The Difficult Airway Algorithm as a Standard of Care

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Disclosures

❖ Cofounder of CoPilot VL, which was acquired in 2017. Remain as an employee of acquiring company.

❖ I will not discuss off label use.
Course Program Online

3 hours of lectures online included with FANA conference fee series

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  - Certificate is only available after passing
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Objectives

❖ To enhance in-depth understanding of and provide learning experiences in the difficult airway algorithm as a standard of care.

❖ The Learner will be able to anticipate, identify, and manage patients with a potentially difficult airway in accordance with the difficult airway algorithm.

❖ When challenged with a difficult ventilation, the Learner will be able to demonstrate the appropriate steps outlined in the difficult airway algorithm.

❖ When challenged with a known difficult airway, the Learner will be able to demonstrate the appropriate steps outlined in the difficult airway algorithm.

❖ When challenged with a "cannot ventilate, cannot intubate" incident, the Learner will be able to demonstrate the appropriate steps outlined in the difficult airway algorithm.
History

- ASA Closed Claims Project (1990) identified adverse respiratory events as a major cause of unfavorable anesthetic outcomes
- Created the Task Force on Management of the Difficult Airway
- Practice Guidelines for the Management of the Difficult Airway published in 1993
- Purpose: “To facilitate the management of the difficult airway and to reduce the likelihood of adverse outcomes.”
- Updates in 2003 and 2013

Awake Intubation

Airway approached by non-invasive intubation → Invasive airway access

- Succeed: Cancel case
- Fail: Consider feasibility of other options → Invasive airway access

Intubation attempts after induction of general anesthesia

- Initial intubation attempts successful →
- Initial intubation attempts UNSUCCESSFUL →
  - From this point onwards consider:
    1. Calling for help
    2. Returning to spontaneous ventilation
    3. Awakening the patient

FACE MASK VENTILATION ADEQUATE

NON-EMERGENCY PATHWAY (Ventilation adequate, intubation unsuccessful)

- Alternate approach to intubation →
  - Successful intubation
  - FAIL after multiple attempts →
    - Invasive airway access
    - Consider feasibility of other options

FACE MASK VENTILATION INADEQUATE

EMERGENCY PATHWAY (Ventilation not adequate, intubation unsuccessful)

CALL FOR HELP

- Emergency non-invasive airway ventilation
  - Successful ventilation → Awaken patient
  - FAIL → Emergency invasive airway access
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 forums commentary, and clinical feasibility data.


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:
Practice guidelines

❖ Airway evaluation
❖ Basic preparation
❖ Strategy for intubation
❖ Strategy for extubation
❖ Follow up care

How are the Practice Guidelines put together?

- Evaluation of medical literature
- Opinion surveys
- Expert consultants

Difficult airway: The clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation, or both.


Image courtesy of Twin Oaks Anesthesia Service; [www.twinoaksanesthesia.com](http://www.twinoaksanesthesia.com)
More definitions

**Difficult face mask or supraglottic airway (SGA) ventilation:** It is not possible for the anesthetist to provide adequate ventilation because of one or more of the following problems: inadequate mask or SGA seal, excessive gas leak, or excessive resistance of the ingress or egress of gas.

**Difficult SGA placement:** SGA placement requires multiple attempts, in the presence or absence of tracheal pathology.
And even more...

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

**Difficult tracheal intubation**: Tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology.

**Failed intubation**: Placement of the endotracheal tube fails after multiple attempts.

Guideline 1: Airway evaluation

❖ History
❖ Physical examination
❖ Additional evaluation

Airway Assessment

❖ El-Ganzouri Risk Index
❖ Score > 4 indicate potential difficult direct laryngoscopy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth Opening</td>
<td>0-1</td>
</tr>
<tr>
<td>Mallampati</td>
<td>0-2</td>
</tr>
<tr>
<td>TM distance</td>
<td>0-2</td>
</tr>
<tr>
<td>Neck movement</td>
<td>0-2</td>
</tr>
<tr>
<td>Hx diff intubation</td>
<td>0-2</td>
</tr>
<tr>
<td>Ability to prognath</td>
<td>0-1</td>
</tr>
<tr>
<td>Weight</td>
<td>0-2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>0-12</strong></td>
</tr>
</tbody>
</table>
Airway ultrasound

Airway Ultrasound Courtesy of Twin Oaks Anesthesia Services; http://www.twinoaksanesthesia.com
Guideline 2: Basic Preparation for Difficult Airway Management

- Inform the patient
- Equipment: portable storage unit
- Adequate assistance
- Preoxygenation
- Supplemental oxygen

The “Difficult Airway Cart”

Created a suggested contents for portable storage unit aka…

The Difficult Airway Cart

- Different shapes and sizes of rigid laryngoscopes blades
- Tracheal tube guides (stylets, bougies, light wand)
- SGAs (preferably second generation)
- Fiberoptic equipment
- Equipment for emergency invasive airway access
- An exhaled CO2 detector

Guideline 3: Strategy
Guideline 3: Strategy

- Anticipated surgery
- Condition of the patient
- Skills and preferences of the provider

Consider potential difficulty with:

1. Patient cooperation or consent
2. Mask ventilation
3. SGA placement
4. Laryngoscopy
5. Intubation
6. Surgical airway
Strategy for the Intubation of the Difficult Airway

Awake vs Asleep

Noninvasive (or nonsurgical) vs Invasive (or surgical)

Preservation of respiration vs Ablation of respiration

Also consider:

Video laryngoscopy as initial approach
“Hope is NOT a strategy.”

I don’t know who originally said that but I love it.
Alternative Approaches to Intubation

- Alternative laryngoscope blades
- SGA as an intubating conduit
- Fiberoptic intubation
- Intubating stylet or tube exchanger
- Light wand

Options other than intubation

- Face mask
- SGA
- Local anesthetic
- Regional nerve block

Is regional an option?
Strategy for Extubation of the Difficult Airway

❖ Consider merits of awake vs extubation before the return of consciousness
❖ Consider clinical factors contributing to difficulty ventilating after extubation
❖ A plan in case patient needs to be reintubated
❖ Short term “bridge” device (LMA, tube exchanger)

Guideline 4: Follow Up Care

- Documentation
- Inform the patient
- Potential complications

Complications of difficult laryngoscopy/intubation

- Dental damage
- Aspiration
- Hypoxia
- Pharyngeal injury*
- Esophageal injury*
- Brain damage/death

How to use the algorithm

Let’s break it down into basically three areas:

1. Awake vs asleep
2. Difficult intubation *with* adequate ventilation
3. Difficult intubation *without* adequate ventilation
2013 Difficult Airway Algorithm

Awake Intubation

Airway approached by non-invasive intubation

- Succeed
  - Cancel case
  - Consider feasibility of other options
  - Invasive airway access

- Fail
  - Invasive airway access

Intubation attempts after induction of general anesthesia

- Initial intubation attempts successful
  - From this point onwards consider:
    1. Calling for help
    2. Returning to spontaneous ventilation
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- Initial intubation attempts UNSUCCESSFUL

FACE MASK VENTILATION ADEQUATE

- Non-emergency pathway (Ventilation adequate, intubation unsuccessful)
  - Alternate approach to intubation
    - Successful intubation
    - FAIL after multiple attempts

FACE MASK VENTILATION INADEQUATE

- Consider/Attempt SGA
  - SGA adequate
  - SGA not adequate or not feasible

EMERGENCY PATHWAY (Ventilation not adequate, intubation unsuccessful)

- Call for help
  - Emergency non-invasive airway ventilation
  - Successful ventilation
  - Fail
    - Invasive airway access
    - Consider feasibility of other options
    - Awaken patient
  - Invasive airway access
2013 Difficult Airway Algorithm

Awake Intubation

Airway approached by non-invasive intubation

Succeed

Fail

Invasive airway access

Cancel case

Consider feasibility of other options

Invasive airway access

Planned Awake intubation
Anticipated Difficult Intubation

Non-Invasive vs. Invasive Airway access
2013 Difficult Airway Algorithm

Planned asleep intubation

Success = proceed

Fail = next step
2013 Difficult Airway Algorithm

Non-Emergent Pathway vs Emergent Pathway

FACE MASK VENTILATION ADEQUATE

NON-EMERGENCY PATHWAY (Ventilation adequate, intubation unsuccessful)

Alternate approach to intubation

SUCCESSFUL INTUBATION

FAIL after multiple attempts

INVASIVE AIRWAY ACCESS

IF MASK VENTILATION BECOMES INADEQUATE

SUCCESSFUL VENTILATION

FAIL

Awaken patient

Consider feasibility of other options

Emergency non-invasive airway ventilation

CALL FOR HELP

Emergency invasive airway access

FACE MASK VENTILATION INADEQUATE

EMERGENCY PATHWAY (Ventilation not adequate, intubation unsuccessful)

CALL FOR HELP

Emergency non-invasive airway ventilation

SUCCESSFUL VENTILATION

FAIL

Awaken patient

Consider feasibility of other options

Emergency invasive airway access

SGA adequate

SGA not adequate or not feasible

Consider/Attempt SGA
2013 Difficult Airway Algorithm

Non-Emergent Pathway

FACE MASK VENTILATION ADEQUATE

NON-EMERGENCY PATHWAY
(Ventilation adequate, intubation unsuccessful)

Alternate approach to intubation

Successful intubation

FAIL after multiple attempts

Invasive airway access

Consider feasibility of other options

Awaken patient
# Difficult mask ventilation

<table>
<thead>
<tr>
<th>MOANS(^1)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Mask seal</td>
</tr>
<tr>
<td>O</td>
<td>Obesity/obstruction</td>
</tr>
<tr>
<td>A</td>
<td>Age &gt; 55 years</td>
</tr>
<tr>
<td>N</td>
<td>No teeth</td>
</tr>
<tr>
<td>S</td>
<td>Stiff lungs/chest wall</td>
</tr>
</tbody>
</table>

*Adapted with permission from The Difficult Airway Site (TheAirwaySite.com) & Walls RM & Murphy, MF: Manual of Emergency Airway Management, 4th ed Philadelphia, Lippincott, Williams and Wilkins, 2012*
Options for difficult mask ventilation

- Ensure optimized positioning
- Oral/nasopharyngeal airway
- Head extension, chin lift, jaw thrust
- Two person mask
- SGA


Public Service Announcement
2013 Difficult Airway Algorithm

Emergent Pathway

- Face mask ventilation inadequate
  - Consider/attempt SGA
    - SGA adequate
      - SGA not adequate or not feasible
        - Emergency pathway (Ventilation not adequate, intubation unsuccessful)
          - Call for help
            - Emergency non-invasive airway ventilation
              - Successful ventilation
                - Invasive airway access
              - Fail
                - Emergency invasive airway access
            - Awaken patient
              - Consider feasibility of other options
                - Invasive airway access
Emergency invasive airway access

❖ Surgical airway
❖ Other
   ❖ Transtracheal jet ventilation
   ❖ Needle cricothyroidotomy
   ❖ Retrograde intubation

**Mark the spot prior to airway management**

Complications of percutaneous airway

- Hemorrhage
- Aspiration
- Pneumothorax
- Pneumomediastinum
- Subcutaneous emphysema
Other Ventilation Options

• Supraglottic airway
• Rigid bronchoscope
• Intratracheal jet stylet
Critiques of the algorithm

❖ Can appear confusing
❖ Insufficiently specific for a true emergency
❖ Intended as basic recommendation, not standard of care
❖ Use to help formulate a plan
Engineering Flowchart

DOES IT MOVE?

No

- Should it?
  - No
    - No Problem
  - Yes
    - WD-40

Yes

- Should it?
  - Yes
    - WD-40
  - No
    - No Problem
Other algorithms to consider

❖ DAS: Difficult Airway Society
❖ R. Adams Cowley Shock Trauma
❖ SLAM: Street Level Airway Management

Currently, there is no evidence that demonstrates superiority of any of these algorithms we’re talking about.


Difficult Airway Society (UK) Algorithm

- Takes a different approach than ASA algorithm: more focused on the unanticipated difficult airway
- Plan A, B, C, D
- Analysis of NAP 4 revealed that human factors influenced every adverse airway outcome.
- Includes discussion about human factors in adverse airway outcomes: loss of situational awareness, poor communication, poor training and teamwork etc.
- “Stop and think.”

**DAS Difficult Intubation Guidelines**

**PLAN A:** Facemask ventilation and tracheal intubation

- **Laryngoscopy:** Succeed → Tracheal intubation
- **Failed intubation**

**PLAN B:** Maintaining oxygenation: SAD insertion

- **Supraglottic airway device:** Succeed
- **Failed SAD ventilation**

**PLAN C:** Facemask ventilation

- **Final attempt at face mask ventilation:** Succeed → Wake the patient up
- **CICO**

**PLAN D:** Emergency front of neck access

- **Cricothyroidotomy**

**STOP AND THINK**
Options (consider risks and benefits):
1. Wake the patient up
2. Intubate trachea via the SAD
3. Proceed without intubating the trachea
4. Tracheostomy or circothyroidotomy

Reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults
PLAN A: Facemask ventilation and tracheal intubation

Laryngoscopy
Succeed
Tracheal intubation

Reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults
DAS Difficult Intubation Guidelines

PLAN B:  
Maintaining oxygenation:  
SAD insertion

Failed intubation

Supraglottic airway device

Succeed

STOP AND THINK
Options (consider risks and benefits):
1. Wake the patient up
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Reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults
PLAN C: Facemask ventilation

Failed SAD ventilation

Final attempt at facemask ventilation

Succeed

Wake the patient up

Reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults
PLAN D:
Emergency front of neck access

CICO

Cricothyroidotomy

Reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults
Critiques of DAS Algorithm

- No suggestion of awake intubation as a management strategy
- No formal aggregation and classification of evidence
- Does not include recommendations for the prediction of difficult airway
Shock Trauma Algorithm

❖ One of the most studied: A retrospective study in more than 30,000 patients showed overall rate of surgical airway was 0.1 with no failed airways.

❖ Simplified version of DAA:
  • Starts with induction of anesthesia
  • RSI with up to 3 laryngoscopy attempts
  • Attempt at SGA
  • Performance of surgical airway

Shock Trauma Algorithm

Need for intubation

Know or suspected difficult airway

Rapid sequence induction
  - Pre-oxygenation
  - Cricoid pressure
  - In-line cervical stabilization

Cooperative, stable

Uncooperative, unstable

Consider alternatives:
  - A FOI
  - Tracheotomy under local anesthesia

Options following LMA placement include:
  - Further intubation attempts
  - Intubations through the LMA
  - Surgical airway

Consider options

Operating room for formal tracheotomy

Muscle relaxation

Induction

Laryngoscopy #1

Success

Laryngoscopy #2 +/- Bougie

Success

Laryngoscopy #3 by attending

Success

Attempt LMA placement

Failure

Success

Confirmation:
  - Capnometry
  - Auscultation

Success
Awake laryngoscopy/intubation

Technique by Will Rosenblatt, MD

- Can be used to prep for awake FOB or awake video laryngoscopy
- Systematic approach breaks down into 6 distinct elements
  - Explanation
  - Desiccation
  - Dilatation
  - Topicalization
  - Sedation
  - Procrastination

Explanation

- Take time to explain the need for the procedure
- Patients want the safest method available
- Explain that they won’t feel or remember much
Saliva is a protective barrier that will also dilute the topical local anesthetic.

Saliva also can act as an airway stimulant: cough, laryngospasm

Glycopyrrolate, atropine, clonidine, scopolamine.

Get antisialogogue on board at least 15 minutes before any local.
Dilation aka “prepare the nose”

- The nasal prep is recommended regardless of the intent to intubate via the mouth or nose.
  - Cross innervation between nose and oropharynx
  - In case of difficult oral intubation, nose is ready for Plan B.
- Oxymetazoline is an effective and long acting vasoconstrictor
Topicalization

❖ Nasal passage/nasopharynx
  • Anterior ethmoid nerve/nasopalantine nerve
  • Advance swabs with local anesthetic; advance until sphenoid holds up the swab.

❖ Base of tongue/posterior oropharyngeal wall
  • Glossopharyngeal nerve: responsible for gag.
  • Swabs inserted along the tongue until they contact the anterior surface of the base of the tongue.

❖ Hypopharynx/larynx-trachea
  • 10 ml syringe with large plastic angiocath
  • Grasp tongue with 4x4, drip 2% lidocaine onto base of the tongue. May not need all 10 ml.
Sedation

1. Cautious titration
2. Avoid polypharmacy
3. Have reversal available

“Don’t confuse deep sedation with awake intubation.”
Procrastination

HOW THE SURGEON LOOKS

DURING TURNOVER
Procrastination

- Execute all of the previous procedures in a **controlled** pace and **composed** environment
- Take your time!
- Start early: pre-op holding
  - Can even start oxymetazoline and glycopyrrolate (IM injection) in admitting.
Case Study

❖ 45 year old male, s/p MVA
❖ ICU
❖ You arrive after a resident has already failed multiple times with DL
So what happened?

- Initial look with DL, no view
- Airway bloody, edematous tissues
- Retrograde intubation using a wire from a central line kit
Emergency front of neck access

Surgical Cricothyrotomy: indicated when other rescue techniques have failed or are not feasible.


Identification of the Cricoid Membrane

“Laryngeal Handshake”

1. Use thumb and index finger to grasp the top of the thyroid cartilage and gently rock side to side.

2. Slide down over the thyroid laminae.

3. Thumb and middle finger rest on cricoid cartilage with index finger palpating the cricoid membrane

Scalpel Cricothyroidotomy

1. Stand on patient’s left hand side if you are right handed
2. Stabilize the larynx with left hand, identify cricothyroid membrane
3. Transverse stab incision with cutting edge of blade facing you
4. Keep scalpel perpendicular and turn 90 degrees toward feet
5. Switch hands, pick up bougie with right hand, insert bougie coude tip first, advance 10-15 cm
6. Remove scalpel
7. Hold tension on skin and railroad a lubricated 6.0 ETT over bougie
8. Remove bougie
9. Infl. cuff and confirm ventilation with capnography

Equipment: scalpel with 10 blade, bougie with coude tip, cuffed 6.0 tube
Studies suggest the DAA has decreased intubation complications, but severe adverse events related to extubation persist.

Elective surgeries: reintubation rate 0.1% and 0.45%

Critically ill patients much higher: 0.4% to 25%.
Causes of reintubation events

- **Airway obstruction**: most common cause
  - Laryngeal edema
  - Sedation, inadequate reversal of neuromuscular blockade, and inappropriate fluid
  - Other factors include patient co-morbidities, type of surgery and postoperative management

Extubation strategy

- Optimize patients condition
- Careful timing
- Personnel trained in advanced airway management
- Ensure availability of necessary equipment
- Post-extubation monitoring

Extubation Algorithm

DAS Extubation Guidelines Difficult Airway Society. Sasukcom. 2016. Available at: https://www.das.uk.com/content/das-extubation-guidelines
What about when surgery is over?

- Document:
  - What happened?
  - Devices and procedures used
  - Patient notification
  - Use standard definitions

Esophagus and pharynx are most commonly damaged; can be difficult to diagnose.

Monitor for severe sore throat, cervical pain, fever, and crepitus

Review for quality improvement purposes
AIRWAY ALERT

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Date of birth</td>
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<tr>
<td>Hospital number</td>
</tr>
<tr>
<td>Home address</td>
</tr>
<tr>
<td>Telephone</td>
</tr>
<tr>
<td>Fax</td>
</tr>
<tr>
<td>Email</td>
</tr>
</tbody>
</table>

To the patient:
Please keep this letter safe and show it to your doctor if you are admitted to hospital.
Please show this letter to the anaesthetic doctor if you need an operation.
This letter explains the difficulties that were found during your recent anaesthetic and the information may be useful to doctors treating you in the future.

To the GP:
Please copy this letter with any future referral.

Summary of Airway Management
Date of operation:
Type of operation:

<table>
<thead>
<tr>
<th>Reason/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult mask ventilation?</td>
</tr>
<tr>
<td>Difficult Direct laryngoscopy?</td>
</tr>
<tr>
<td>Difficult tracheal intubation?</td>
</tr>
<tr>
<td>Laryngoscopy grade</td>
</tr>
</tbody>
</table>

Equipment used:
Other information:
Is awake intubation necessary in the future?

Follow up care (Click when completed)
Copies of letter:
- [ ] To patient
- [ ] To GP
- [ ] To anaesthetic department

According to patient:
- [ ] Anaesthetic chart complete
- [ ] Information on front of case notes
- [ ] Medic Alert or Difficult Airway
- [ ] Referral for emergency department

Name of anaesthetist: Grade: Date:

If you require further information please contact the Anaesthetic Department.
Case Study

- 37 year old female, ASA 1, normal BMI
- Endoscopic sinus surgery
- Initial plan: LMA
Final Thoughts

• Perform **and** document an airway assessment
• Have a **strategy** that includes multiple plans
• **Stop and think**
• Consider and plan for extubation
References


