urges clinicians and investigators to use explicit descriptions of the difficult airway. Descriptions that can be categorized or expressed as numerical values are particularly desirable, because this type of information lends itself to aggregate analysis and cross-study comparisons. Suggested descriptions include, but are not limited to:

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are available in both the HTML and PDF versions of this article. Links to the digital files are provided in the HTML text of this article on the Journal's Web site (www.anesthesiology.org).

Updated by the Committee on Standards and Practice Parameters: Jeffrey L. Apfelbaum, M.D. (Chair), Chicago, Illinois; Carin A. Hagberg, M.D., Houston, Texas; and selected members of the Task Force on Management of the Difficult Airway: Robert A. Caplan, M.D. (Chair), Seattle, Washington; Casey D. Blitt, M.D., Coronado, California; Richard T. Connis, Ph.D., Woodinville, Washington; and David G. Nickinovich, Ph.D., Bellevue, Washington. The previous update was developed by the American Society of Anesthesiologists Task Force on Difficult Airway Management: Robert A. Caplan, M.D. (Chair), Seattle, Washington; Jonathan L. Benumof, M.D., San Diego, California; Frederic A. Berry, M.D., Charlottesville, Virginia; Casey D. Blitt, M.D., Tucson, Arizona; Robert H. Bode, M.D., Boston, Massachusetts; Frederick W. Cheney, M.D., Seattle, Washington; Richard T. Connis, Ph.D., Woodinville, Washington; Orin F. Guidry, M.D., Jackson, Mississippi; David G. Nickinovich, Ph.D., Bellevue, Washington; and Andranik Ovassapian, M.D., Chicago, Illinois.

Received from American Society of Anesthesiologists, Park Ridge, Illinois. Submitted for publication October 18, 2012. Accepted for publication October 18, 2012. Supported by the American Society of Anesthesiologists and developed under the direction of the Committee on Standards and Practice Parameters, Jeffrey L. Apfelbaum, M.D. (Chair). Approved by the ASA House of Delegates on October 17, 2012. A complete bibliography used to develop these updated Guidelines, arranged alphabetically by author, is available as Supplemental Digital Content 1, http://links.lww.com/ALN/A902.

Address correspondence to the American Society of Anesthesiologists: 520 N. Northwest Highway, Park Ridge, Illinois 60068–2573. These Practice Guidelines, and all ASA Practice Parameters, may be obtained at no cost through the Journal Web site, www.anesthesiology.org.

*American Society of Anesthesiologists: Practice guidelines for management of the difficult airway: An updated report. ANESTHESIOLOGY 2003; 98:1269–1277.

 Anesthesiology 2013; 118:251–70

1. Difficult facemask or supraglottic airway (SGA) ventilation (*e.g.*, laryngeal mask airway [LMA], intubating LMA [ILMA], laryngeal tube): It is not possible for the anesthesiologist to provide adequate ventilation because of one or more of the following problems: inadequate mask or SGA seal, excessive gas leak, or excessive resistance to the ingress or egress of gas. Signs of inadequate ventilation include (but are not limited to) absent or inadequate chest movement, absent or inadequate breath sounds, auscultatory signs of severe obstruction, cyanosis, gastric air entry or dilatation, decreasing or inadequate oxygen saturation (SpO_2), absent or inadequate exhaled carbon dioxide, absent or inadequate spirometric measures of exhaled gas flow, and hemodynamic changes associated with hypoxemia or hypercarbia (*e.g.*, hypertension, tachycardia, arrhythmia).
2. Difficult SGA placement: SGA placement requires multiple attempts, in the presence or absence of tracheal pathology.
3. Difficult laryngoscopy: It is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.
4. Difficult tracheal intubation: Tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology.
5. Failed intubation: Placement of the endotracheal tube fails after multiple attempts.

B. Purposes of the Guidelines for Difficult Airway Management

The purpose of these Guidelines is to facilitate the management of the difficult airway and to reduce the likelihood of adverse outcomes. The principal adverse outcomes associated with the difficult airway include (but are not limited to) death, brain injury, cardiopulmonary arrest, unnecessary surgical airway, airway trauma, and damage to the teeth.

C. Focus

The primary focus of these Guidelines is the management of the difficult airway encountered during administration of anesthesia and tracheal intubation. Some aspects of the Guidelines may be relevant in other clinical contexts. The Guidelines do not represent an exhaustive consideration of all manifestations of the difficult airway or all possible approaches to management.

D. Application

The Guidelines are intended for use by an Anesthesiologists and by individuals who deliver anesthetic care and airway management under the direct supervision of an anesthesiologist. The Guidelines apply to all types of anesthetic care and airway management delivered in anesthetizing locations and is intended for all patients of all ages.

E. Task Force Members and Consultants

The original Guidelines and the first update were developed by an ASA-appointed Task Force of ten members, consisting of Anesthesiologists in private and academic practices from various geographic areas of the United States and two consulting methodologists from the ASA Committee on Standards and Practice Parameters.

The original Guidelines and the first update in 2002 were developed by means of a seven-step process. First, the Task Force reached consensus on the criteria for evidence. Second, original published research studies from peer-reviewed journals relevant to difficult airway management were reviewed and evaluated. Third, expert consultants were asked to: (1) participate in opinion surveys on the effectiveness of various difficult airway management recommendations and (2) review and comment on a draft of the Guidelines. Fourth, opinions about the Guideline recommendations were solicited from a sample of active members of the ASA. Fifth, opinion-based information obtained during open forums for the original Guidelines,† and for the previous updated Guidelines,‡ was evaluated. Sixth, the consultants were surveyed to assess their opinions on the feasibility of implementing the updated Guidelines. Seventh, all available information was used to build consensus to finalize the updated Guidelines.

In 2011, the ASA Committee on Standards and Practice Parameters requested that the updated Guidelines published in 2002 be re-evaluated. This update consists of an evaluation of literature published since completion of the first update, and an evaluation of new survey findings of expert consultants and ASA members. A summary of recommendations can be found in appendix 1.

F. Availability and Strength of Evidence

Preparation of these updated Guidelines followed a rigorous methodological process. Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence.

Scientific Evidence

Scientific evidence used in the development of these Guidelines is based on findings from literature published in peer-reviewed journals. Literature citations are obtained from PubMed and other healthcare databases, direct Internet searches, Task Force members, liaisons with other organizations, and from hand searches of references located in reviewed articles.

Findings from the aggregated literature are reported in the text of the Guidelines by evidence category, level, and direction. Evidence categories refer specifically to the strength and quality of the *research design* of the studies. Category A evidence represents results obtained from randomized

†International Anesthesia Research Society 66th Clinical and Scientific Congress, San Francisco, CA, March 15, 1992.

‡American Society of Anesthesiologists Annual Meeting, Dallas, TX, October 10, 1999.

controlled trials (RCTs), and Category B evidence represents observational results obtained from nonrandomized study designs or RCTs without pertinent controls. When available, Category A evidence is given precedence over Category B evidence in the reporting of results. These evidence categories are further divided into evidence levels. Evidence levels refer specifically to the strength and quality of the summarized study *findings* (*i.e.*, statistical findings, type of data, and the number of studies reporting/replicating the findings) within the two evidence categories. For this document, only the highest level of evidence is included in the summary report for each intervention. Finally, a directional designation of benefit, harm, or equivocality for each outcome is indicated in the summary report.

Category A

RCTs report comparative findings between clinical interventions for specified outcomes. Statistically significant ($P < 0.01$) outcomes are designated as beneficial (B) or harmful (H) for the patient; statistically nonsignificant findings are designated as equivocal (E).

Level 1: The literature contains a sufficient number of RCTs to conduct meta-analysis,§ and meta-analytic findings from these aggregated studies are reported as evidence.

Level 2: The literature contains multiple RCTs, but the number of RCTs is not sufficient to conduct a viable meta-analysis for the purpose of these Guidelines. Findings from these RCTs are reported as evidence.

Level 3: The literature contains a single RCT, and findings from this study are reported as evidence.

Category B

Observational studies or RCTs without pertinent comparison groups may permit *inference* of beneficial or harmful relationships among clinical interventions and outcomes. Inferred findings are given a directional designation of beneficial (B), harmful (H), or equivocal (E). For studies that report statistical findings, the threshold for significance is $P < 0.01$.

Level 1: The literature contains observational comparisons (*e.g.*, cohort, case–control research designs) between clinical interventions for a specified outcome.

Level 2: The literature contains observational studies with associative statistics (*e.g.*, relative risk, correlation, sensitivity/specificity).

Level 3: The literature contains noncomparative observational studies with descriptive statistics (*e.g.*, frequencies, percentages).

Level 4: The literature contains case reports.

Insufficient Evidence

The lack of sufficient scientific evidence in the literature may occur when the evidence is either unavailable (*i.e.*, no pertinent studies found) or inadequate. Inadequate literature cannot be used to assess relationships among clinical interventions and outcomes, since such literature does not permit a clear interpretation of findings due to methodological concerns (*e.g.*, confounding in study design or implementation) or does not meet the criteria for content as defined in the "Focus" of the Guidelines.

Opinion-based Evidence

All opinion-based evidence (*e.g.*, survey data, open-forum testimony, Internet-based comments, letters, and editorials) relevant to each topic was considered in the development of these updated Guidelines. However, only the findings obtained from formal surveys are reported.

Opinion surveys were developed for this update by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants and ASA members.

Category A: Expert Opinion

Survey findings from Task Force–appointed expert consultants are reported in summary form in the text, with a complete listing of survey responses reported in appendix 2.

Category B: Membership Opinion

Survey findings from a random sample of active ASA members are reported in summary form in the text, with a complete listing of survey responses reported in appendix 2.

Survey responses from expert and membership sources are recorded using a five-point scale and summarized based on median values.‖

Strongly Agree: Median score of 5 (At least 50% of the responses are 5)

Agree: Median score of 4 (At least 50% of the responses are 4 or 4 and 5)

Equivocal: Median score of 3 (At least 50% of the responses are 3, or no other response category or combination of similar categories contain at least 50% of the responses)

Disagree: Median score of 2 (At least 50% of responses are 2 or 1 and 2)

Strongly Disagree: Median score of 1 (At least 50% of responses are 1)

Category C: Informal Opinion

Open-forum testimony during development of the previous update, Internet-based comments, letters, and editorials are

§ All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document.

‖ When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.

all informally evaluated and discussed during the formulation of Guideline recommendations. When warranted, the Task Force may add educational information or cautionary notes based on this information.

Guidelines

I. Evaluation of the Airway

History. Although there is insufficient literature to evaluate the efficacy of conducting a directed medical history or reviewing previous medical records to identify the presence of a difficult airway, the Task Force points out the obvious value of these activities. Based on recognized associations between a difficult airway and a variety of patient characteristics, some features of a patient's medical history or previous medical records may be related to the likelihood of encountering a difficult airway.

Observational studies of nonselected patients report associations between several preoperative patient characteristics (*e.g.*, age, obesity, obstructive sleep apnea, history of snoring) and difficult laryngoscopy or intubation (*Category B2-H evidence*).[1–6] Observational studies report difficult intubation or extubation occurring in patients with mediastinal masses (*Category B3-H evidence*).[7,8]

Case reports of difficult laryngoscopy or intubation among patients with a variety of acquired or congenital disease states (*e.g.*, ankylosis, degenerative osteoarthritis, subglottic stenosis, lingual thyroid or tonsillar hypertrophy, Treacher-Collins, Pierre Robin or Down syndromes) are also reported (*Category B4-H evidence*).[9–18]

The consultants and ASA members strongly agree that an airway history should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.

Physical Examination. Observational studies of nonselected patients report associations between certain anatomical features (*e.g.*, physical features of head and neck) and the likelihood of a difficult airway (*Category B2-H evidence*).[19–21] The presence of upper airway pathologies or anatomical anomalies may be identified by conducting a pre-procedure physical examination. There is insufficient published evidence to evaluate the predictive value of multiple features of the airway physical examination *versus* single features in predicting the presence of a difficult airway.

The consultants and ASA members strongly agree that an airway physical examination should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients. The consultants and ASA members strongly agree that multiple features# should be assessed during a physical examination.

Additional Evaluation. The airway history or physical examination may provide indications for additional diagnostic testing in some patients. Observational studies and case reports indicate that certain diagnostic tests (*e.g.*, radiography, computed tomography scans, fluoroscopy) can identify a variety of acquired or congenital features in patients with difficult airways (*Category B3-B/B4-B evidence*).[22–33] The literature does not provide a basis for using specific diagnostic tests as routine screening tools in the evaluation of the difficult airway.

The consultants and ASA members strongly agree that additional evaluation may be indicated in some patients to characterize the likelihood or nature of the anticipated airway difficulty.

Recommendations for Evaluation of the Airway

History. An airway history should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients. The intent of the airway history is to detect medical, surgical, and anesthetic factors that may indicate the presence of a difficult airway. Examination of previous anesthetic records, if available in a timely manner, may yield useful information about airway management.

Physical Examination. An airway physical examination should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients. The intent of this examination is to detect physical characteristics that may indicate the presence of a difficult airway. Multiple airway features should be assessed (table 1).

Additional Evaluation. Additional evaluation may be indicated in some patients to characterize the likelihood or nature of the anticipated airway difficulty. The findings of the airway history and physical examination may be useful in guiding the selection of specific diagnostic tests and consultation.

II. Basic Preparation for Difficult Airway Management

Basic preparation for difficult airway management includes: (1) availability of equipment for management of a difficult airway (*i.e.*, portable storage unit), (2) informing the patient with a known or suspected difficult airway, (3) assigning an individual to provide assistance when a difficult airway is encountered, (4) preanesthetic preoxygenation by mask, and (5) administration of supplemental oxygen throughout the process of difficult airway management.

The literature is insufficient to evaluate the benefits of the availability of difficult airway management equipment, informing the patient of a known or suspected difficult airway, or assigning an individual to provide assistance when a difficult airway is encountered.

One RCT indicates that preanesthetic preoxygenation by mask maintains higher oxygen saturation values compared with room air controls (*Category A3-B evidence*).[34] Two RCTs indicate that 3 min of preanesthetic preoxygenation maintains higher oxygen saturation values compared with 1 min of preanesthetic preoxygenation (*Category A2-B evidence*).[35,36] Meta-analysis of RCTs indicate that oxygen

Including, but not limited to: length of upper incisors, relation of maxillary and mandibular incisors during normal jaw closure and voluntary protrusion, interincisor distance, visibility of uvula, shape of palate, compliance of mandibular space, thyromental distance, length and thickness of neck, and range of motion of head and neck.

saturation levels after preoxygenation are equivocal when comparing preoxygenation for 3 min with fast-track preoxygenation of four maximal breaths in 30 s (*Category A1-E evidence*).[37–41] Three RCTs indicate that times to desaturation thresholds of 93–95% oxygen concentration are longer for 3 min of preoxygenation (*Category A2-B evidence*).[37,41,42] Meta-analysis of RCTs comparing postextubation supplemental oxygen with no supplemental oxygen indicates lower frequencies of arterial desaturation during transport with supplemental oxygen to or in the postanesthesia care unit (*Category A1-B evidence*).[43–48] Subjects in the above studies do not exclusively consist of patients with difficult airways.

The consultants and ASA members strongly agree that at least one portable storage unit that contains specialized equipment for difficult airway management should be readily available. The consultants and ASA members strongly agree that if a difficult airway is known or suspected, the anesthesiologist should: (1) inform the patient (or responsible person) of the special risks and procedures pertaining to management of the difficult airway, (2) ascertain that there is at least one additional individual who is immediately available to serve as an assistant in difficult airway management, (3) administer facemask preoxygenation before initiating management of a difficult airway, and (4) actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.

Recommendations for Basic Preparation

At least one portable storage unit that contains specialized equipment for difficult airway management should be readily available (table 2). If a difficult airway is known or suspected, the following steps are recommended:

- Inform the patient (or responsible person) of the special risks and procedures pertaining to management of the difficult airway.
- Ascertain that there is at least one additional individual who is immediately available to serve as an assistant in difficult airway management.
- Administer facemask preoxygenation before initiating management of the difficult airway. The uncooperative or pediatric patient may impede opportunities for preoxygenation.
- Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management. Opportunities for supplemental oxygen administration include (but are not limited to) oxygen delivery by nasal cannulae, facemask, or LMA, insufflation; and oxygen delivery by facemask, blow-by, or nasal cannulae after extubation of the trachea.

III. Strategy for Intubation of the Difficult Airway

A preplanned preinduction strategy includes the consideration of various interventions designed to facilitate intubation should a difficult airway occur. Noninvasive interventions intended to manage a difficult airway include, but are not limited to: (1) awake intubation, (2) video-assisted laryngoscopy, (3) intubating stylets or tube-changers, (4) SGA for ventilation (*e.g.*, LMA, laryngeal tube), (5) SGA for intubation (*e.g.*, ILMA), (6) rigid laryngoscopic blades of varying design and size, (7) fiberoptic-guided intubation, and (8) lighted stylets or light wands.

Awake Intubation. Studies with observational findings indicate that awake fiberoptic intubation is successful in 88–100% of difficult airway patients (Category B3-B evidence).[49–53] Case reports using other methods for awake intubation (*e.g.*, blind tracheal intubation, intubation through supraglottic devices, optically guided intubation) also report success with difficult airway patients (Category B4-B evidence).[12,54–61]

Video-assisted Laryngoscopy. Meta-analyses of RCTs comparing video-assisted laryngoscopy with direct laryngoscopy in patients with predicted or simulated difficult airways report improved laryngeal views, a higher frequency of successful intubations, and a higher frequency of first attempt intubations with video-assisted laryngoscopy (Category A1-B evidence); no differences in time to intubation, airway trauma, lip/gum trauma, dental trauma, or sore throat were reported (Category A1-E evidence).[62–70] One RCT comparing the use of video-assisted laryngoscopy with Macintosh-assisted intubation reported no significant differences inthe degree of cervical spine deviation (Category A3-E evidence).[69] A study with observational findings and four case reports indicate that airway injury can occur during intubation with video-assisted laryngoscopy (Category B3/B4-H evidence).[71–75]

Intubating Stylets or Tube-Changers. Observational studies report successful intubation in 78–100% of difficult airway patients when intubating stylets were used (*Category B3-B evidence*).[76–81] Reported complications from intubating stylets include mild mucosal bleeding and sore throat (*Category B3-H evidence*).[80] Reported complications after the use of a tube-changer or airway exchange catheter include lung laceration and gastric perforation (*Category B4-H evidence*).[82,83]

SGAs for Ventilation. RCTs comparing the LMA with facemask for ventilation were only available for nondifficult airway patients. Case reports indicate that use of the LMA can maintain or restore ventilation for adult difficult airway patients (*Category B4-B evidence*).[84–86] Two observational studies indicate that desaturation (SpO_2 < 90%) frequencies of 0–6% occur when the LMA is used for pediatric difficult airway patients (*Category B3-H evidence*).[87,88] An observational study reports the LMA providing successful rescue ventilation in 94.1% of patients who cannot be mask ventilated or intubated (*Category B3-B evidence*).[89] Reported complications of LMA use with difficult airway patients include bronchospasm, difficulty in swallowing, respiratory obstruction, laryngeal nerve injury, edema, and hypoglossal nerve paralysis (*Category B4-H evidence*).[90–93] One observational study reports that the laryngeal tube provides adequate ventilation for 95% of patients with pharyngeal and laryngeal tumors.[94]

ILMA. RCTs comparing the ILMA with standard laryngoscopic intubation were only available for nondifficult airway patients. Observational studies report successful intubation in 71.4–100% of difficult airway patients when an ILMA was used (*Category B3-B evidence*).[95–100] One observational study indicated that when the ILMA is used with a simulated difficult airway using a semirigid collar, 3 of 10 patients were successfully intubated (*Category B3-B evidence*).[101] RCTs comparing the fiberoptic ILMA with standard fiberoptic intubation report a higher frequency of first attempt successful intubation for patients with predicted or simulated difficult airways (*Category A2-B evidence*).[102,103] Reported complications from ILMAs include sore throat, hoarseness, and pharyngeal edema (*Category B3-H evidence*).[99]

Rigid Laryngoscopic Blades of Alternative Design and Size. Observational studies indicate that the use of rigid laryngoscopic blades of alternative design may improve glottic visualization and facilitate successful intubation for difficult airway patients (*Category B3-B evidence*).[104,105]

Fiberoptic-guided Intubation. Observational studies report successful fiberoptic intubation in 87–100% of difficult airway patients (*Category B3-B evidence*).[106–117] Three RCTs comparing rigid fiberscopes (UpsherScopes, WuScopes, and Bullard laryngoscopes) with rigid direct laryngoscopy report equivocal findings for successful intubation and time to intubate; two of these studies used simulated difficult airways, and the third contained only patients with Mallampati 3–4 scores (*Category A2-E evidence*).[118–120]

Lighted Stylets or Light Wands. Observational studies report successful intubation in 96.8–100% of difficult airway patients when lighted stylets or light wands were used (*Category B3-B evidence*).[120–125] Two RCTs report equivocal findings when comparing lighted stylets with direct laryngoscopy (*Category A2-E evidence*).[126,127]

Confirmation of Tracheal Intubation. Studies with observational findings report that capnography or end-tidal carbon dioxide monitoring confirms tracheal intubation in 88.5–100% of difficult airway patients (*Category B3-B evidence*).[128–130]

The consultants and ASA members strongly agree that the anesthesiologist should have a *preplanned strategy* for intubation of the difficult airway. The consultants and ASA members strongly agree that the strategy for intubation of the difficult airway should include the identification of a primary or preferred approach to: (1) awake intubation, (2) the patient who can be adequately ventilated but who is difficult to intubate, and (3) the life-threatening situation in which the patient cannot be ventilated or intubated. The consultants and ASA members strongly agree that the strategy for intubation of the difficult airway should include the identification of alternative approaches that can be used if the primary approach fails or is not feasible. The consultants and ASA members strongly agree that the strategy for intubation of the difficult airway should include confirmation of tracheal intubation (*e.g.*, capnography).

Recommendations for Strategy for Intubation

The anesthesiologist should have a preformulated strategy for intubation of the difficult airway. The algorithm shown in figure 1 is a recommended strategy. This strategy will depend, in part, on the anticipated surgery, the condition of the patient, and the skills and preferences of the anesthesiologist. The recommended strategy for intubation of the difficult airway includes:

- An assessment of the likelihood and anticipated clinical impact of six basic problems that may occur alone or in combination: (1) difficulty with patient cooperation or consent, (2) difficult mask ventilation, (3) difficult SGA placement, (4) difficult laryngoscopy, (5) difficult intubation, and (6) difficult surgical airway access.
- A consideration of the relative clinical merits and feasibility of four basic management choices: (1) awake intubation *versus* intubation after induction of general anesthesia, (2) noninvasive techniques *versus* invasive techniques (*i.e.*, surgical or percutaneous airway) for the initial approach to intubation, (3) video-assisted laryngoscopy as an initial approach to intubation, and (4) preservation *versus* ablation of spontaneous ventilation.
- The identification of a primary or preferred approach to: (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, and (3) the life-threatening situation in which the patient cannot be ventilated or intubated.
- The identification of alternative approaches that can be used if the primary approach fails or is not feasible (table 3).
    - The uncooperative or pediatric patient may restrict the options for difficult airway management, particularly options that involve awake intubation. Airway management in the uncooperative or pediatric patient may require an approach (*e.g.*, intubation attempts after induction of general anesthesia) that might not be regarded as a primary approach in a cooperative patient.
    - The conduct of surgery using local anesthetic infiltration or regional nerve blockade may provide an alternative to the direct management of the difficult airway, but this approach does not represent a definitive solution to the presence of a difficult airway, nor does it obviate the need for a preformulated strategy for intubation of the difficult airway.
- Confirmation of tracheal intubation using capnography or end-tidal carbon dioxide monitoring.

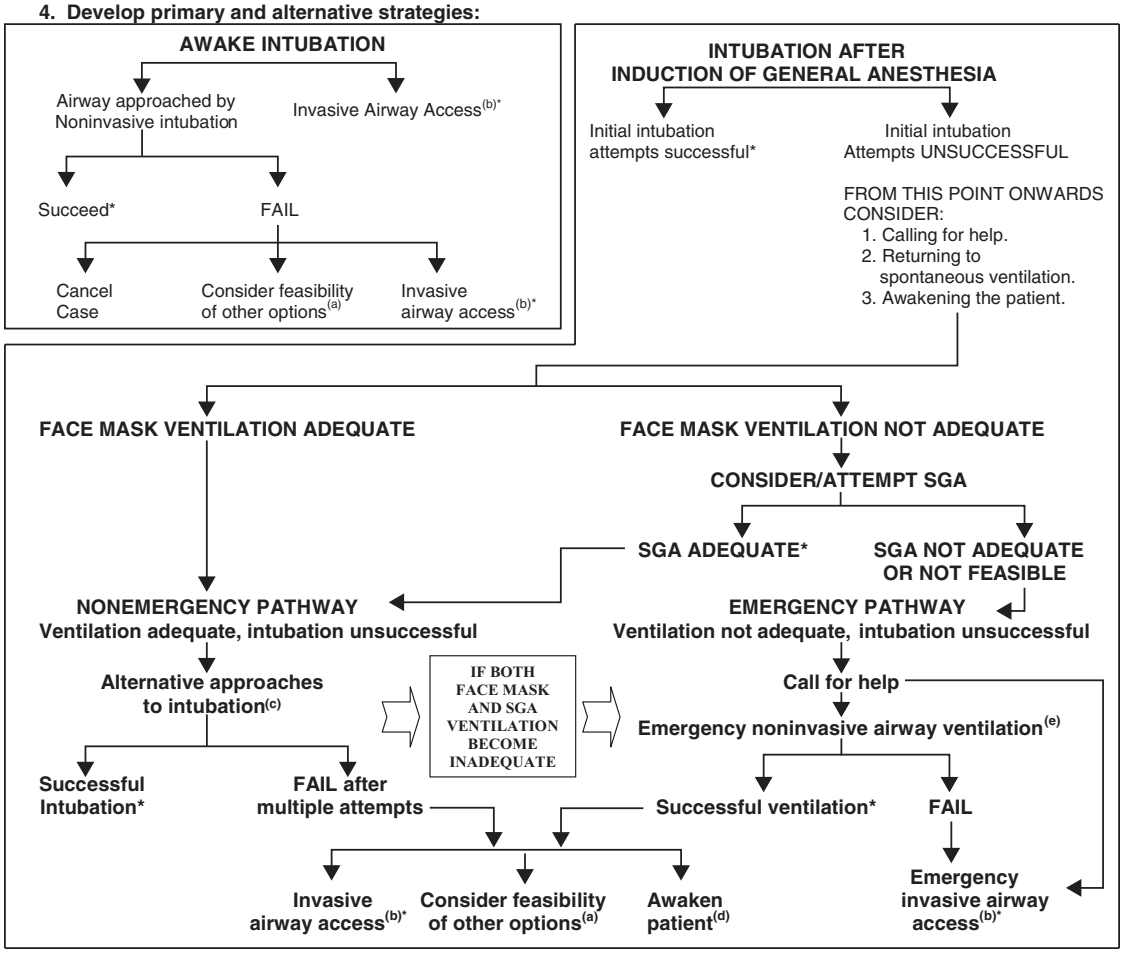
IV. Strategy for Extubation of the Difficult Airway

The literature does not provide a sufficient basis for evaluating the benefits of an extubation strategy for the difficult airway. For purposes of this Guideline, an extubation strategy is considered to be a logical extension of the intubation strategy.

American Society of Anesthesiologists®

DIFFICULT AIRWAY ALGORITHM

1. **Assess the likelihood and clinical impact of basic management problems:**
   - **Difficulty with patient cooperation or consent**
   - **Difficult mask ventilation**
   - **Difficult supraglottic airway placement**
   - **Difficult laryngoscopy**
   - **Difficult intubation**
   - **Difficult surgical airway access**
2. **Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.**
3. **Consider the relative merits and feasibility of basic management choices:**
   - **Awake intubation *vs.* intubation after induction of general anesthesia**
   - **Non-invasive technique *vs.* invasive techniques for the initial approach to intubation**
   - **Video-assisted laryngoscopy as an initial approach to intubation**
   - **Preservation *vs.* ablation of spontaneous ventilation**
4. **Develop primary and alternative strategies:**



***Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO_2.**

a. Other options include (but are not limited to): surgery utilizing face mask or supraglottic airway (SGA) anesthesia (e.g., LMA, ILMA, laryngeal tube), local anesthesia infiltration or regional nerve blockade. Pursuit of these options usually implies that mask ventilation will not be problematic. Therefore, these options may be of limited value if this step in the algorithm has been reached via the Emergency Pathway.

b. Invasive airway access includes surgical or percutaneous airway, jet ventilation, and retrograde intubation.

c. Alternative difficult intubation approaches include (but are not limited to): video-assisted laryngoscopy, alternative laryngoscope blades, SGA (e.g., LMA or ILMA) as an intubation conduit (with or without fiberoptic guidance), fiberoptic intubation, intubating stylet or tube changer, light wand, and blind oral or nasal intubation.

d. Consider re-preparation of the patient for awake intubation or canceling surgery.

e. Emergency non-invasive airway ventilation consists of a SGA.

Fig. 1. Difficult Airway Algorithm.

The consultants and ASA members strongly agree that the preformulated extubation strategy should include consideration of: (1) the relative merits of awake extubation *versus* extubation before the return of consciousness, (2) general clinical factors that may produce an adverse impact on ventilation after the patient has been extubated, and (3) an airway management plan that can be implemented if the patient is not able to maintain adequate ventilation after extubation. The ASA members agree and the consultants strongly agree that the preformulated extubation strategy should include consideration of the short-term use of a device that can serve as a guide for expedited reintubation.

Recommendations for Extubation

The anesthesiologist should have a preformulated strategy for extubation of the difficult airway. This strategy will depend, in part, on the surgery, the condition of the patient, and the skills and preferences of the anesthesiologist.

The recommended strategy for extubation of the difficult airway includes consideration of:

- The relative merits of awake extubation *versus* extubation before the return of consciousness.
- General clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.
- An airway management plan that can be implemented if the patient is not able to maintain adequate ventilation after extubation.
- Short-term use of a device that can serve as a guide for expedited reintubation. This type of device can be a stylet (intubating bougie) or conduit. Stylets or intubating bougies are usually inserted through the lumen of the tracheal tube and into the trachea before the tracheal tube is removed. Stylets or intubating bougies mayinclude a hollow core that can be used to provide a temporary means of oxygenation and ventilation. Conduits are usually inserted through the mouth and can be used for supraglottic ventilation and intubation. The ILMA and LMA are examples of conduits.

V. Follow-up Care

Follow-up care includes: (1) documentation of difficult airway and management and (2) informing and advising the patient (or responsible person) of the occurrence and potential complications associated with the difficult airway. The literature is insufficient to evaluate the benefits of follow-up care for difficult airway patients.

The consultants and ASA members strongly agree that the anesthesiologist should: (1) document the presence and nature of the airway difficulty in the medical record, (2) inform the patient or responsible person of the airway difficulty that was encountered, and (3) evaluate and follow-up with the patient for potential complications of difficult airway management. The consultants and ASA members strongly agree that the patient should be advised of the potential clinical signs and symptoms associated with life-threatening complications of difficult airway management.

Recommendations for Follow-up Care

The anesthesiologist should document the presence and nature of the airway difficulty in the medical record. The intent of this documentation is to guide and facilitate the delivery of future care. Aspects of documentation that may prove helpful include:

- A description of the airway difficulties that were encountered. The description should distinguish between difficulties encountered in facemask or SGA ventilation and difficulties encountered in tracheal intubation.
- A description of the various airway management techniques that were used. The description should indicate the extent to which each of the techniques served a beneficial or detrimental role in management of the difficult airway.

The anesthesiologist should inform the patient (or responsible person) of the airway difficulty that was encountered. The intent of this communication is to provide the patient (or responsible person) with a role in guiding and facilitating the delivery of future care. The information conveyed may include (but is not limited to) the presence of a difficult airway, the apparent reasons for difficulty, how the intubation was accomplished, and the implications for future care. Notification systems, such as a written report or letter to the patient, a written report in the medical chart, communication with the patient's surgeon or primary caregiver, a notification bracelet or equivalent identification device, or chart flags, may be considered.

The anesthesiologist should evaluate and follow-up with the patient for potential complications of difficult airway management. These complications include (but are not limited to) edema, bleeding, tracheal and esophageal perforation, pneumothorax, and aspiration. The patient should be advised of the potential clinical signs and symptoms associated with life-threatening complications of difficult airway management. These signs and symptoms include (but are not limited to) sore throat, pain or swelling of the face and neck, chest pain, subcutaneous emphysema, and difficulty swallowing.

Appendix 1: Summary of Recommendations

I. Evaluation of the Airway

- An airway history should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.
    - The intent of the airway history is to detect medical, surgical, and anesthetic factors that may indicate the presence of a difficult airway.
    - Examination of previous anesthetic records, if available in a timely manner, may yield useful information about airway management.

- An airway physical examination should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.
    - The intent of the physical examination is to detect physical characteristics that may indicate the presence of a difficult airway.
    - Multiple airway features should be assessed.
- Additional evaluation may be indicated in some patients to characterize the likelihood or nature of the anticipated airway difficulty.
- The findings of the airway history and physical examination may be useful in guiding the selection of specific diagnostic tests and consultation.

II. Basic Preparation for Difficult Airway Management

- At least one portable storage unit that contains specialized equipment for difficult airway management should be readily available.
- If a difficult airway is known or suspected, the following steps are recommended:
    - Inform the patient (or responsible person) of the special risks and procedures pertaining to management of the difficult airway.
    - Ascertain that there is at least one additional individual who is immediately available to serve as an assistant in difficult airway management.
    - Administer facemask preoxygenation before initiating management of the difficult airway. The uncooperative or pediatric patient may impede opportunities for preoxygenation.
    - Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.
        - Opportunities for supplemental oxygen administration include (but are not limited to) oxygen delivery by nasal cannulae, facemask or laryngeal mask airway, insufflation; and oxygen delivery by facemask, blow-by, or nasal cannulae after extubation of the trachea.

III. Strategy for Intubation of the Difficult Airway

- The anesthesiologist should have a preformulated strategy for intubation of the difficult airway. The algorithm shown in figure 1 is a recommended strategy.
    - This strategy will depend, in part, on the anticipated surgery, the condition of the patient, and the skills and preferences of the anesthesiologist.
- The recommended strategy for intubation of the difficult airway includes:
    - An assessment of the likelihood and anticipated clinical impact of six basic problems that may occur alone or in combination: (1) difficulty with patient cooperation or consent, (2) difficult mask ventilation, (3) difficult supraglottic airway placement, (4) difficult laryngoscopy, (5) difficult intubation, and (6) difficult surgical airway access.
    - A consideration of the relative clinical merits and feasibility of four basic management choices: (1) awake intubation *versus* intubation after induction of general anesthesia, (2) noninvasive techniques *versus* invasive techniques (*i.e.*, surgical or percutaneous surgical airway) for the initial approach to intubation, (3) video-assisted laryngoscopy as an initial approach to intubation, and (4) preservation *versus* ablation of spontaneous ventilation.
    - The identification of a primary or preferred approach to: (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, and (3) the life-threatening situation in which the patient cannot be ventilated or intubated.
- The identification of alternative approaches that can be used if the primary approach fails or is not feasible.
    - The uncooperative or pediatric patient may restrict the options for difficult airway management, particularly options that involve awake intubation.
    - Airway management in the uncooperative or pediatric patient may require an approach (*e.g.*, intubation attempts after induction of general anesthesia) that might not be regarded as a primary approach in a cooperative patient.
    - The conduct of surgery using local anesthetic infiltration or regional nerve blockade may provide an alternative to the direct management of the difficult airway, but this approach does not represent a definitive solution to the presence of a difficult airway, nor does it obviate the need for a preformulated strategy for intubation of the difficult airway.
- Confirmation of tracheal intubation with capnography or end-tidal carbon dioxide monitoring.

IV. Strategy for Extubation of the Difficult Airway

- The anesthesiologist should have a preformulated strategy for extubation of the difficult airway.
    - This strategy will depend, in part, on the surgery, the condition of the patient, and the skills and preferences of the anesthesiologist.
    - The recommended strategy for extubation of the difficult airway includes consideration of:
        - The relative merits of awake extubation *versus* extubation before the return of consciousness.
        - General clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.

- An airway management plan that can be implemented if the patient is not able to maintain adequate ventilation after extubation.
- Short-term use of a device that can serve as a guide for expedited reintubation. This type of device can be a stylet (intubating bougie) or conduit. Stylets or intubating bougies are usually inserted through the lumen of the tracheal tube and into the trachea before the tracheal tube is removed. Stylets or intubating bougies may include a hollow core that can be used to provide a temporary means of oxygenation and ventilation. Conduits are usually inserted through the mouth and can be used for supraglottic ventilation and intubation. The intubating laryngeal mask airway and laryngeal mask airway are examples of conduits.

V. Follow-up Care

- The anesthesiologist should document the presence and nature of the airway difficulty in the medical record. The intent of this documentation is to guide and facilitate the delivery of future care. Aspects of documentation that may prove helpful include (but are not limited to):
  - A description of the airway difficulties that were encountered. The description should distinguish between difficulties encountered in facemask or supraglottic airway ventilation and difficulties encountered in tracheal intubation.
  - A description of the various airway management techniques that were used. The description should indicate the extent to which each of the techniques served a beneficial or detrimental role in management of the difficult airway.
- The anesthesiologist should inform the patient (or responsible person) of the airway difficulty that was encountered.
  - The intent of this communication is to provide the patient (or responsible person) with a role in guiding and facilitating the delivery of future care.
  - The information conveyed may include (but is not limited to) the presence of a difficult airway, the apparent reasons for difficulty, how the intubation was accomplished, and the implications for future care.
  - Notification systems, such as a written report or letter to the patient, a written report in the medical chart, communication with the patient's surgeon or primary caregiver, a notification bracelet or equivalent identification device, or chart flags, may be considered.
- The anesthesiologist should evaluate and follow-up with the patient for potential complications of difficult airway management.
  - These complications include (but are not limited to) edema, bleeding, tracheal and esophageal perforation, pneumothorax, and aspiration.
  - The patient should be advised of the potential clinical signs and symptoms associated with life-threatening complications of difficult airway management.
  - These signs and symptoms include (but are not limited to) sore throat, pain or swelling of the face and neck, chest pain, subcutaneous emphysema, and difficulty swallowing.

Appendix 2: Methods and Analyses

A. State of the Literature.

For these updated Guidelines, a review of studies used in the development of the previous update†† was combined with new studies published from 2002–2012. The scientific assessment of these Guidelines was based on evidence linkages or statements regarding potential relationships between clinical interventions and outcomes. The interventions listed below were examined to assess their relationship to a variety of outcomes related to difficult airway management.

Evaluation of the Airway:

A directed patient history
A directed airway physical examination
Diagnostic tests (*e.g.*, radiography)

Basic Preparation for Difficult Airway Management:

Informing the patient with a known or suspected difficult airway
Availability of equipment for management of a difficult airway (*i.e.*, a portable storage unit)
Availability of an assigned individual to provide assistance when a difficult airway is encountered
Preanesthetic preoxygenation by facemask before induction of anesthesia

Strategies for Intubation and Ventilation:

Awake intubation
Adequate facemask ventilation after induction:

- Videolaryngoscopy
- Intubating stylet, tube-changer, or gum elastic bougie

Laryngeal mask airway:

- Laryngeal mask airway *versus* facemask
- Laryngeal mask airway *versus* tracheal intubation
- Laryngeal mask airway *versus* oropharyngeal airway

Intubating laryngeal mask airway or the laryngeal mask airway as an intubation conduit

††American Society of Anesthesiologists: Practice Guidelines for Management of the Difficult Airway: An Updated Report. Anesthesiology 2003; 98:1269–1277.

Rigid laryngoscopic blades of alternative design or size
Fiberoptic-guided intubation
A lighted stylet or light wand

Inadequate Facemask Ventilation After Induction—Cannot Intubate:

Laryngeal mask airway for emergency ventilation
Rigid bronchoscope
Confirmation of tracheal intubation with capnography or end-tidal carbon dioxide monitoring
Awake extubation
Supplemental oxygen:
- Supplemental oxygen delivery before induction by facemask or insufflation
- Supplemental oxygen delivery after extubation by facemask, blow-by, or nasal cannulae of the trachea

Follow-up Care:

Postextubation care and counseling
Documentation of a difficult airway and its management
Registration with an emergency notification service

For the literature review, potentially relevant clinical studies were identified *via* electronic and manual searches of the literature. The updated electronic search covered an 11-yr period from 2002 through 2012. The manual search covered a 16-yr period from 1997 through 2012. Over 400 citations that addressed topics related to the evidence linkages were identified. These articles were reviewed and combined with pre-2002 articles used in the original Guidelines, resulting in a total of 693 articles that contained airway management data. Of these, 253 contained data pertaining specifically to difficult airway management. The remaining 440 articles used nondifficult airway patients or an inseparable mix of difficult and nondifficult airway patients as subjects, and findings from these articles are not considered direct evidence. A complete bibliography used to develop these updated Guidelines, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com/ALN/A903.

Initially, each pertinent study finding was classified and summarized to determine meta-analysis potential. The original Guidelines reported literature pertaining to seven clinical interventions that contained enough studies with well-defined experimental designs and statistical information to conduct formal meta-analyses. New literature pertaining to two clinical interventions contained enough studies with well-defined experimental designs and statistical information sufficient for meta-analyses. These interventions were: (1) preoxygenation: 3–5 min of breathing oxygen *versus* four maximal breaths, and (2) postextubation supplemental oxygen: delivery by mask, blow-by, or nasal cannulae *versus* room air.

General variance-based effect-size estimates or combined probability tests were obtained for continuous outcome measures, and Mantel–Haenszel odds ratios were obtained for dichotomous outcome measures. Two combined probability tests were used as follows: (1) the Fisher combined test, producing chi-square values based on logarithmic transformations of the reported *P* values from the independent studies, and (2) the Stouffer combined test, providing weighted representation of the studies by weighting each of the standard normal deviates by the size of the sample. An odds ratio procedure based on the Mantel–Haenszel method for combining study results using 2×2 tables was used with outcome frequency information. An acceptable significance level was set at $P < 0.01$ (one-tailed). Tests for heterogeneity of the independent studies were conducted to ensure consistency among the study results. DerSimonian–Laird random-effects odds ratios were obtained when significant heterogeneity was found ($P < 0.01$). To control for potential publishing bias, a "fail-safe n" value was calculated. No search for unpublished studies was conducted, and no reliability tests for locating research results were performed. To be accepted as significant findings, Mantel–Haenszel odds ratios must agree with combined test results whenever both types of data are assessed. In the absence of Mantel–Haenszel odds ratios, findings from both the Fisher and weighted Stouffer combined tests must agree with each other to be acceptable as significant.

New meta-analytic findings were obtained for the following evidence linkages: (1) preoxygenation for 3-5 min *versus* 4 deep breaths, (2) videolaryngoscope *versus* direct laryngoscopy, and (3) supplemental oxygen after extubation (table 4).

In the original Guidelines, interobserver agreement among Task Force members and two methodologists was established by interrater reliability testing. Agreement levels using a kappa (κ) statistic for two-rater agreement pairs were as follows: (1) type of study design, $\kappa = 0.64–0.78$; (2) type of analysis, $\kappa = 0.78–0.85$; (3) evidence linkage assignment, $\kappa = 0.89–0.95$; and (4) literature inclusion for database, $\kappa = 0.62–1.00$. Three-rater chance-corrected agreement values were: (1) study design, Sav = 0.73, Var (Sav) = 0.008; (2) type of analysis, Sav = 0.80, Var (Sav) = 0.008; (3) linkage assignment, Sav = 0.93, Var (Sav) = 0.003; (4) literature database inclusion, Sav = 0.80, Var (Sav) = 0.032. These values represent moderate to high levels of agreement. For the updated Guidelines, the same two methodologists involved in the original Guidelines conducted the literature review.

B. Consensus-Based Evidence

Consensus was obtained from multiple sources, including: (1) survey opinion from consultants who were selected based on their knowledge or expertise in difficult airway management, (2) survey opinions solicited from active members of the American Society of Anesthesiologists, (3) testimony for the previous update from attendees of a publicly held open-forum at a major national anesthesia meeting‡‡, (4) Internet commentary, and (5) Task Force opinion and interpretation. The survey rate of return was 63% (n = 66 of 105) for the consultants (table 5), and 302 surveys were

‡‡American Society of Anesthesiologists Annual Meeting, Dallas, TX, October, 1999.

received from active American Society of Anesthesiologists members (table 6).

An additional survey was sent to the expert consultants asking them to indicate which, if any, of the evidence linkages would change their clinical practices if the Guideline update was instituted. The rate of return was 24% (n = 25 of 105). The percent of responding consultants expecting no change associated with each linkage were as follows: (1) airway history = 84%, (2) airway physical examination =88%, (3) preparation of patient and equipment = 80%, and (4) difficult airway strategy = 80%, extubation strategy =64% and follow-up care = 72%. Eighty-eight percent of the respondents indicated that the Guidelines would have no effect on the amount of time spent on a typical case, and 12% indicated that there would be an increase of the amount of time spent on a typical case with the implementation of these Guidelines. Hundred percent indicated that new equipment, supplies, or training would not be needed to implement the Guidelines, and 100% indicated that implementation of the Guidelines would not require changes in practice that would affect costs.

Table 1. Components of the Preoperative Airway Physical Examination

Airway Examination Component	Nonreassuring Findings
Length of upper incisors	Relatively long
Relationship of maxillary and mandibular incisors during normal jaw closure	Prominent "overbite" (maxillary incisors anterior to mandibular incisors)
Relationship of maxillary and mandibular incisors during voluntary protrusion of mandible	Patient cannot bring mandibular incisors anterior to (in front of) maxillary incisors
Interincisor distance	Less than 3 cm
Visibility of uvula	Not visible when tongue is protruded with patient in sitting position (*e.g.*, Mallampati class >2)
Shape of palate	Highly arched or very narrow
Compliance of mandibular space	Stiff, indurated, occupied by mass, or nonresilient
Thyromental distance	Less than three ordinary finger breadths
Length of neck	Short
Thickness of neck	Thick
Range of motion of head and neck	Patient cannot touch tip of chin to chest or cannot extend neck

This table displays some findings of the airway physical examination that may suggest the presence of a difficult intubation. The decision to examine some or all of the airway components shown on this table is dependent on the clinical context and judgment of the practitioner. The table is not intended as a mandatory or exhaustive list of the components of an airway examination. The order of presentation in this table follows the "line of sight" that occurs during conventional oral laryngoscopy.

Table 2. Suggested Contents of the Portable Storage Unit for Difficult Airway Management

Rigid laryngoscope blades of alternate design and size from those routinely used; this may include a rigid fiberoptic laryngoscope.
Videolaryngoscope.
Tracheal tubes of assorted sizes.
Tracheal tube guides. Examples include (but are not limited to) semirigid stylets, ventilating tube-changer, light wands, and forceps designed to manipulate the distal portion of the tracheal tube.
Supraglottic airways (*e.g.*, LMA or ILMA of assorted sizes for noninvasive airway ventilation/intubation).
Flexible fiberoptic intubation equipment.
Equipment suitable for emergency invasive airway access.
An exhaled carbon dioxide detector.

The items listed in this table represent suggestions. The contents of the portable storage unit should be customized to meet the specific needs, preferences, and skills of the practitioner and healthcare facility.

ILMA = intubating LMA; LMA = laryngeal mask airway.

Table 3. Techniques for Difficult Airway Management

Techniques for Difficult Intubation	Techniques for Difficult Ventilation
Awake intubation	Intratracheal jet stylet
Blind intubation (oral or nasal)	Invasive airway access
Fiberoptic intubation	Supraglottic airway
Intubating stylet or tube-changer	Oral and nasopharyngeal airways
Supraglottic airway as an intubating conduit	Rigid ventilating bronchoscope
Laryngoscope blades of varying design and size	Two-person mask ventilation
Light wand	
Videolaryngoscope	

This table displays commonly cited techniques. It is not a comprehensive list. The order of presentation is alphabetical and does not imply preference for a given technique or sequence of use. Combinations of techniques may be used. The techniques chosen by the practitioner in a particular case will depend on specific needs, preferences, skills, and clinical constraints.

Table 4. Meta-analysis Summary

Evidence Linkages	N	Fisher Chi-Square	*P*	Weighted Stouffer Z_c	*P*	Effect Size	Odds Ratio	CI	Heterogeneity *P*	Heterogeneity Effect Size
Preoxygenation for 3–5 min *vs.* 4 deep breaths										
Oxygen saturation after preoxygenation	5	41.17	0.001	−0.46	0.323	0.31			0.001	0.001
Videolaryngoscope vs. direct laryngoscopy										
Laryngeal view grade 1	7						7.11*	2.58–10.72		0.001
Laryngeal view grades 1 and 2	7						5.29	3.36–8.33		0.414
Successful intubation	9						3.24	1.59–6.61		0.745
Successful first attempt intubation	6						3.10	1.66–5.81		0.247
Time to intubation	7	72.86	0.001	2.23	0.013	0.05			0.001	0.001
Supplemental oxygen after extubation										
Hypoxemia	6						0.18	0.10–0.32		0.486

* Random effects odds ratio.

CI = 99% confidence interval.

Table 5. Consultant Survey Responses†

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
1. The likelihood and clinical impact of the following basic management problems should be assessed:						
Difficulty with patient cooperation or consent	66	60.6*	33.3	3.0	3.0	0.0
Difficult mask ventilation	66	93.9*	6.1	0.0	0.0	0.0
Difficult supraglottic placement	66	75.8*	21.2	1.5	1.5	0.0
Difficult laryngoscopy	66	84.8*	10.6	4.6	0.0	0.0
Difficult intubation	66	89.4*	9.1	1.5	0.0	0.0
Difficult surgical airway access	66	71.2*	24.2	4.6	0.0	0.0
2. Opportunities to deliver supplemental oxygen should be actively pursued throughout the process of difficult airway management.	66	86.4*	10.6	1.5	1.5	0.0
3. The relative merits and feasibility of the following basic management choices should be considered:						
Awake intubation *vs.* intubation after induction of general anesthesia.	66	78.8*	19.7	1.5	3.0	0.0
Noninvasive technique *vs.* invasive technique for initial approach to intubation.	66	54.5*	34.8	9.1	1.5	0.0
Preservation of spontaneous ventilation *vs.* ablation of spontaneous ventilation.	66	74.2*	21.2	1.5	1.5	1.5
Use of video-assisted laryngoscopy *vs.* rigid laryngoscopic blades as an initial approach to intubation.	66	48.5	25.8*	16.7	7.6	1.5
4. The following airway devices should be options for emergency noninvasive airway ventilation:						
Rigid bronchoscope	66	13.6	33.3	16.7*	30.3	6.1
Fiberoptic bronchoscope	66	69.7*	12.1	3.0	12.1	3.0
Supraglottic airway	66	92.4*	7.6	0.0	0.0	0.0

(continued)

Table 5. (*Continued*)

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
5. A videolaryngoscope should be included in the portable storage unit for difficult airway management.	66	71.2*	18.2	7.6	3.0	0.0
6. Transtracheal jet ventilation should be considered an example of: (check one)	66					
Invasive airway ventilation 95.4%						
Noninvasive airway ventilation 4.6%						
7. An airway history should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.	66	90.9*	6.1	3.0	0.0	0.0
8. An airway physical examination should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.	66	92.4*	7.6	0.0	0.0	0.0
9. Multiple airway features should be assessed‡	66	80.3*	10.6	6.1	3.0	0.0
10. Additional evaluation may be indicated in some patients to characterize the likelihood or nature of anticipated airway difficulty.	66	51.5*	39.4	6.1	1.5	1.5
11. At least one portable storage unit that contains specialized equipment for difficult airway management should be readily available.	66	92.4*	6.1	1.5	0.0	0.0
12. If a difficult airway is known or suspected, the anesthesiologist should inform the patient (or responsible person) of the special risks and procedures pertaining to management of the difficult airway.	66	78.8*	19.7	1.5	0.0	0.0
13. If a difficult airway is known or suspected, the anesthesiologist should ascertain that there is at least one additional individual who is immediately available to serve as an assistant in difficult airway management.	66	65.2*	25.7	9.1	0.0	0.0
14. If a difficult airway is known or suspected, the anesthesiologist should administer facemask preoxygenation before initiating management of the difficult airway.	66	71.2*	15.1	6.1	7.6	0.0
15. If a difficult airway is known or suspected, the anesthesiologist should actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.	66	86.4*	13.6	0.0	0.0	0.0
16. The anesthesiologist should have a preformulated strategy for intubation of the difficult airway.	66	95.5*	3.0	1.5	0.0	0.0
17. The strategy for intubation of the difficult airway should include consideration of the relative clinical merits and feasibility of four basic management choices:						
Awake intubation *vs.* intubation after induction of general anesthesia.	66	89.4*	7.6	1.5	1.5	0.0
Noninvasive techniques for the initial approach to intubation *vs*. invasive techniques (*i.e.*, surgical or percutaneous airway).	66	71.2*	25.8	3.0	0.0	0.0
Video-assisted laryngoscopy as an initial approach to intubation.	66	48.5	22.7*	16.7	10.6	1.5
Preservation *vs.* ablation of spontaneous ventilation.	66	80.3*	12.1	6.1	0.0	1.5
18. The strategy for intubation of the difficult airway should include the identification of a primary or preferred approach to:						
Awake intubation.	66	71.2*	24.2	3.0	0.0	1.5
The patient who can be adequately ventilated but who is difficult to intubate.	66	77.3*	19.7	3.0	0.0	0.0
The life-threatening situation in which the patient cannot be ventilated or intubated.	66	93.9*	6.1	0.0	0.0	0.0
19. The strategy for intubation of the difficult airway should include the identification of alternative approaches that can be used if the primary approach fails or is not feasible.	66	98.5*	1.5	0.0	0.0	0.0

(continued)

Table 5. (*Continued*)

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
20. The strategy for intubation of the difficult airway should include confirmation of tracheal intubation (*e.g.*, capnography).	66	98.5*	1.5	0.0	0.0	0.0
21. The preformulated extubation strategy should include consideration of:						
The relative merits of awake extubation *vs*. extubation before the return of consciousness.	66	72.7*	21.2	3.0	1.5	1.5
General clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.	66	84.8*	15.2	0.0	0.0	0.0
An airway management plan that can be implemented if the patient is not able to maintain adequate ventilation after extubation.	66	89.4*	9.1	1.5	0.0	0.0
Short-term use of a device that can serve as a guide for expedited reintubation.	66	63.6*	28.8	7.6	0.0	0.0
22. The anesthesiologist should document the presence and nature of the airway difficulty in the medical record.	66	95.5*	4.5	0.0	0.0	0.0
23. The anesthesiologist should inform the patient (or responsible person) of the airway difficulty that was encountered.	66	87.9*	12.1	0.0	0.0	0.0
24. The anesthesiologist should evaluate and follow-up with the patient for potential complications of difficult airway management.	66	77.3*	19.7	3.0	0.0	0.0
25. The patient should be advised of the potential clinical signs and symptoms associated with life-threatening complications of difficult airway management.	66	65.1*	25.8	7.6	1.5	0.0

*Median; †N = number of consultants who responded to each item. An asterisk beside a percentage score indicates the median. ‡Including, but not limited to, length of upper incisors, relation of maxillary and mandibular incisors during normal jaw closure and voluntary protrusion, interincisor distance, visibility of uvula, shape of palate, compliance of mandibular space, thyromental distance, length and thickness of neck, and range of motion of the head and neck.

Table 6. ASA Members Survey Responses†

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
1. The likelihood and clinical impact of the following basic management problems should be assessed:						
Difficulty with patient cooperation or consent	302	49.7	36.4*	8.6	4.0	1.3
Difficult mask ventilation	302	81.8*	15.9	1.0	1.3	0.0
Difficult supraglottic placement	302	64.5*	28.5	5.0	2.0	0.0
Difficult laryngoscopy	302	84.4*	14.6	0.3	0.7	0.0
Difficult intubation	302	87.7*	12.3	0.0	0.0	0.0
Difficult surgical airway access	302	54.6*	32.5	11.3	1.3	0.3
2. Opportunities to deliver supplemental oxygen should be actively pursued throughout the process of difficult airway management.	302	79.8*	16.9	3.0	0.3	0.0

(continued)

Table 6. (*Continued*)

		Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
3. The relative merits and feasibility of the following basic management choices should be considered:						
Awake intubation *vs*. intubation after induction of general anesthesia.	302	73.8*	23.2	2.3	0.7	0.0
Noninvasive technique *vs*. invasive technique for initial approach to intubation.	302	52.0*	37.1	9.6	1.3	0.0
Preservation of spontaneous ventilation *vs*. ablation of spontaneous ventilation.	302	65.2*	28.5	5.3	1.0	0.0
Use of video-assisted laryngoscopy *vs*. rigid laryngoscopic blades as an initial approach to intubation.	302	53.0*	29.5	12.9	4.6	0.0
4. The following airway devices should be options for emergency noninvasive airway ventilation:						
Rigid bronchoscope	302	6.3	21.5	33.7*	31.5	7.0
Fiberoptic bronchoscope	302	64.2*	19.2	4.6	8.9	3.0
Supraglottic airway	302	91.4*	8.3	0.3	0.0	0.0
5. A videolaryngoscope should be included in the portable storage unit for difficult airway management.	302	69.5*	20.5	6.6	3.3	0.0
6. Transtracheal jet ventilation should be considered an example of: (check one)	302					
Invasive airway ventilation 95.7%						
Noninvasive airway ventilation 4.3%						
7. An airway history should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.	302	87.1*	10.9	0.7	1.3	0.0
8. An airway physical examination should be conducted, whenever feasible, before the initiation of anesthetic care and airway management in all patients.	302	91.1*	7.9	0.7	0.3	0.0
9. Multiple airway features should be assessed.‡	302	71.8*	22.5	2.6	2.0	1.0
10. Additional evaluation may be indicated in some patients to characterize the likelihood or nature of anticipated airway difficulty.	302	55.6*	35.1	7.6	1.3	0.3
11. At least one portable storage unit that contains specialized equipment for difficult airway management should be readily available.	302	85.8*	12.2	2.0	0.0	0.0
12. If a difficult airway is known or suspected, the anesthesiologist should inform the patient (or responsible person) of the special risks and procedures pertaining to management of the difficult airway.	302	73.8*	24.2	1.7	0.0	0.3
13. If a difficult airway is known or suspected, the anesthesiologist should ascertain that there is at least one additional individual who is immediately available to serve as an assistant in difficult airway management.	302	58.3*	30.5	6.9	3.0	1.3
14. If a difficult airway is known or suspected, the anesthesiologist should administer facemask preoxygenation before initiating management of the difficult airway.	302	77.8*	14.2	5.3	2.0	0.7
15. If a difficult airway is known or suspected, the anesthesiologist should actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.	302	73.5*	22.5	3.6	0.3	0.0
16. The anesthesiologist should have a preformulated strategy for intubation of the difficult airway.	302	84.4*	14.9	0.7	0.0	0.0
17. The strategy for intubation of the difficult airway should include consideration of the relative clinical merits and feasibility of four basic management choices:						
Awake intubation *vs.* intubation after induction of general anesthesia.	302	76.5*	21.5	2.0	1.5	0.0
Noninvasive techniques for the initial approach to intubation *vs*. invasive techniques (*i.e.*, surgical or percutaneous airway).	302	62.2*	34.8	2.3	0.7	0.0

(*continued*)

Table 6. (*Continued*)

	Percent Responding to Each Item					
	N	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Video-assisted laryngoscopy as an initial approach to intubation.	302	53.6*	33.1	8.6	3.3	1.3
Preservation *vs.* ablation of spontaneous ventilation.	302	62.6*	29.1	6.3	2.0	0.0
18. The strategy for intubation of the difficult airway should include the identification of a primary or preferred approach to:						
Awake intubation.	302	61.9*	31.5	5.6	1.0	0.0
The patient who can be adequately ventilated but who is difficult to intubate.	302	62.2*	35.1	2.0	0.7	0.0
The life-threatening situation in which the patient cannot be ventilated or intubated.	302	85.1*	13.9	1.0	0.0	0.0
19. The strategy for intubation of the difficult airway should include the identification of alternative approaches that can be used if the primary approach fails or is not feasible.	302	86.4*	13.2	0.3	0.0	0.0
20. The strategy for intubation of the difficult airway should include confirmation of tracheal intubation (*e.g.*, capnography).	302	90.4*	9.6	0.0	0.0	0.0
21. The preformulated extubation strategy should include consideration of:	302	76.2*	18.2	2.6	1.7	1.3
The relative merits of awake extubation *vs*. extubation before the return of consciousness.						
General clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.	302	73.8*	22.8	3.0	0.3	0.0
An airway management plan that can be implemented if the patient is not able to maintain adequate ventilation after extubation.	302	75.5*	23.2	1.0	0.3	0.0
Short-term use of a device that can serve as a guide for expedited reintubation.	302	45.4	36.7*	14.5	2.0	1.3
22. The anesthesiologist should document the presence and nature of the airway difficulty in the medical record.	302	90.7*	8.6	0.7	0.0	0.0
23. The anesthesiologist should inform the patient (or responsible person) of the airway difficulty that was encountered.	302	85.7*	13.6	0.7	0.0	0.0
24. The anesthesiologist should evaluate and follow-up with the patient for potential complications of difficult airway management.	302	55.3*	37.7	6.6	0.0	0.3
25. The patient should be advised of the potential clinical signs and symptoms associated with life-threatening complications of difficult airway management.	302	56.0*	32.1	10.6	1.0	0.3

†N = number of ASA members who responded to each item. An asterisk beside a percentage score indicates the median. ‡Including, but not limited to, length of upper incisors, relation of maxillary and mandibular incisors during normal jaw closure and voluntary protrusion, inter-incisor distance, visibility of uvula, shape of palate, compliance of mandibular space, thyromental distance, length and thickness of neck, and range of motion of the head and neck.

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