# Trauma: Airway Management

# ASA Difficult Airway Algorithm Modified for Trauma — and Five Common Trauma Intubation Scenarios

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ontrary to popular opinion, trauma and emergency intubation situations can be aptly handled by following the ASA Difficult Airway (DA) Algorithm. To do so, however, requires that certain elements of the algorithm be de-emphasized (e.g., references to stopping airway management and coming back later).

This article summarizes the important concepts that have been developed over the last decade in management of the traumatized airway. Because airway management is the most important initial element in trauma management, and because anesthesiologists are typically providing this support, it is important that our specialty develop an organized approach to the general condition of the "trauma airway" as well as for several common trauma DA scenarios.

To this end, this article provides a brief history of the ASA DA Algorithm, followed by a survey of the current algorithm (published in Anesthesiology in May 2003), focusing upon the exceptions and emphasizing trauma. After this, five common trauma scenarios with airway considerations are explored with their condition specific algorithms.  $P_{ET}CO_2$  detection is recommended for confirming endotracheal tube (ETT) position when cardiac output is adequate. When cardiac output is inadequate to demonstrate exhaled  $CO_2$ , the self-inflating bulb (SIB), also known as the esophageal detector device (EDD), should be used to confirm ETT position when the cardiac output is not adequate.

These algorithms represent years of refinement. Although they represent the current state of the art as of November 2005, they should still be considered works in progress. We are continuously looking for improved clarity of thought and improvements in patient safety during emergency trauma airway management.

Continued on page 11

Some material in this article was presented by William C. Wilson, M.D., University of California-San Diego Medical Center, and Mohammad I. El-Orbany, M.D., Ninos J. Joseph, B.S., and M. Ramez Salem, M.D., Department of Anesthesiology, Advocate Illinois Masonic Medical Center, Chicago, Illinois, as a Scientific Exhibit at the 2003 ASA Annual Meeting in San Francisco.

The full version of this article can be found on the ASA Web site at <a href="https://www.ASAhq.org/Newsletters/2005/11-05/wilson10\_05.html">www.ASAhq.org/Newsletters/2005/11-05/wilson10\_05.html</a>

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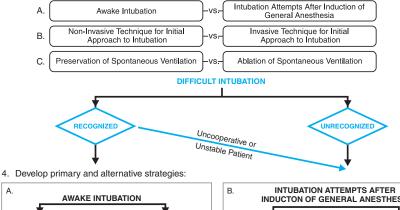
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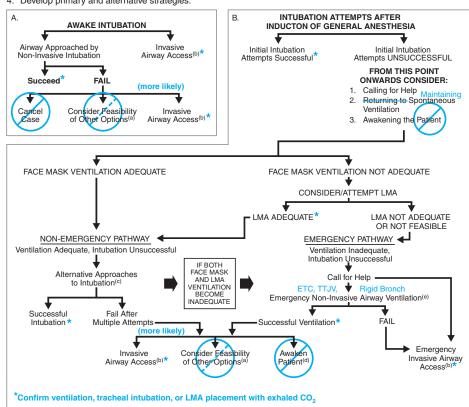




# 2003 DIFFICULT AIRWAY ALGORITHM (MODIFIED FOR TRAUMA)

- 1. Assess the likelihood and clinical impact of basic management problems.
  - A. Difficult Ventilation
  - В Difficult Intubation
  - Difficulty with Patient Cooperation or Consent
  - Difficult Tracheostomy
- 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:





- a. Other options include (but are not limited to): surgery utilizing face mask or LMA anesthesia, 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. Judgment required, Rarely appropriate for trauma pat
- b. Invasive airway access includes surgical or percutaneous tracheostomy or cricothyrotomy.
- c. Alternative non-invasive approaches to difficult intubation include (but are not limited to): use of different laryngoscope blades, LMA as an intubation
- conduit (with or without fiberoptic guidance), fiberoptic intubation (FOB), intubation stylet or tube changer (airway exchange cathe (AEC) light wand, retrograde intubation, and blind oral or nasal intubation.
- d. Consider re-preparation of the patient for awake intubation or canceling surgery. Rarely applicable in the trauma patient
- e. Options for emergency non-invasive airway ventilation include (but are not limited to): rigid bronchoscope (Rigid Bronch), esophagealtracheal combitube ventilation (ETC), or transtracheal jet ventilation (TTJV).
- f. Extubation strategies include: evaluation of the airway with FOB and extubation over an airway exchange catheter (AEC).

# **ASA Difficult Airway Algorithm Development**

Practice guidelines for management of the DA were originally published in 1993 (*Anesthesiology*. 1993; 78:597-602) and were updated recently in a report published by the ASA Task Force on Management of the Difficult Airway in May 2003 (*Anesthesiology*. 2003; 98:1269-1277).

The original practice guidelines (1993) were published by a task force of ASA members who expounded upon the original ideas put forth in a "Medical Intelligence Article" in *Anesthesiology* written by Jonathan L. Benumof, M.D., in 1991 titled "Management of the Difficult Airway" (*Anesthesiology*. 1991; 75:1087-1110).

In 1996, Dr. Benumof wrote another landmark article discussing the development and use of the laryngeal mask airway (LMA) and its implications on the ASA DA Algorithm (*Anesthesiology*. 1996; 84:686-699). This article contributed to ASA's decision to revise the 1993 algorithm. The current (May 2003) version emerged after the ASA task force reviewed the literature published over the last 60 years and obtained expert opinions from other ASA members to build a consensus.

Continued on page 12

# Modifications of the ASA DA Algorithm for Trauma (shown on algorithm on page 10)

- A. Stopping to come back another day is seldom an option with trauma.
- B. A surgical airway may be the first/best choice in certain conditions.
- C. An awake ETT technique should be chosen in a DA patient provided the patient is cooperative, stable and spontaneously ventilating.
- D. If the patient becomes uncooperative/combative, general anesthesia (GA) may need to be administered but if the airway is difficult, spontaneous ventilation (SV) should be continued (if possible).
- E. Awake limb of the ASA Algorithm-Trauma Notes. An awake intubation technique is recommended for all trauma patients with a recognized difficult airway, provided the patient is cooperative, stable and maintains spontaneous ventilation and adequacy of O<sub>2</sub> saturation. The ASA DA Algorithm does not endorse any particular airway technique. It does, however, emphasize that the patient must be properly prepared (mentally and physically) for an awake technique.
- F. Anesthetized or uncooperative limb of ASA DA Algorithm-Trauma Notes. There are three common conditions when the need arises to intubate the trachea of an unconscious or anesthetized trauma patient with a DA:
  - 1. Clinician fails to recognize a difficult airway in preoperative evaluation prior to the induction of anesthesia.
  - 2. The DA patient is already unconscious prior to being assessed by the trauma anesthesiologist.
  - 3. The patient obviously has a DA but is hemodynamically unstable (e.g., following trauma) or absolutely refuses to cooperate with an awake intubation (e.g., child, mentally retarded, drugged or head-injured adult). Once the patient is anesthetized or is rendered apneic or presents comatose and the trachea cannot be intubated, O<sub>2</sub>-enriched mask ventilation (MV) is attempted.

If MV is adequate, a number of intubation techniques may be employed. Techniques allowing continuous ventilation during airway manipulations are favored over those requiring an interruption of mask ventilation (e.g., fiberoptic bronchoscope [FOB], via an LMA or an airway intubating mask, with self-sealing diaphragm).

Alternatively, techniques requiring a cessation of ventilation (at least temporarily) can be employed. These techniques are relatively contraindicated for patients with large right-to-left transpulmonary shunt or decreased functional residual capacity.

- G. Confirmation of ETT position. Immediately after the patient's trachea is intubated, one must confirm ETT position with end-tidal CO<sub>2</sub> measurement. If end-tidal CO<sub>2</sub> measurement is unavailable, Wee's esophageal detector device (EDD) is reasonably reliable (close to 100 percent sensitive and specific).
- H. Extubation or ETT change of the DA. If the conditions that caused the airway to be difficult to intubate still exist at the time of extubation, or if new DA conditions exist (e.g., airway edema, halo), then the trachea should be extubated over an airway exchange catheter and/or with the assistance of an FOB.

# ASA DA Algorithm Applied to Specific Trauma Conditions

# **Closed-Head Injury / Intoxication**

#### **General Considerations:**

If DA, do an awake intubation, provided the patient is cooperative, stable, maintains SV and has a GCS > 9.

# **Key Questions Driving Algorithm Decision-Making:**

# How severe?

- GCS  $\leq$  9 = RSI ( $\pm$  modified, i.e., cricoid pressure,  $\pm$  PPV)
- GCS > 9 = Awake option

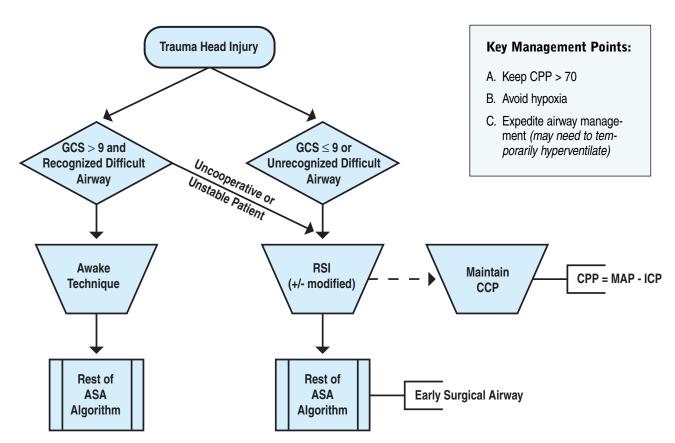
# Cooperative?

If yes, do awake technique.



CT of brain demonstrating severe closed- head injury with right temporoparital subdural hematoma.

# **Closed-Head Injury Algorithm**



# **Airway Disruption**

# **General Considerations:**

Do an awake intubation, provided the patient is cooperative, stable, maintains SV, especially for major laryngeal/tracheal tears.

# Top: Site-specific frequencies of blunt traumatic airway injuries. Bottom: Biomechanics of blunt trauma to the major airways.

# **Key Questions:**

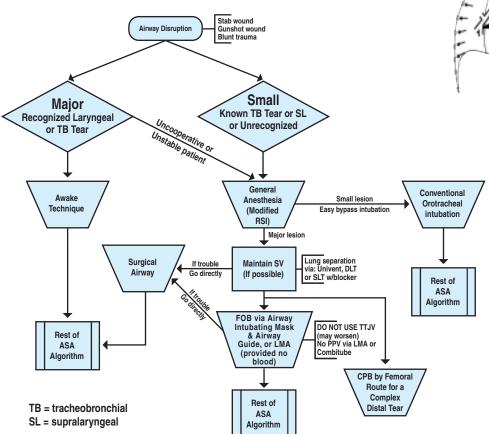
Major lary ngeal/tracheal tears? Small lesions? Or supralary ngeal?

If so, do awake technique.

If so, RSI (± modified).

# ry ngeal?

# **Airway Disruption Algorithm**



# Key Management Points:

80%

- A. Maintain SV even with modified RSI technique.
- B. Get ETT below tear.
- C. Do not pressurize airway proximal to tear.
- D. No TTJV, LMA, etc.
- E. Consider DLT, Consider CPB.

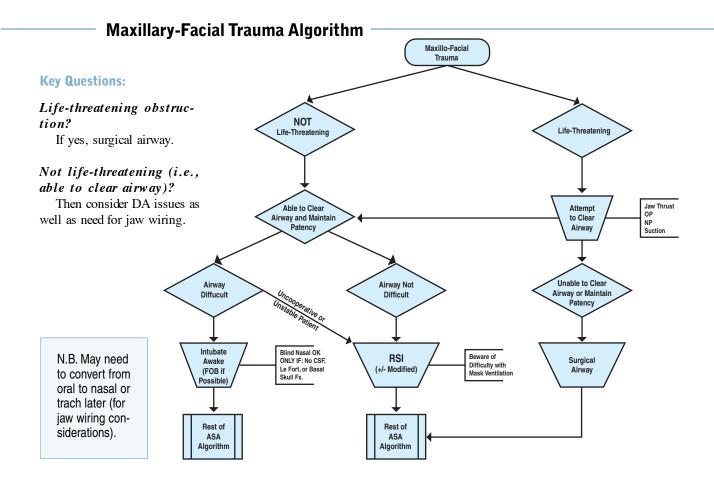
# **Maxillary-Facial Trauma**

# **General Considerations:**

- A. Do awake ETT, provided the patient is cooperative, stable, maintains SV and O<sub>2</sub> saturation and is able to clear airway of blood, foreign bodies, secretions and maintain patency.
- B. MV may be difficult even if ETT is easy.
- C. Blind nasal technique is contraindicated if: CSF leak, Le Fort or basal skull fracture.
- D. Initial decision-making based upon A.B.C.s; later, must be practical with the need for future jaw wiring.



Traumatic injury to face, maxilla and mandible. (Image courtesy of Pablo Pratesi, Hospital Universitario Austral, Argentina.)



# **Cervical Spine Injury**

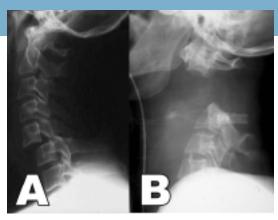
#### **General Considerations:**

If DA, do an awake intubation, provided the patient is cooperative, stable, maintains SV, especially if the patient has neurological symptoms from spinal cord injury (SCI).

# **Key Questions:**

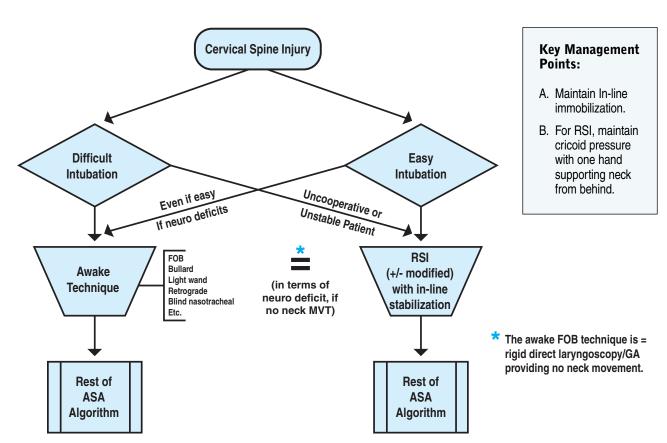
Does the rest of the airway examination (HMD < 6 cm, Mallampati Class IV, small mouth) predict a DA? If yes, do awake.

**Does the patient have a neurological deficit?** If yes, do awake.



A.Lateral C-spine X-ray showing C5-6 bifacet dislocation. B. Lateral C-spine X-ray showing atlanto-occipital dislocation.

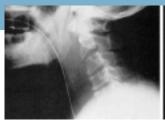
# **Cervical Spine Injury Algorithm**

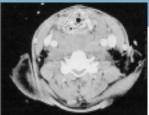


# **Airway Compression**

# **General Considerations:**

Do awake intubation, provided the patient is cooperative, stable, maintains SV, not life-threatening and able to maintain patency.





Lateral C-spine X-ray (left) and CT scan (right) showing massive retropharyngeal hematoma.

# **Key Questions:**

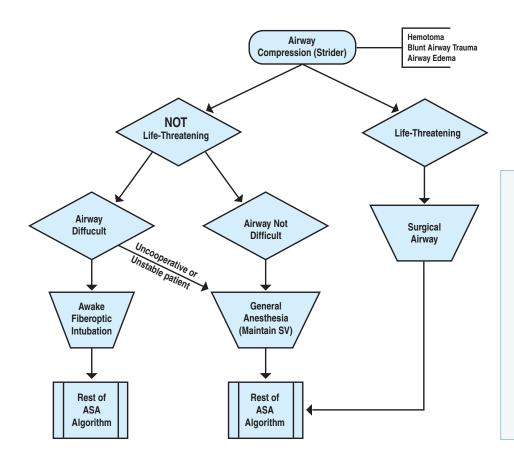
# Life-threatening obstruction?

If so, surgical airway.

# Not life-threatening?

If not, FOB a good choice as long as able to see entire way.

# **Airway Compression Algorithm**



# Key Management Points:

- A. Maintain SV even when with GA (modified RSI).
- B. Get ETT below obstruction.
- C. No supraglottic solutions (LMA, ETC, etc.).
- D. If using TTJV, may need help with exhalation.
   Consider opening wound if strider due to postoperative expanding neck hematoma.