Purpose:
To provide a standardized and interdisciplinary approach to airway management of trauma patients. These guidelines were created through a collaborative effort between the Departments of Anesthesia, Emergency Medicine, and Trauma Surgery.

Approach to airway management:
Early recognition of the difficult airway and a methodical, prepared approach will assist in establishing a safe and successful intubation. The emergency airway management algorithms endorsed by the American Society of Anesthesiologists, Walls et al. and Dunham et al. are included in this guideline. They are referenced and attached as appendices (1-3).

Indications for intubation:
Airway management is a critical component of resuscitation of the trauma patient. Clinical indications for endotracheal intubation may include:
- Airway Obstruction
- Altered mental status with severe cognitive impairment (GCS < 8)
- Cardiac Arrest
- Hypoventilation
- Hypoxia
- Hemorrhagic shock
- Smoke inhalation or burns
- Anticipated clinical course

Guidelines:
The following guidelines are acceptable best practices for airway management in trauma patients:

1. Roles, Experience & Training in emergency airway management:
   1. Physicians performing intubation of trauma patients should have prior training in emergency airway management and the approach to the difficult airway.
   2. The physician should also have familiarity with the available equipment (Appendix 4), personnel, and protocols of trauma airway management in the Emergency Department.
   3. Physicians should have knowledge of indications and contra-indications of the available airway devices
   4. The decision to intubate a patient will be made by the resuscitation leader in conjunction with the EM attending, Trauma Surgery, and Anesthesia attendings.
   5. The specific primary team responsible for intubation will be determined by the prior written policy between the Departments of Emergency Medicine, Anesthesia, and Trauma Surgery
      1. As of August 2008:
         Monday 6:00 AM until Saturday 6:00 AM:
            1. Anesthesia team has the primary responsibility for the trauma airway
         Saturday 6:00 AM until Monday 6:00 AM:
            2. Emergency Medicine team has the primary responsibility for the trauma airway
      6. When the EM team is primarily managing the airway, the Anesthesia team will support the EM airway team as a consultant in case of difficulties. Ideally, a short briefing between the EM team and the anesthesia consultant is performed prior to the
arrival of the patient\(^1\).

2. **Preparation:**
   1. The equipment available for airway management will be regularly checked and re-stocked per Emergency Department Protocol. The physician managing the airway will be responsible for verifying:
      1. Functioning and appropriately sized laryngoscopes, blades and endotracheal tubes (Adults: size 6.5-8.0; Pediatrics: size 3.5-6.0; stylet and balloon tested)
      2. Oral and nasal airways
      3. Intravenous access
      4. Cardiac monitoring
      5. Oximetry and Capnography
      6. Suction (Yankauer, endotracheal suction)
      7. Bag-Valve-Mask (BVM)
      8. Supraglottic device (LMA / Combitube)
      9. Cricothyrotomy kit

3. **Assessment:**
   1. In order to identify the anticipated difficult airway, the airway team should perform early examination (when feasible), including Mallampati score and assessment of thyromental distance (i.e. LEMON, Appendix 5).
   2. When a difficult airway is encountered or anticipated, a call for additional equipment, resources and the anesthesia team should be made.

4. **Positioning:**
   1. If there is concern of cervical spine injury, cervical spine immobilization should be maintained prior to intubation and after the airway is secured.
   2. During the procedure, the cervical spine collar (if used) should be opened and an assistant designated by the airway physician will provide in-line cervical spine stabilization
   3. Cricoid pressure should be applied when the patient is unconscious. If an inadequate view is encountered, the intubating physician may manually reposition the larynx, or direct the assistant to release cricoid pressure.

5. **Preoxygenation:**
   1. If feasible, patients will be administered 100% oxygen for at least 3 minutes, or 8 vital capacity breaths by BVM prior to intubation

6. **Medications:**
   1. A standard intubating drug (Appendix 6) kit will be requested with any 900/911-trauma activation
   2. In case of peri-intubation hemodynamic collapse vasoactive drugs (ACLS) should be available, including atropine, phenylephrine, and epinephrine.
   3. The medications given for rapid sequence induction and intubation will be under the direction of the physician overseeing airway management
   4. As medications are administered, they will be announced and recorded by the nursing scribe during the resuscitation
   5. Upon successful intubation, post-intubation sedation medications will be ordered by the airway physician

7. **Pre-treatment:**
   1. In selected patients with signs of increased intracranial pressure, aortic dissection, or reactive airway disease the following medications may be considered as pre-

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\(^1\) At San Francisco General Hospital, the Associate Dean of the Medical School, the hospital Chief of Staff and the hospital Chief Medical Officer have assigned the attending anesthesiologist authority to intervene in difficult airway cases.
treatment:
1. Lidocaine 1.5 mg/kg IV
2. Fentanyl 1-3 mcg/kg IV (caution: hypovolemia may cause hypotension)

8. Induction:
1. The following medications are recommended for induction
   1. Etomidate 0.2-0.3 mg/kg IV

9. Paralysis:
1. The following medications are recommended for paralysis
   1. Succinylcholine 1.0 - 1.5 mg/kg IV (*contraindications: appendix 7)
   2. Alternative: Rocuronium 1.0 - 1.2 mg/kg

10. Confirmation
1. After placement of an endotracheal tube, confirmation of proper placement should be confirmed by:
   1. Capnography and
   2. Auscultation of breath sounds and absence of gastric sounds
2. Additional methods of endotracheal tube verification include:
   1. Chest Radiography
   2. Fiberoptic visualization of endotracheal placement

11. Post Intubation Management
1. After the placement of a cuffed endotracheal tube has been verified, the following medications are recommended for post-intubation sedation.
   1. Midazolam 0.01-0.05 mg/kg IV OR
   2. Alternative: Propofol 25-100 mcg/kg/min IV drip
2. For pain control, the following medication is recommended:
   1. Fentanyl 1-3 mcg/kg IV
3. If paralysis is required, the following medication is recommended:
   1. Rocuronium: 0.5 mg/kg IV

Appendices & References:


4. Airway Management Equipment List (in progress)

5. ASSESS the Airway: LEMON mnemonic
   1. L Look externally
   2. E Evaluate 3-3-2
   3. M Mallampati Score
   4. O Obstruction/Obesity
   5. N Neck mobility

6. Intubating Drug Kit Contents:
   1. Succinylcholine Prefilled syringe
2. Etomidate
3. Rocuronium

7. Succinylcholine contraindications include:
   1. Burns or crush injury >48 hours post initial injury
   2. Known or suspected myopathy
   3. Hyperkalemia
   4. Malignant Hyperthermia
Appendix 1:

2003 DIFFICULT AIRWAY ALGORITHM (MODIFIED FOR TRAUMA)

1. Assess the likelihood and clinical impact of basic management problems.
   A. Difficult Ventilation
   B. Difficult Intubation
   C. Difficulty with Patient Cooperation or Consent
   D. 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. Awake Intubation
   B. Non-Invasive Technique for Initial Approach to Intubation
   C. Preservation of Spontaneous Ventilation

DIFFICULT INTUBATION

RECOGNIZED

UNCOOPERATIVE OR UNSTABLE PATIENT

UNRECOGNIZED

4. Develop primary and alternative strategies:

A. AWAKE INTUBATION
   - Airway approached by non-invasive intubation
   - Invasive Airway Access
   - Succeed: Consider feasibility of other options
   - Fail: Consider feasibility of other options

B. 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
   - Alternative Approaches to Intubation

    - Successful Intubation
    - Fail: Multiple Attempts

FACE MASK VENTILATION NOT ADEQUATE

CONSIDER/ATTEMPT LMA

EMERGENCY PATHWAY
   - Ventilation Inadequate, Intubation Unsuccessful
   - Call for Help
   - ETC, TTJV, Rigid Bronch
   - Emergency Non-Invasive Airway Ventilation

*Confirm ventilation, tracheal intubation, or LMA placement with exhaled CO₂

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 patient.

b. Invasive airway access includes surgical or percutaneous tracheostomy or cricothyotomy.

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 catheter, (AEC) light wire, 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), esophageal-tracheal combitube ventilation (ETC), or transtracheal jet ventilation (TTJV).

f. Exsufflation strategies include: evaluation of the airway with FOB and exsufflation over an airway exchange catheter (AEC).
Appendix 2:

Needs intubation

Unresponsive? Near death?

No

Predict difficult airway?

No

From difficult airway?

No

RSI

Yes

Crash airway

No

Difficult airway

BMV

Attempt oral intubation

Successful?

No

BMV successful?

Failed airway

Yes

Post-intubation management

Succinylcholine 2.0 mg/kg IV

Failed airway

≥3 attempts at OTI by experienced operator?

No

Failed airway

Yes

≥3 attempts by experienced operator?

No

Failed airway

Yes

Post-intubation management

Difficult airway predicted

S$_{PO_2}$ ≥90 percent?

No

Call for assistance

Yes

BMV predicted to be successful?

No

Failed airway

Yes

BMV maintains S$_{PO_2}$ ≥90 percent?

No

Cricothyrotomy

Yes

If contraindicated

LMA or Combitube may be attempted while preparing for cricothyrotomy

Call for assistance

Yes

Consider:
Fiberoptic method
I-LMA
Lighted Stylet
 Supraglottic airway

Time allows and successful?

Yes

Cuffed ETT placed?

Yes

Cricothyrotomy

No

Post-intubation management

Failed airway

Arrange for definitive airway management

No

Sten osseotracheal
Cricothyrotomy
Fiberoptic method
I-LMA
Lighted stylet
Post-intubation management or RSI

S$_{PO_2}$ ≥90 percent?

Yes

Unsuccessful

No

Post-intubation management

Failed airway

Cricothyrotomy

Successful

Go to main algorithm

"Awake" technique

RSI (± double set-up)
Appendix 3:

![Diagram](image)

**Fig. 1.** Procedure options for trauma patients needing emergency tracheal intubation.