

**2022 American  
Society of  
Anesthesiologists  
Practice  
Guidelines for  
Management of  
the  
Difficult Airway**

Jeffrey L. Apfelbaum, M.D., Carin A. Hagberg,  
M.D.,  
Richard T. Connis, Ph.D., Basem B. Abdelmalak,  
M.D.,  
Madhulika Agarkar, M.P.H., Richard P. Dutton,  
M.D.,  
John E. Fiadjoe, M.D., Robert Greif, M.D.,  
P. Allan Klock, Jr., M.D., David Mercier, M.D.,  
Sheila N. Myatra, M.D., Ellen P. O'Sullivan, M.D.,  
William H. Rosenblatt, M.D.,  
Massimiliano Sorbello, M.D.,  
Avery Tung, M.D.

# Definition of Difficult Airway

**Difficult Facemask Ventilation.** It is not possible to provide adequate ventilation (e.g., confirmed by end-tidal carbon dioxide detection), because of one or more of the following problems: inadequate mask seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.

**Difficult Laryngoscopy.** It is not possible to visualize any portion of the vocal cords after multiple attempts at laryngoscopy.

**Difficult Supraglottic Airway Ventilation.** It is not possible to provide adequate ventilation because of one or more of the following problems: difficult supraglottic airway placement, supraglottic airway placement requiring multiple attempts, inadequate supraglottic airway seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.

**Difficult or Failed Tracheal Intubation.** Tracheal intubation requires multiple attempts or tracheal intubation fails after multiple attempts.

**Difficult or Failed Tracheal Extubation.** The loss of airway patency and adequate ventilation after removal of a tracheal tube or supraglottic airway from a patient with a known or suspected difficult airway (i.e., an “at risk” extubation).

**Difficult or Failed Invasive Airway.** Anatomic features or abnormalities reducing or preventing the likelihood of successfully placing an airway into the trachea through the front of the neck.

**Inadequate Ventilation.** Indicators of inadequate ventilation include absent or inadequate exhaled carbon dioxide, 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, absent or inadequate exhaled gas flow as measured by spirometry, anatomic lung abnormalities as detected by lung ultrasound, and hemodynamic changes associated with hypoxemia or hypercarbia (e.g., hypertension, tachycardia, bradycardia,



# Purposes of the Guidelines

The purposes of these guidelines are to guide the management of patients with difficult airways, optimize first attempt success of airway management, improve patient safety during airway management, and minimize/avoid adverse events.

The principal adverse outcomes associated with the difficult airway include (but are not limited to) death, brain injury, cardiopulmonary arrest, airway trauma, and damage to the teeth.

# Application

These guidelines are intended for use by anesthesiologists and all other individuals who perform anesthesia care or airway management. The guidelines are intended to apply to all airway management and anesthetic care delivered in inpatient (e.g., perioperative, nonoperating room, emergency department, and critical care settings) and ambulatory settings (e.g., ambulatory surgery centers and office-based surgery and procedure centers performing invasive airway procedures).

Excluded are prehospital settings and individuals who do not deliver anesthetic care or perform airway management.

These guidelines are also intended to serve as a resource for other physicians and patient care personnel who are involved in the care of difficult airway patients, including those involved in local policy development.

# Process and Evaluation of Evidence

These updated guidelines were developed by means of a six-step process.

First, consensus was reached on the criteria for evidence.

Second, a comprehensive literature search was conducted by an independent librarian to identify citations relevant to the evidence criteria.

Third, original published articles from peer-reviewed journals relevant to difficult airway management were evaluated and added to literature included in the previous update.

Fourth, consultants who had expertise or interest in difficult airway management and who practiced or worked in various settings (e.g., private and academic practice) were asked to participate in opinion surveys addressing the appropriateness, completeness, and feasibility of implementation of the draft recommendations and to review and comment on a draft of the guidelines.

Fifth, additional opinions were solicited from random samples of active members of the ASA and participating organizations.

Sixth, all available information was used to build consensus to finalize the Guidelines

**Inclusion Criteria** for literature acceptance included randomized controlled trials, prospective nonrandomized comparative studies (e.g., quasiexperimental, cohort), retrospective comparative studies (e.g., case control), observational studies (e.g., correlational or descriptive statistics), and case reports or case series from peer-reviewed journals.

**Exclusion criteria** included:

- (1) patients or practitioners described in the study who were specifically excluded or not identified by evidence criteria in the evidence model;
- (2) interventions not identified or specifically excluded in the evidence model;
- (3) studies with insufficient or no outcome data or reported outcomes not relevant to the evidence model;
- (4) articles with no original data, including review articles, descriptive letters, or editorials;
- (5) systematic reviews, secondary data, meta-analysis, or other articles with no original data;
- (6) abstracts, letters, or articles not published in a peer-reviewed journal;
- (7) studies outside of designated search dates;
- (8) duplicate data presented in a different reviewed article; or

# Evaluation of the Airway

Airway evaluation topics include

- (1) risk assessment to predict a difficult airway or risk of aspiration, and
- (2) Airway examination (bedside and advanced).

**Risk assessment** includes evaluation of information obtained from a patient's history or medical records, including demographic information, clinical conditions, diagnostic tests, and patient/family interviews or questionnaires.

**Airway examination** is intended to identify the presence of upper airway pathologies or anatomical anomalies. Issues addressed in these guidelines include:

- (1) measurement of facial and jaw features,
- (2) anatomical measurements and landmarks,
- (3) Imaging with ultrasound or virtual laryngoscopy/bronchoscopy,
- (4) three-dimensional printing, and
- (5) bedside endoscopy.



## Patient demographic and personal characteristics

evaluated for difficult airway risk prediction included age, sex, body mass index, weight, and height.

## Clinical characteristics assessed included

a history of difficult intubation, distorted airway anatomy, snoring, obstructive sleep apnea, diabetes mellitus, or findings from diagnostic tests (e.g., radiography, computed tomography), patient interviews, and questionnaires.

Measurement of facial and jaw features included mouth opening, the ability to prognath, head and neck mobility, prominent upper incisors, presence of a beard, and an upper lip bite test.

Anatomical measures included Mallampati and modified Mallampati scores, thyromental distance, sternomental distance, interincisor distance, neck circumference, ratio of neck circumference to thyromental distance, ratio of height to thyromental distance, hyomental distance, and hyomental distance ratio. Measurements obtained from ultrasound included skin-to-hyoid distance, tongue volume, and distance from skin to epiglottis.



## ***Recommendations for Evaluation of the Airway***

- Before the initiation of anesthetic care or airway management, ensure that an airway risk assessment is performed by the person(s) responsible for airway management whenever feasible to identify patient, medical, surgical, environmental, and anesthetic factors (e.g., risk of aspiration) that may indicate the potential for a difficult airway.
  - When available in the patient's medical records, evaluate demographic information, clinical conditions, diagnostic test findings, patient/family interviews, and questionnaire responses.
  - Assess multiple demographic and clinical characteristics to determine a patient's potential for a difficult airway or aspiration.
- Before the initiation of anesthetic care or airway management, conduct an airway physical examination to further identify physical characteristics that may indicate the potential for a difficult airway.
  - The physical examination may include assessment of facial features†† and assessment of anatomical measurements and landmarks.
  - Additional evaluation to characterize the likelihood or nature of the anticipated airway difficulty may include bedside endoscopy, virtual laryngoscopy/bronchoscopy, or three-dimensional printing.
- Assess multiple airway features to determine a patient's potential for a difficult airway or aspiration.

## Preparation for Difficult Airway Management

- Topics related to interventions intended to prepare for difficult airway management include
- (1) the availability of equipment for airway management (e.g., items for anesthetizing locations, portable storage unit, cart, or trolley for difficult airway management);
  - (2) informing the patient with a known or suspected difficult airway;
  - (3) preoxygenation;
  - (4) patient positioning;
  - (5) sedative administration;
  - (6) local anesthesia;
  - (7) supplemental oxygen during difficult airway management;
  - (8) patient monitoring; and
  - (9) human factors

# ***Recommendations for Preparation for Difficult Airway Management***

- Ensure that airway management equipment is available in the room.
- Ensure that a portable storage unit that contains specialized equipment for difficult airway management is immediately available.
- If a difficult airway is known or suspected:
  - Ensure that a skilled individual is present or immediately available to assist with airway management when feasible.
  - Inform the patient or responsible person of the special risks and procedures pertaining to management of the difficult airway.
  - Properly position the patient, administer supplemental oxygen before initiating management of the difficult airway, and continue to deliver supplemental oxygen whenever feasible throughout the process of difficult airway management, including extubation.
- Ensure that, at a minimum, monitoring according to the ASA Standards for Basic Anesthesia Monitoring are followed immediately before, during, and after airway management of all patients.

## Anticipated Difficult Airway Management

Airway management of an anticipated difficult airway consists of interventions addressing awake tracheal intubation, anesthetized tracheal intubation, or both awake and anesthetized intubation.

### *Recommendations for Anticipated Difficult Airway Management*

- Have a preformulated strategy for management of the anticipated difficult airway.
  - This strategy will depend, in part, on the anticipated surgery, the condition of the patient, patient cooperation/consent, the age of the patient, and the skills and preferences of the anesthesiologist.
  - Identify a strategy for: (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, (3) the patient who cannot be ventilated or intubated, and (4) difficulty with emergency invasive airway rescue.

- When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and one or more of the following apply: (1) difficult ventilation (face mask/supraglottic airway), (2) increased risk of aspiration, (3) the patient is likely incapable of tolerating a brief apneic episode, or (4) there is expected difficulty with emergency invasive airway rescue

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.

- Proceed with airway management after induction of general anesthesia when the benefits are judged to outweigh the risks.
- For either awake or anesthetized intubation, airway maneuver(s) may be attempted to facilitate intubation.
- Before attempting intubation of the anticipated difficult airway, determine the benefit of a noninvasive *versus* invasive approach to airway management.
  - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.
    - If difficulty is encountered with individual techniques, combination techniques may be performed.
    - Be aware of the passage of time, the number of attempts, and oxygen saturation.
    - Provide and test mask ventilation after each attempt, when feasible.
    - Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
  - If an elective invasive approach to the airway is selected, identify a preferred intervention.
    - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
    - If the selected approach fails or is not feasible, identify an alternative invasive intervention.
- Initiate ECMO when/if appropriate and available

# Unanticipated and Emergency Difficult Airway Management

Airway management of an unanticipated or emergency difficult airway consists of interventions addressing

- (1) Calling for help,
- (2) optimization of oxygenation,
- (3) use of a cognitive aid,
- (4) noninvasive airway management devices,
- (5) combination techniques,
- (6) invasive airway management interventions, and
- (7) ECMO.

# *Recommendations for Unanticipated and Emergency Difficult Airway Management*

- Call for help.
- Optimize oxygenation.
- When appropriate, refer to an algorithm and/or cognitive aid.
- Upon encountering an unanticipated difficult airway:
  - Determine the benefit of waking and/or restoring spontaneous breathing.
  - Determine the benefit of a noninvasive *versus* invasive approach to airway management.
  - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.
    - If difficulty is encountered with individual techniques, combination techniques may be performed.
    - Be aware of the passage of time, the number of attempts, and oxygen saturation.
    - Provide and test mask ventilation after each attempt, when feasible. ■ Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
- If an invasive approach to the airway is necessary (i.e., cannot intubate, cannot ventilate), identify a referred intervention
  - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
  - Ensure that an invasive airway is performed as rapidly as possible.
  - If the selected invasive approach fails or is not feasible, identify an alternative invasive



# Extubation of the Difficult Airway

An extubation strategy includes interventions that may be used to facilitate airway management associated with extubation of a difficult airway.

Extubation intervention topics addressed by these guidelines include:

- (1) Assessment of patient readiness for extubation,
- (2) the presence of a skilled individual to assist with extubation,
- (3) selection of an appropriate time and location for extubation,
- (4) Planning for possible reintubation,
- (5) elective tracheostomy,
- (6) awake extubation or supraglottic airway removal,
- (7) supplemental oxygen throughout the extubation process, and
- (8) extubation with an airway exchange catheter or supraglottic airway.

The task force regards the concept of an extubation strategy as a logical extension of the intubation strategy.

# ***Recommendations for Extubation of the Difficult Airway***

- Have a preformulated strategy for extubation and subsequent airway management.
  - This strategy will depend, in part, on the surgery/procedure, other perioperative circumstances, the condition of the patient, and the skills and preferences of the clinician.
- Assess patient readiness for extubation.
- Ensure that a skilled individual is present to assist with extubation when feasible.
- Select an appropriate time and location for extubation when possible.
- Assess the relative clinical merits and feasibility of the short-term use of an airway exchange catheter and/or supraglottic airway that can serve as a guide for expedited reintubation.
  - Minimize the use of an airway exchange catheter with pediatric patients.
- Before attempting extubation, evaluate the risks and benefits of elective surgical tracheostomy.
- Evaluate the risks and benefits of awake extubation *versus* extubation before the return to consciousness.

## Follow-up Care

Follow-up care includes the topics of:

- (1) Postextubation care (*i.e.*, steroids, racemic epinephrine),
- (2) Postextubation counseling (*i.e.*, informing and advising the patient or responsible individual of the occurrence and potential complications associated with a difficult airway),
- (3) Documentation of difficult airway and management in the medical record and to the patient, and
- (4) registration with a difficult airway notification service.

## *Recommendations for Follow-up Care.*

- Use postextubation steroids and/or racemic epinephrine when appropriate.
- Inform the patient or a responsible person of the airway difficulty that was encountered 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.
- Document the presence and nature of the airway difficulty in the medical record to guide and facilitate the delivery of future care.
- Instruct the patient to register with an emergency notification service when appropriate and feasible.

## Table 1. Airway Management Items for Anesthetizing Locations

Self-inflating resuscitation bag

Suction tubing, Yankauers, suction catheters, and appropriate connectors

Various sizes of face masks

Various sizes of oral and nasal airways

Various sizes and types of laryngoscope blades and handles

Various sizes and types of tracheal tubes

Tracheal tube introducer (bougie) for adult patients

Tracheal tube stylets (malleable and rigid)

Equipment for emergency invasive airway management

Various sizes of supraglottic airways

Water-soluble medical lubricant

Nasal cannula and oxygen face masks

Video laryngoscope with appropriate stylets

Standard ASA monitors

Anesthetic induction, maintenance, and rescue medications

The examples listed in this table represent basic minimum contents for an anesthetizing location cart or trolley. The cart may be customized to meet the specific needs, preferences, and skills of the practitioner and healthcare facility.

ASA, American Society of Anesthesiologists.

**Table 2.** Portable Storage Unit Items for Difficult Airway Management

Category*	Item†‡
Alternative/rescue ventilation equipment	Oral and nasal airways of assorted sizes Supraglottic airways of assorted sizes/cuffed pharyngeal sealer Nasal cannula
Alternative intubation equipment	Tracheal tubes of assorted sizes (including microlaryngeal tubes) Rigid blades of alternate design and size for intubation Tracheal tube guides. Examples include (but are not limited to) semirigid stylets, lighted stylets, forceps designed to manipulate the distal portion of the tracheal tube Intubating supraglottic airway Videolaryngoscope with appropriate stylet Optical laryngoscope Intubating video stylet Flexible intubating bronchoscope along with topical anesthetic and equipment, and airway/bite block Aintree catheter
Emergency airway equipment	Equipment for emergency invasive airway management Jet ventilation equipment
Miscellaneous	Airway exchange catheters of assorted sizes Multiple exhaled carbon dioxide detectors A laminated version of a local accepted difficult airway algorithm/cognitive aid/checklist Defogger

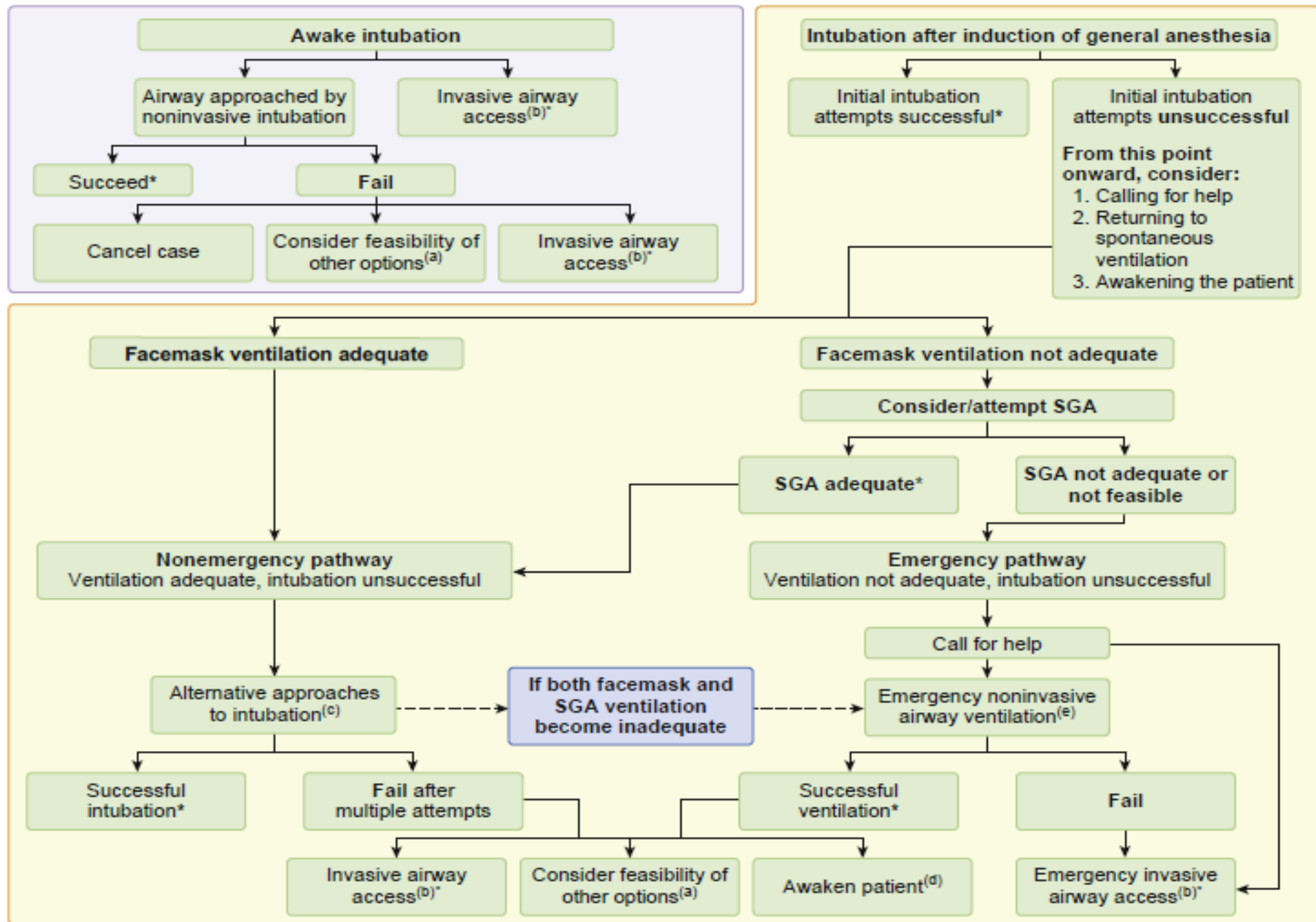
The examples listed in this table represent airway management equipment beyond what may be available in the anesthetizing location (see Table 1). In areas where these items are not available at the anesthetizing location, add them to this portable storage unit.

\*Equipment and supplies sizes should match the intended population to be served (*e.g.*, neonates, pediatrics, adults). †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. ‡Choice of some items (*e.g.*, videolaryngoscope, jet ventilation equipment) may depend on practitioner familiarity and experience with the device.

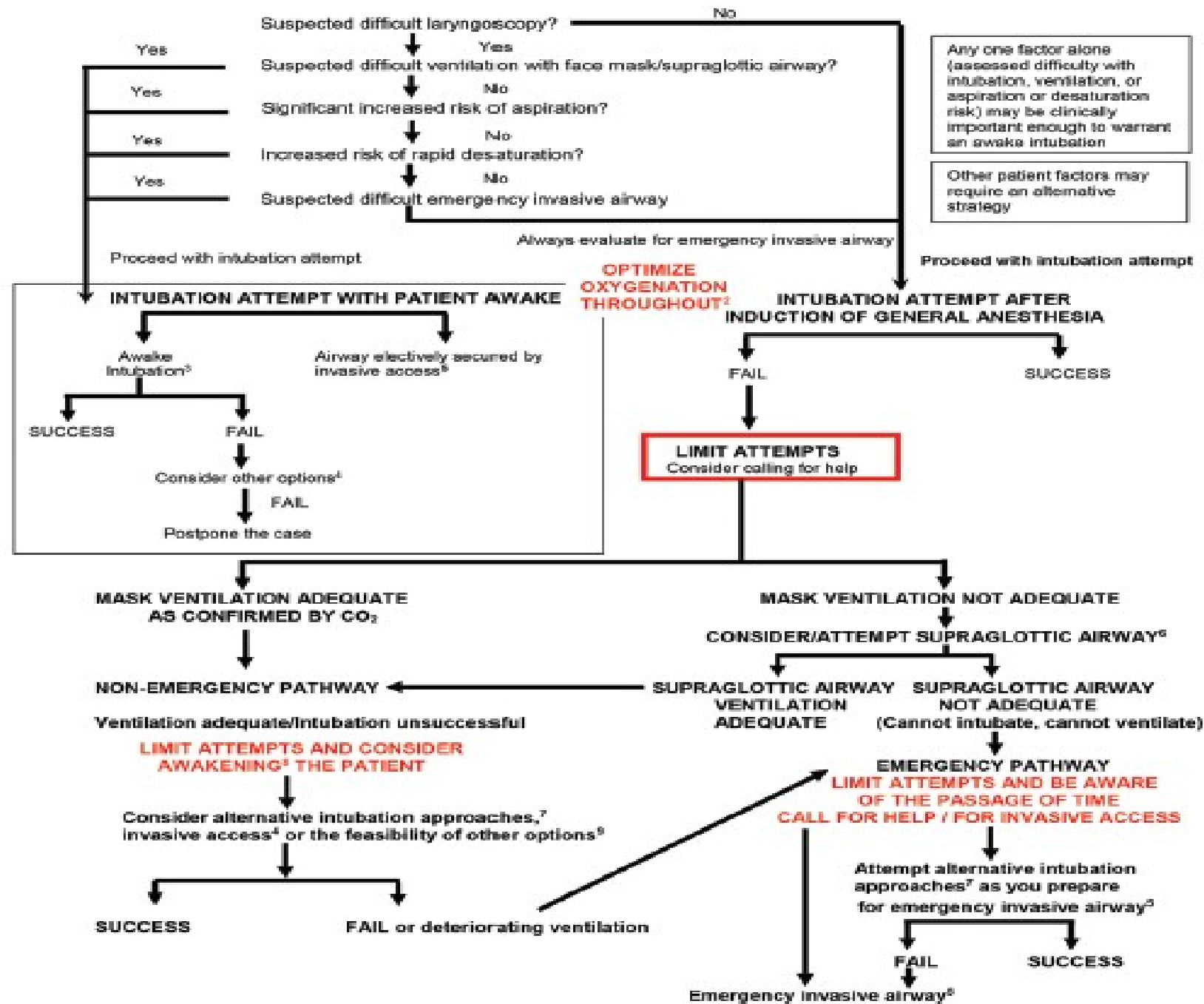
1. Assess the likelihood and clinical impact of basic management problems:
  - Difficulty with patient cooperation or consent
  - Difficult mask ventilation
  - Difficult supraglottic airway placement
  - Difficult laryngoscopy
  - Difficult intubation
  - Difficult surgical airway access
  
2. Actively 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
  - Noninvasive 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:

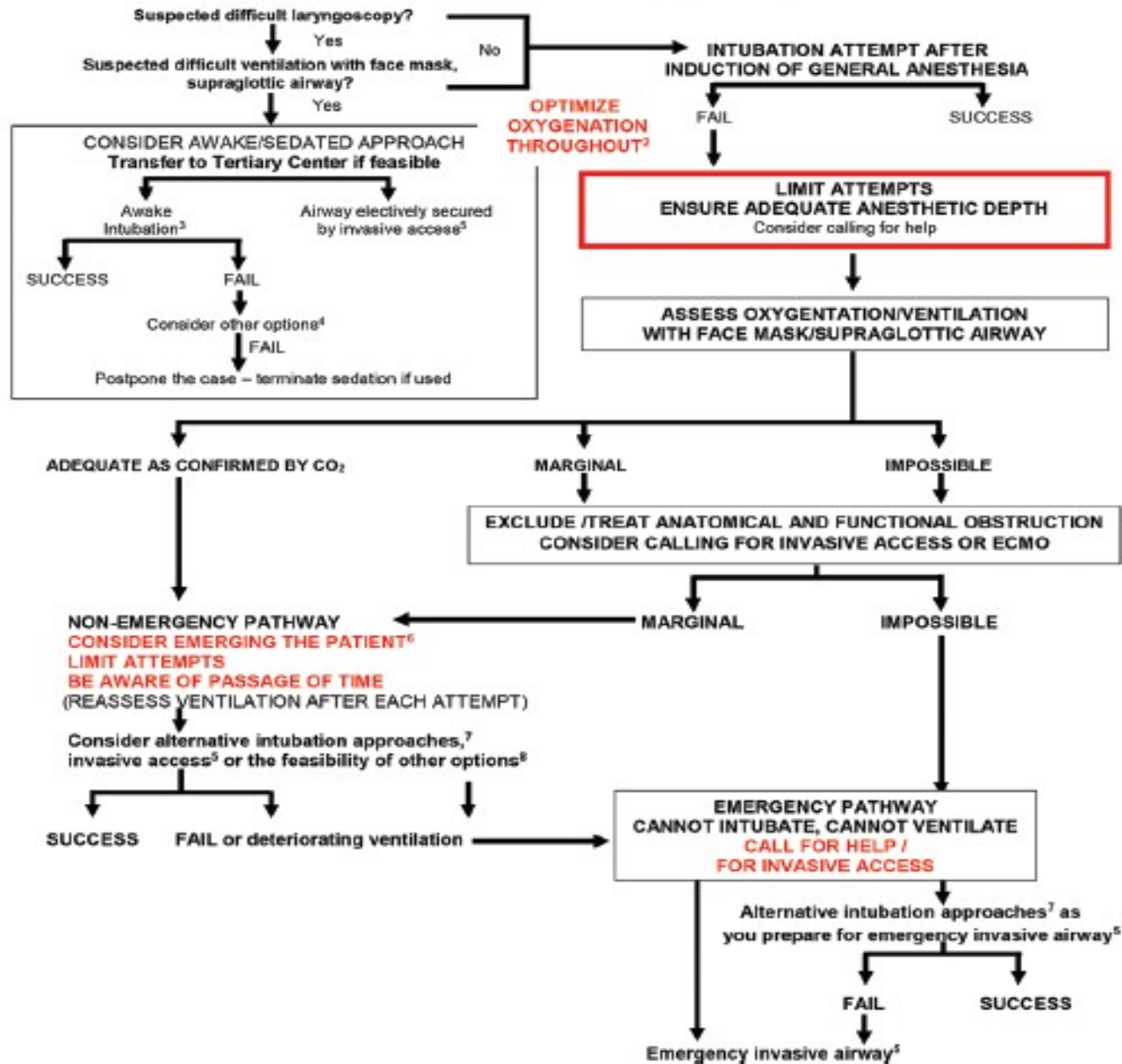


\*Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO<sub>2</sub>.



## ASA DIFFICULT AIRWAY ALGORITHM: PEDIATRIC PATIENTS

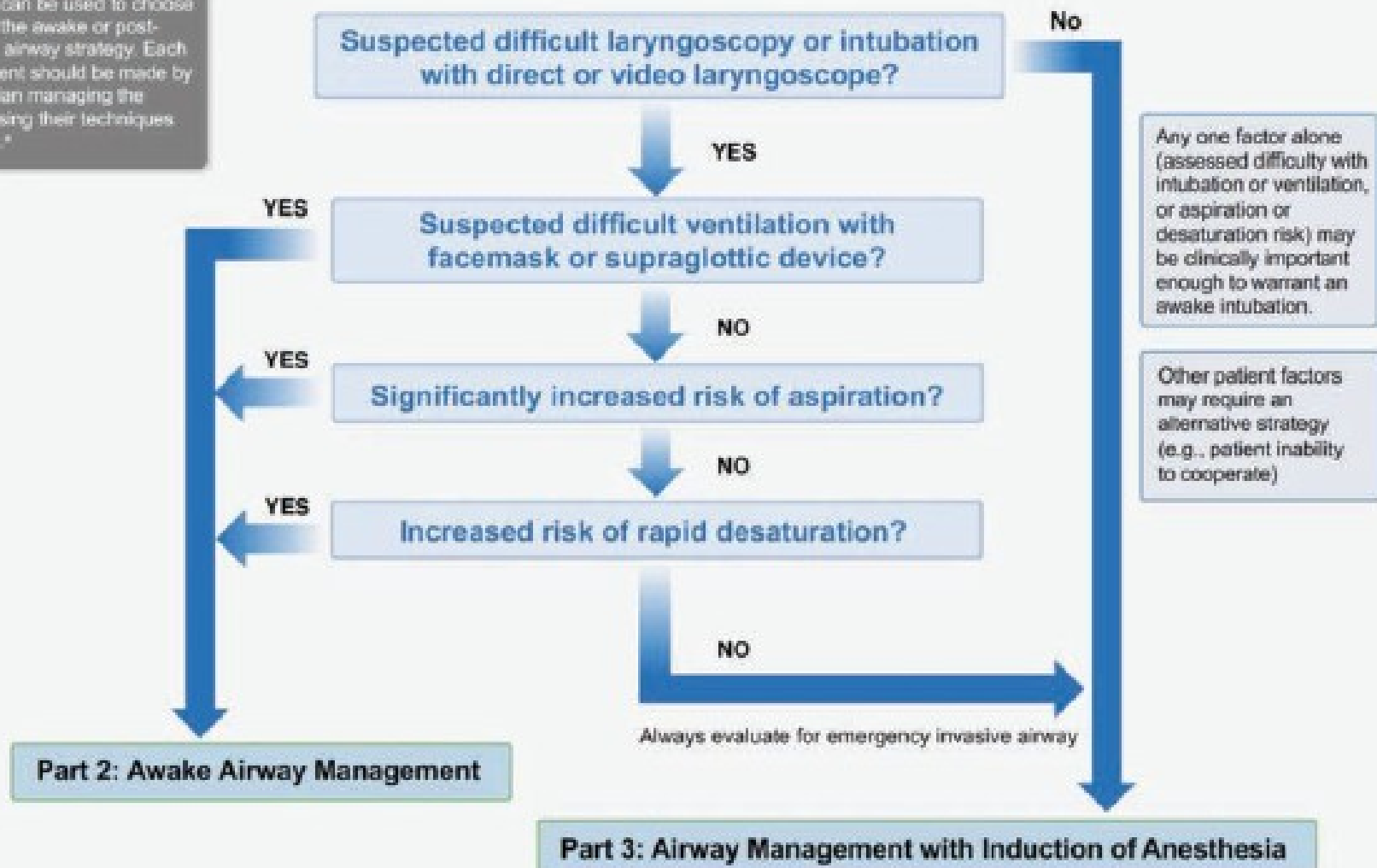
**Pre-intubation:** Before attempting intubation, choose between either an awake or post-induction airway strategy. Choice of strategy and technique should be made by the clinician managing the airway.<sup>1</sup>



# DIFFICULT AIRWAY INFOGRAPHIC: ADULT PATIENTS

## Part 1: Pre-Airway Management Decision Making Tool (planning)

This tool can be used to choose between the awake or post-induction airway strategy. Each assessment should be made by the clinician managing the airway, using their techniques of choice.\*



Any one factor alone (assessed difficulty with intubation or ventilation, or aspiration or desaturation risk) may be clinically important enough to warrant an awake intubation.

Other patient factors may require an alternative strategy (e.g., patient inability to cooperate)

Always evaluate for emergency invasive airway

## Part 2: Awake Airway Management

Review airway strategy for awake airway management <sup>a,b</sup>

Awake technique

Elective invasive airway <sup>c,e</sup>

Success confirmed by adequate ventilation <sup>c</sup>

Fail to establish tracheal intubation

Awake non-emergency pathway

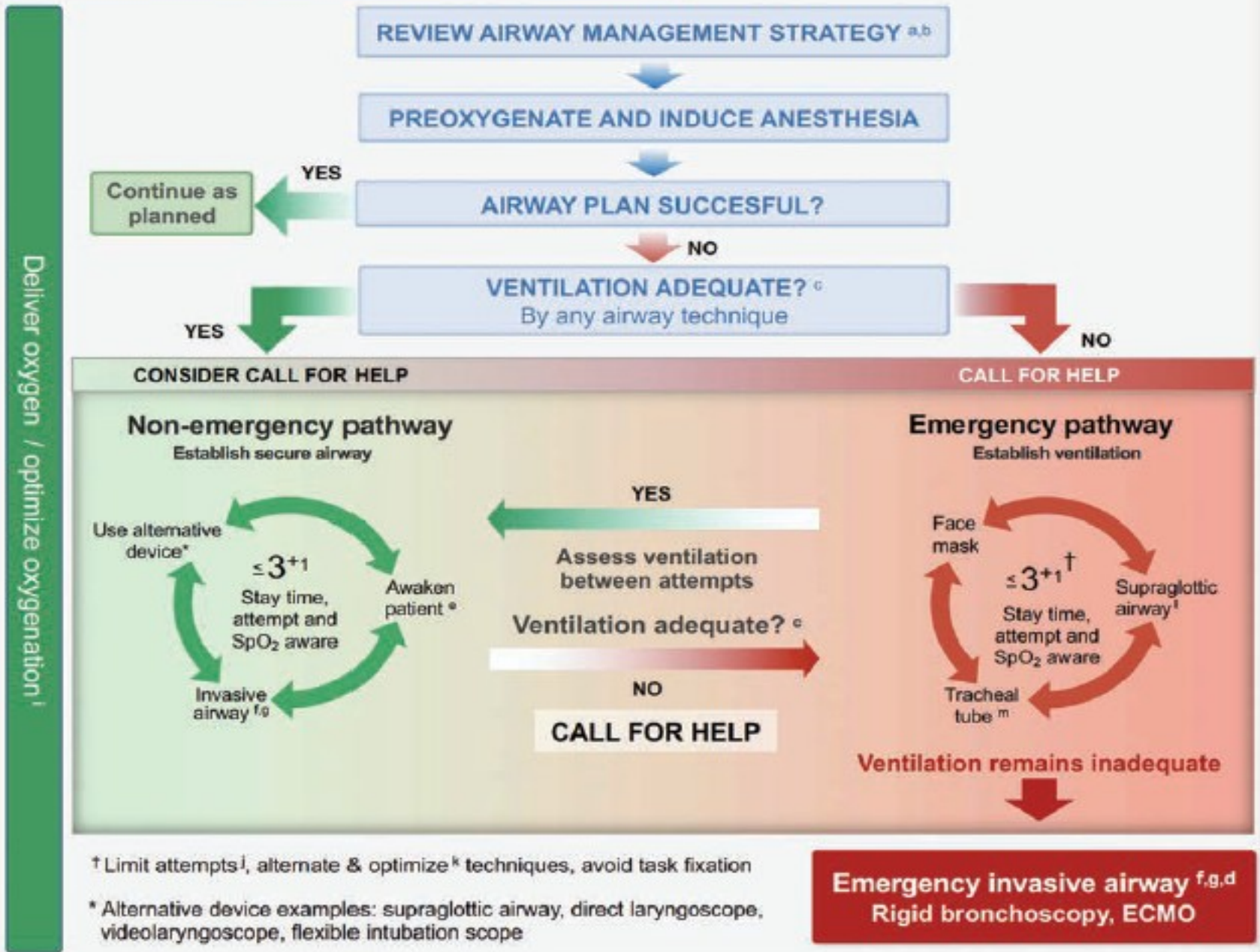
- Postpone <sup>d,e</sup> or consider risks and benefits of
- Alternative awake technique <sup>b</sup>
  - Awake elective invasive airway <sup>c,e</sup>
  - Alternative anesthetic techniques
  - If unstable or can't be postponed, induction of anesthesia (Part 3) with preparations for emergency invasive airway <sup>f,g,h</sup>

Consider call for help

Deliver oxygen / optimize oxygenation <sup>i</sup>



**Part 3: Airway Management with Induction of Anesthesia**

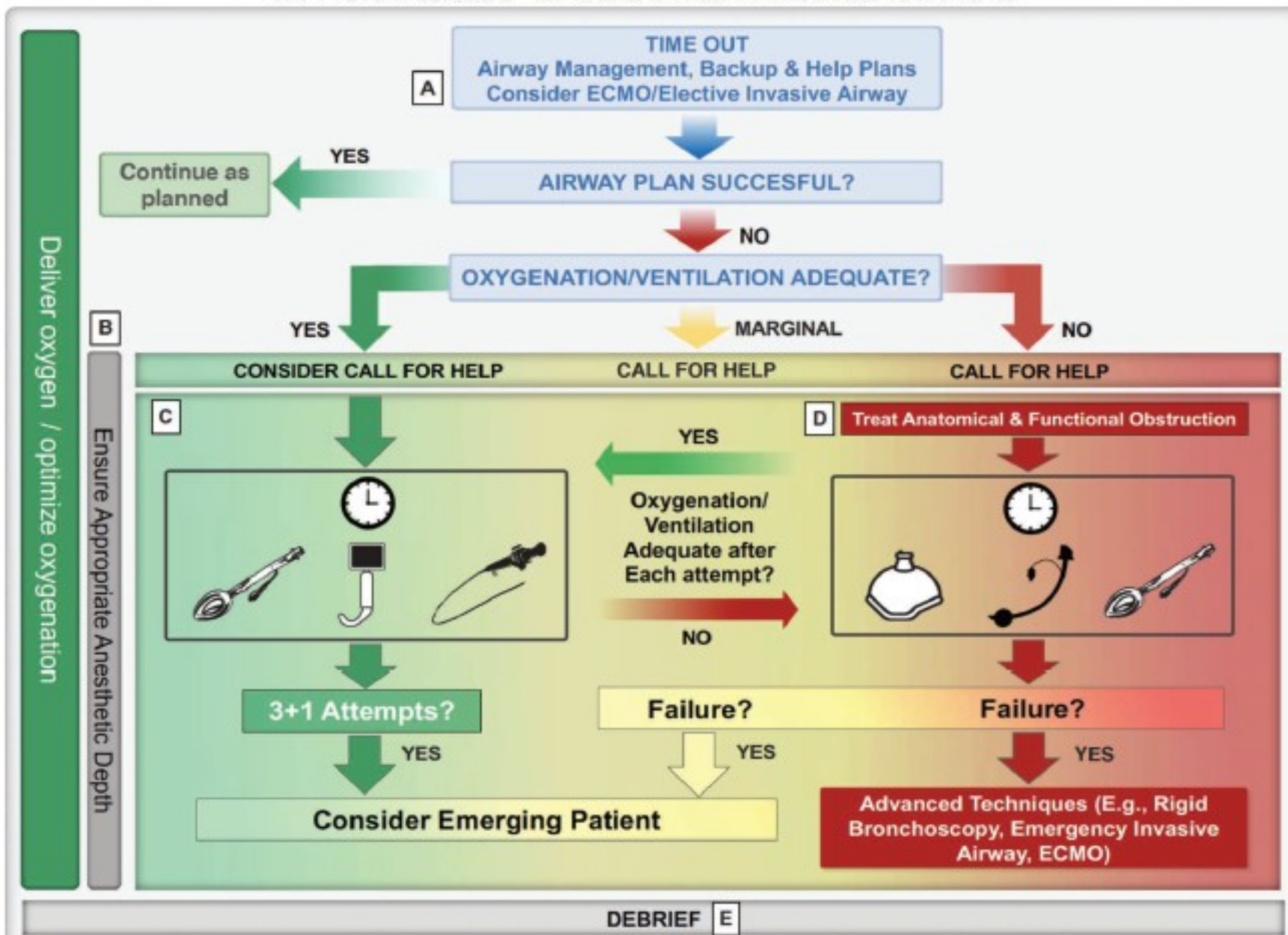


Deliver oxygen / optimize oxygenation<sup>†</sup>

<sup>†</sup> Limit attempts<sup>l</sup>, alternate & optimize<sup>k</sup> techniques, avoid task fixation  
<sup>\*</sup> Alternative device examples: supraglottic airway, direct laryngoscope, videolaryngoscope, flexible intubation scope

**Emergency invasive airway<sup>f,g,d</sup>**  
**Rigid bronchoscopy, ECMO**

# DIFFICULT AIRWAY INFOGRAPHIC: PEDIATRIC PATIENTS



- Select preferred technique in the box  
- Alternate & Optimize Techniques, Limit Attempts  
- Reassess Ventilation after each attempt  
- Evaluate for Task Fixation, Loss aversion



Face mask



Videolaryngoscopy



Tracheal Tube



Flexible Intubation Scope



Supraglottic Airway