The Approach to the Threatened Airway, with General Recomendations for Management

Presented by Davide Cattano, M.D., Ph.D.
Anesthesia Service Chief for Head and Neck Surgery
The University of Texas Medical School at Houston

Dear Colleagues,

It is my pleasure to offer for your attention and discussion the general guidelines for approaching the patients with the “threatened airway”. We have defined the threatened airway (TAW) as a clinical situation where a constant risk exists for the patient to develop a severe, acute upper airway obstruction.

The guidelines and protocols for dealing with airway emergencies are being actively developed in many anesthesiology departments. A Rapid Response team (or its equivalent) is usually requested at the bedside for urgent airway assessment in patients with acute airway compromise. These teams frequently have varying levels of expertise, and in many situations a further expert level of assessment and management becomes necessary.

A long-term focus of our group at the Memorial Hermann Hospital of The University of Texas Medical School (MHH-TMC) has been to identify a general set of interventions required for the patients with the partially obstructed airway, and especially those at risk for developing acute airway obstruction. Some of the clinical entities include the patients with laryngeal cancer, laryngeal edema, neck/submandibular abscesses, status post laser resection of the larynx and trachea, the patients with expanding neck hematoma (e.g. after anterior cervical discectomy/fusion, neck dissection, thyroidectomy), or any other situation where airway edema, trauma, or bleeding precipitate acute airway compromise.

Our group at the MHH-TMC felt that the set of focused recommendations would greatly help to properly and timely recognize such clinical situations, facilitate communication between the providers, and expedite safe and effective management of these patients under the optimal conditions, most commonly in the operating room (OR).

With time, our departmental group of experts has expanded to include inter-institutional consultants with substantial expertise in the field. The initial inter-institutional meetings and discussions occurred during the 2011 and 2012 Society for Airway Management (SAM) meetings, followed by further multiple exchanges and revisions, which have lead to the development of the document you are about to read.

The threatened airway guidelines/recommendations are presented for your perusal, comments, and, hopefully,

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enjoyment. We plan to produce a final revision based on the ensuing discussion, and are looking forward to SHANA endorsement of our efforts for implementing these guidelines in clinical practice.

Credits.

- The TAW initial idea was generated by Drs. Davide Cattano and Ronda Alexander.
- The MHH-TMC focus group: Drs. Davide Cattano, Ronda Alexander, Ron Karni, Carin Hagberg.
- The Airway Experts focus group: Drs. Laura Cavallone, William Rosenblatt, Vladimir Nekhendzy.

Definition

A threatened airway (TAW) is a clinical situation that puts the patient at a constant risk for developing a severe, acute upper airway obstruction.

The persistent risk of the loss of upper airway patency can be caused by different mechanisms, such as inflammation, edema, compression, permanent or intermittent (ball valve phenomenon) obstruction, constriction (scarring, fibrosis), etc. Depending on the underlying condition, more than one mechanism can predominate in a large number of patients, frequently necessitating complex airway management.

Although severe upper airway obstruction may lead to acute and chronic hypercapnia, the pathophysiology of TAW is decisively different from other causes of acute ventilatory failure, where severe abnormalities of gas exchange are caused primarily by inability to maintain adequate minute ventilation to satisfy the metabolic rate (e.g. neuromuscular disorders, obesity), or by the intrapulmonary shunt or diffusion abnormalities (e.g. ARDS, pulmonary edema, asthma and COPD).

The TAW is a critical condition that requires immediate attention and intervention aimed at restoring and/or securing the upper airway patency. If untreated, TAW could rapidly deteriorate, resulting in life threatening emergency and total airway obstruction.

Philosophy

This document was prepared by a small task force of anesthesiologists and ENT surgeons, interested in advanced airway management, and in airway disease/injury. It is intended to serve as a set of general recommendations for caring for TAW in different clinical settings. The clinical judgment of the Anesthesia and Surgical Faculty shall prevail in exigent circumstances. Any medications mentioned should be omitted if the patient has allergy or contraindications to their use.

General Principles

1. Communication among senior anesthesia and surgical providers shall drive the airway-related interventions.
2. A thorough airway exam should be performed whenever possible.
3. TAW should be managed in the operating room (OR) whenever possible.
4. Maintenance of adequate oxygenation at all times constitutes the primary goal.
5. Maintenance of spontaneous ventilation (assisted, if necessary) should be strongly considered until the patient's airway is secured in the OR. If general anesthesia (GA) is planned as a primary approach, detailed airway management strategies must be in place, and agreed upon between the anesthesiologist and the surgeon.
6. Imminent upper airway obstruction may necessitate abolishing of spontaneous ventilation for emergent tracheal intubation outside of the OR.
7. Intravenous (IV) sedating medications and opioids should be avoided whenever possible. Their administration should be left at the discretion of the senior providers, and deferred until the patient is in the OR.
8. Rapid Sequence Induction should be reserved for expected easy intubations and unsafe patient NPO

status.

Equipment and Drugs

The following list is intended to serve as a guide only. The individual skills and availability of the advanced airway management devices/techniques will dictate the airway armamentarium in many circumstances.

1. Personnel protective equipment (masks, goggles).
2. Fully operational anesthesia machine and suction.
3. Ambu bag, CPAP valve, and non-invasive ventilation equipment, if available.
4. Heliox, if available.
5. Range of adult cuffed tracheostomy and standard endotracheal tubes (ETTs).
6. Microlaryngeal (MLT) 4.0-6.0 mm ID and wire-reinforced (6.0 mm ID) ETTs.
7. Laser resistant ETTs.
8. Direct laryngoscopes with the assortment of blades (Mac 3,4; Miller 3,4).
9. Magill forceps.
10. Adult and pediatric size gum elastic bougies/Frova introducers.
11. Flexible fiberoptic bronchoscope (a video bronchoscope is preferred). Strongly consider availability of a small size external diameter (e.g. 3.8-4.2 mm) bronchoscope, to accommodate a small, 4.5-5.0 mm ID ETT.
12. A variety of supraglottic airway (SGA) devices for rescue ventilation, and for the use as a conduit for tracheal intubation. The LMA family of devices and tubular devices, such as the Laryngeal tube and Easy tube have the established track record for rescue ventilation.
13. Aintree catheter.
14. Video laryngoscope (VL). Strongly consider the availability of 2 types of VLs: those, where the styletted ETT is used (“steering technique”, e.g. Glidescope, Storz), and those that utilize the integrated channel built-in system for passing the ETT into the trachea (e.g. Airtraq, Airway scope). Note a unique feature of the Airway scope (AWS), where the VL blade is introduced under the epiglottis, thus avoiding the base of the tongue (BOT) pathology.
15. Fiberoptic optical stylet of choice.
16. Emergency airway supplies (consider commercially available kits), such as needle cricothyrotomy or percutaneous cricothyrotomy catheters and cannulas.
17. Surgical Tracheotomy and/or Cricothyrotomy supplies (**NOT a percutaneous set).
18. A variety of surgical rigid operating laryngoscopes (anterior commissure scopes).
19. An adult and pediatric size rigid bronchoscopes.
20. Automatic high frequency jet ventilator (HFJV) (e.g. Monsoon) with the subglottic jet ventilation catheters (e.g. Hunsaker or LaserJet). Tubing, adapters, and cannulas for supraglottic jet ventilation through the anterior commissure scope and a rigid bronchoscope.
21. Airway exchange catheters (AEC) #11 and #14 Fr.
22. Medications and other supplies:
    - Anesthetic drugs
    - 4% and 2% lidocaine formulations for topical and regional anesthesia of the airway
    - Atomizer of choice
    - Array of syringes, angiocaths, and needles

General “Rules of Engagement”

Identification and First Steps

Once a threatened airway is identified, the physician at the bedside should notify the appropriate providers/supervisors. As a principle, the OR shall be regarded as the ideal setting for TAW management. Compelling reasons for on-site airway management may include distance from the OR, availability of staff/space in the OR, and imminent upper airway obstruction.

The main OR desk, and Anesthesia staff (Faculty and Resident), and the Surgical staff should be immediately notified, once the decision to intervene has been made.

Consultation with the Otolaryngology Service should be urgently requested, if that team is not already involved in the case, and if time permits.

Awake vs Asleep Airway Management

This decision should be based on the ASA recommendation for assessing potential difficulty with mask ventilation, laryngoscopy, intubation, SGA ventilation, and surgical airway placement, and on airway findings identified on preoperative flexible fiberoptic laryngoscopy/nasal endoscopy (if performed).

The IV sedating and opioid medications should be avoided whenever possible. If required, their administration should be reserved for OR use only, and not before the strategies for airway management are agreed upon between the anesthesiologist and the surgeon.

Individual experience with, and availability of advanced airway equipment should guide the airway management strategies for TAW.

If GA is used, inhalation-based spontaneous/assisted ventilation should be strongly considered in many cases of TAW. IV ketamine and dexmedetomidine may be considered as adjuncts, but should be used with extreme caution. For TAW management under GA, IV anesthetic agents, as well as muscle relaxants, may be used effectively to facilitate mask ventilation and tracheal intubation. Please refer to SHANA **Roundtable Discussion on the Management of the Partially Obstructed Airway** for detailed discussion of the subject. The Anesthesia provider and the Surgical team should be strongly confident of the level of obstruction before proceeding with GA.

Patient positioning

Upon arrival to the OR, patient is placed in the semi-sitting or sitting position, to alleviate respiratory distress, and to facilitate spontaneous ventilation for awake flexible fiberoptic intubation, if that approach has been chosen. The OR table/patient's bed, and airway and anesthesia equipment should be arranged in a well thought-through manner, to facilitate a rapid switch between airway management strategies.

The anesthesia team should be prepared to have the patient positioned at 90 or 180 degrees table rotation away from the ventilator for selected cases from the outset. The goal is to minimize the movement of personnel and equipment that would need to take place if the primary strategy fails. (**Figures 1 and 2**)

Articulate primary and secondary airway management strategies

This step should consist of a formal "time-out", where the intended courses of action and roles of the surgical and anesthesia personnel are stated aloud to assure complete understanding of the plans. The senior team members from anesthesia and surgical services shall identify themselves to each other.

The patient's cricothyroid membrane should be identified preoperatively, if possible, and the patient's neck should be prepped for possible surgical access. The surgical airway supplies should be readily available, and at least one surgeon should be scrubbed in for emergency surgical airway access, should that become required. The light cables and microsuction for the surgical laryngoscopes/rigid bronchoscope must be checked, and be fully operational. The airway should not be manipulated in any way until at least one source of suction is operational.

An orderly progression of airway instrumentation should be strongly considered. The airway device(s) shall be selected for use based on the anatomic level of airway pathology and individual technical proficiency. SGA ventilation should be considered as a temporizing measure to facilitate ventilation, when appropriate.

For the airway management under general anesthesia, consider the following sequential strategies, assuming mask ventilation is adequate:

1. Standard direct laryngoscopy (DL) or VL, +/- optical stylets.
2. Flexible nasal/oral fiberoptic bronchoscopy and intubation.
3. Rigid surgical laryngoscopy (e.g. Dedo Laryngoscope) +/- rigid bronchoscopy.
4. Surgical cricothyrotomy.

The decision to use HFJV as a primary *vs* emergency resource has to be made based on the provider(s) expertise, availability of expert help, and the site and severity of upper airway obstruction and the patient's conditions. Please refer to SHANA **Roundtable Discussion on the Management of the Partially Obstructed Airway** for more detailed discussion.

If tracheostomy is avoided, and tracheal extubation deemed feasible, staged extubation over the AEC should be strongly considered in these patients.

Clearly articulate the success/failure of ventilation and/or tracheal intubation at each step

The success or failure shall be clearly articulated to the entire team, and patient's vital signs should be reassessed before and after each intervention.

Document outcome in patient's chart

The sequence of airway interventions performed, including the one that was ultimately successful, shall be legibly documented in the patient's chart in detail.

Apply appropriate warnings in chart and to patient

The factors that contributed to difficulty in airway management, and the technique that was ultimately successful should be documented in the chart in detail.

The patient shall be educated, and instructed to provide and communicate pertinent information to future medical providers. The Medical Alert Indicator which will indicate difficult airway access should be advised, if required.

Continuous evaluation

The suggested "Rules of Engagement" shall be reviewed periodically and integrated into the quality assurance (QA) evaluation of cases involving the management of threatened airways.

Examples of the levels of the upper airway obstruction:

Supraglottic

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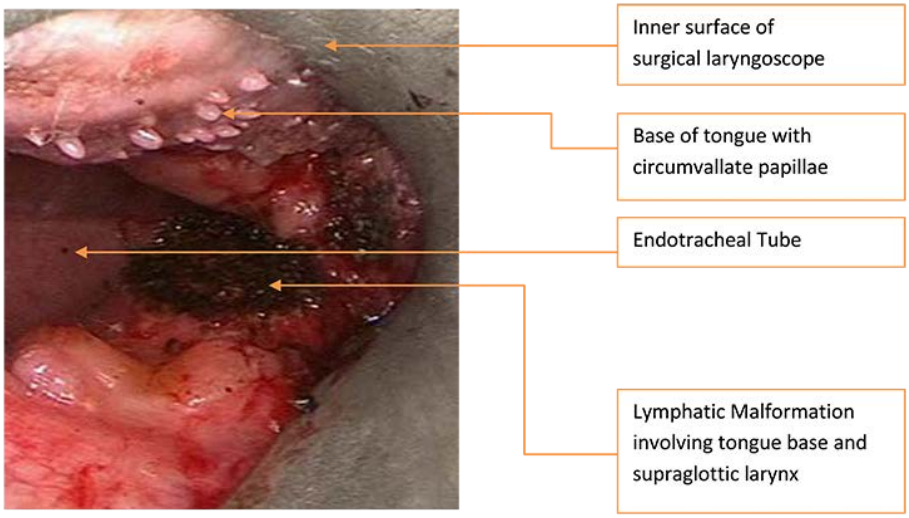

Glottic (laryngeal)

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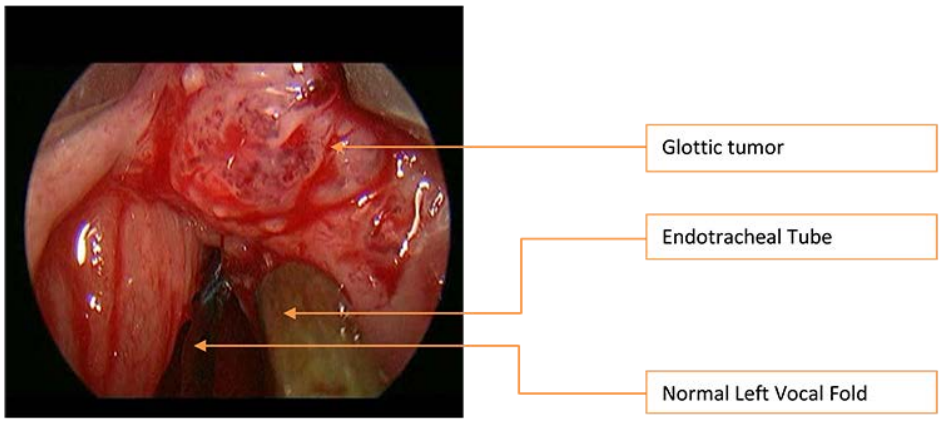

Subglottic

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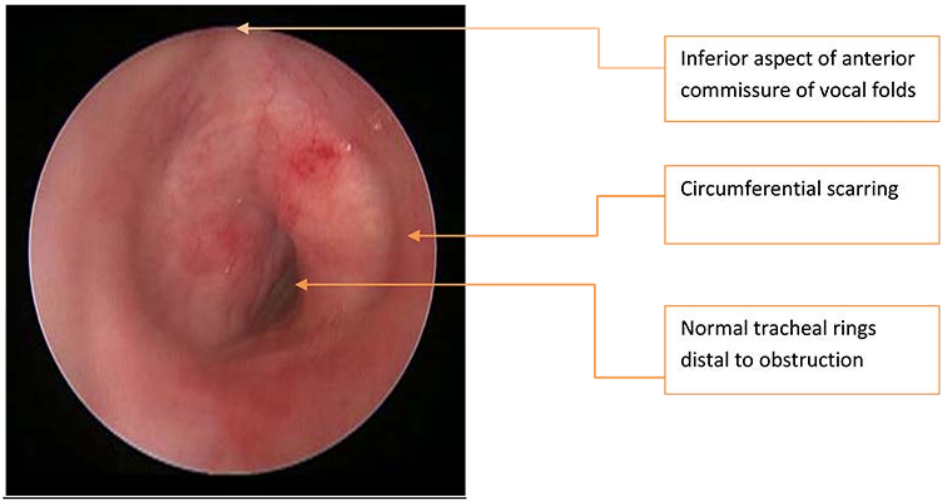

Tracheal

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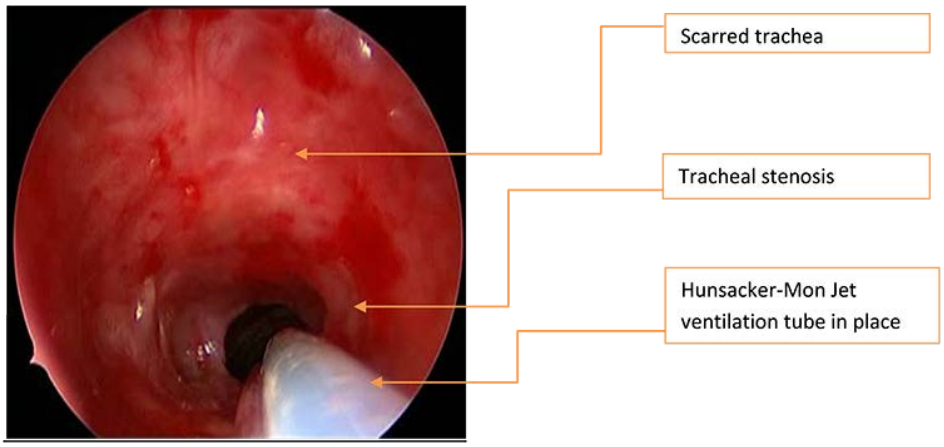

Set-up #1

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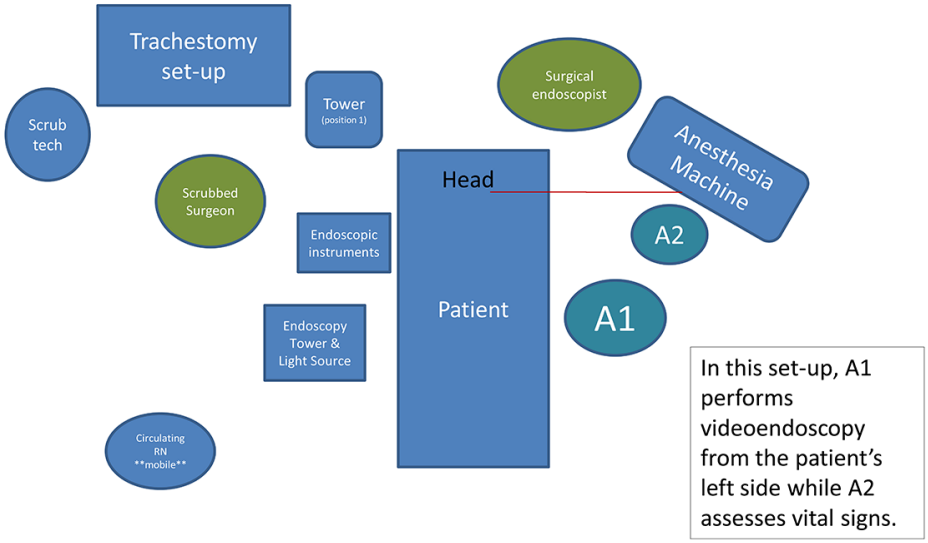

Figure 1. Suggested OR set-up for management of the threatened airway (TAW), based on The University of Texas Medical School at Houston experience. (A – anesthesiologist).

Set-up #2

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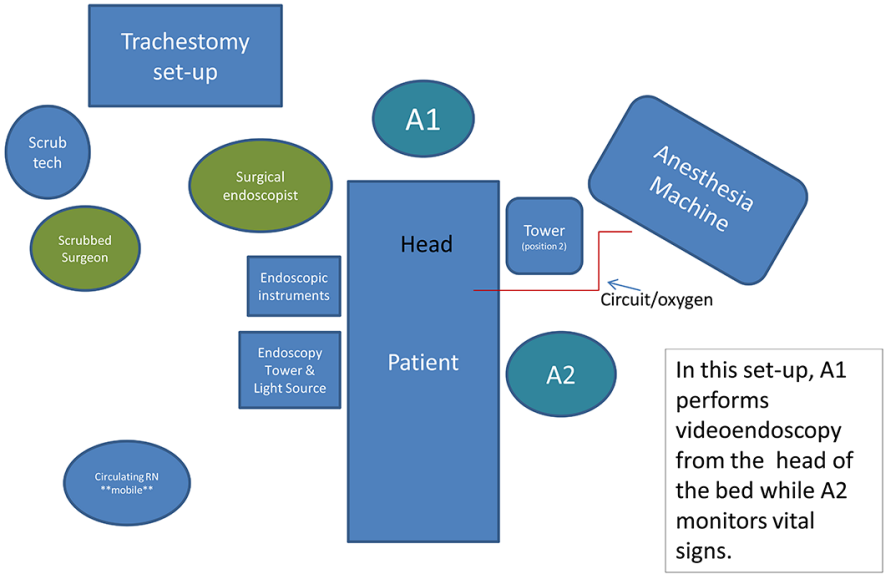

Figure 2. Suggested OR set-up for management of the ethreatened airway (TAW), based on The University of Texas Medical School at Houston experience. (A – anesthesiologist).

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