Managing Difficult Airway for Patients with Burns in Head and Neck Region

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3 year old male, 3 months s/p major burn in head and neck area. Unable to feed due to poor mouth opening. Not gaining weight. Presented to OR for scar release and skin graft. No intravenous line.

Anesthesia induction plan? Airway management plan? Muscle relaxants?
Introduction

• Airway management in patients with major burns
  – Only methods supplying oxygen to the patients
  – Directly related to mortality and morbidity

• Airway issues: two distinctive stages
  1) Acute burn injury: extra- and intra-oral
  2) Post-burn scar contracture: extra-oral

• How to evaluate the airway for intubation

• Pros and cons of various intubation techniques
The Current Problems

- Airway issues in burns: frequent M & M topic
- Disaster or near disaster experience
- Nobody seems to know what to do
- There seems to be no consensus as to how to approach
- ASA airway management guideline may not be appropriate in burns
- Urgent need of developing a new, specific guideline for the burns
Mallapatti Classification

Mallampati I

Mallampati II

Mallampati III

Mallampati IV
Mallampatti Class of ???
Equipment
Sniffing Position
Intubation

Right sided insertion of the blade and swipe the tongue to the left. No tissue to the right side of the blade. Blade in the midline. Remember BURP technique.
Laryngoscopy Grade

Classe I

Classe II

Classe III

Classe IV
Airways in Acute Phase of Major Burns

- Difficulty in manual ventilation

- Poor facemask fitting
  - Systemic and facial edema due to burn injury and fluid resuscitation
  - Wound dressing
  - Use of antiseptic cream
• Early desaturation
  – Inhalational injury
  – Potential ARDS due to trauma
  – Decrease pulmonary function and reserve volume
  – Increased metabolism
  – Increased $O_2$ consumption

• Usually requires two or more people for airway control
• Cannot identify airway structure
  – Edematous epiglottis and oral mucosa
  – Beefy tongue
  – Due to injury and resuscitation

• Oral secretion obscures the view

• Laryngospasm due to upper airway secretion

• Laryngoscope blade is too narrow!!
  – Tongue falls in your view
Difficulty in Securing Endotracheal Tube

Figure 1. The endotracheal tube was wired to the front tooth of an 8-yr-old boy with burn scar contractures of the nasal, facial, and neck region.
Tips For Successful Intubation

- Keep “the Basic Principles.”
- Plan for awake intubation if allowed
- Help should be readily available
- Good pre-oxygenation
- Use stylet, tube exchanger or Bougie
- **Sniffing position**
- Apply cricoid pressure even in NPO
  - **BURP technique**
  - Prevent aspiration
  - Better vocal cord exposure
- Use pre-existing ET tube as guidance if already in place
- Suction should be readily available
- Secure tube by suture to the front teeth
- Never tie around the neck!!
- Avoid tracheostomy at all cost
Airway Problems in Patients with Post-Burn Scar Contracture in Head and Neck Region

- Limited cervical ROM and restricted mobility of mandible
- Retraction of scar tissue after muscle relaxation
  - Dense fibrous hypertrophic sheets and bands
  - Rigid shield obscuring laryngeal and mandibular anatomy
- The mandible immobilized and forced posteriorly
- Concomitant micrognathia due to facial burn in early developmental stage as well as later in life
- Presence of subcutaneous contractures may not be apparent under the mature scar
- Functional anatomy can be missed during routine preop assessment
Tips for Airway Evaluation in Postburn Scar Contracture

• **Red Flags!!!**
  – Most common in *flame burns of the anterior thorax with ascending involvement of the neck and face.*
  – Scheduled for *facial reconstruction.*

• Prediction for difficulties with intubation is not always straight forward.

• Evaluate in “sitting”, not supine or semi-fowler’s position

• **Evaluate the scar,** not just the airway.
  – Look for peri-nasal, circumoral and mento-sternal scar
  – Epiglottis and vocal cord are pulled to where the scar is
  – Not in the midline
  – Remember anterior, anterior, anterior, fish-hook, fish-hook, fish-hook
• Preop airway evaluation cannot predict difficult intubation!!!

• Keep in mind that airway contracture worsens after the induction and NDMRs
  – Preop airway evaluation is obsolete
  – “Looks are very deceiving”
  – The elasticity of scar and the loss of pulling action by the surrounding structures
  – Limited mouth opening becomes so aggravated that the oral airway or laryngoscope blade cannot be passed through mouth
  – Nasal orifice also gets narrower that the nasal airway or endotracheal tube cannot be advanced
• Preparations for dealing with difficult intubation are always indicated in all patients with scarring in the upper thorax, neck and face.

• In patients with extreme deformity, the underlying functional and anatomical distortion may be such that all attempts to intubate fail.
Burn Scar Contracture

- Facial contracture
  1) Perinasal contracture
  2) Circumoral contracture

- Mento-sternal contracture

- Oro-maxillo-facial *skeletal* deformities

- Airway (tracheal) stenosis in inhalational injury
  - Tracheal stent
Circumoral Burn Scar Contractures: Interincisional Gap and Poor Mouth Opening

As long as one can pass the spoon or feed himself, the laryngoscope blade and thereby endotracheal tube can be entered into the oral cavity. Oftentimes, however, they require surgical reconstruction due to inability to eat.
Peri-nasal Burn Scar Contractures

Take a look at nasal orifices during preop airway evaluation as backup. Use smaller sized endotracheal tube, gel, and stylet to pass through the nasal orifice.
Post-burn Mentosternal Contractures

- Receding jaw and mandible
- Limited cervical ROM and hyperextension
- Aggravated contractures after muscle relaxation
- Difficult exposure of vocal cord
A Classification System for Postburn Mentosternal Contractures

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Figure 2. Type 1a contracture.

Figure 3. Type 1b contracture.

Figure 4. Type 2a contracture.

Figure 5. Type 2b contracture.

Figure 6. Type 3a contracture.

Figure 7. Type 3b contracture. A. Typical appearance of a patient with a type 3b contracture. B. Typical appearance of the eye in another patient.
Oro-maxillofacial skeletal deformities resulting from burn scar contractures of the face and neck

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Figure 2. Intraral view of the patient on admission. Note flaring of the anterior lower teeth.

Figure 7. Hullihean's case - note the similarity between his and our cases, 150 years apart.

Figure 4. Lateral cephalograms: a. in the initial phase; b. after the orthodontic treatment; c. after surgery.
Micrognathia
Skeletal Deformity due to Burn Scar Contracture
Oro-Maxillo-Facial Skeletal Deformity
Skeletal deformity of lower incisor, demands more upward and forward displacement of laryngoscopy to expose the epiglottis and to lift up the surrounding tissues.
Various Distances Based on Anatomical Reference Points

• Hyoid mental distance > 5 cm
• Thyromental distances
• Sternomental distance > 12.5 cm
Limited ROM of Cervical Spine

Figure 42-3 Schematic diagram demonstrating the head position for endotracheal intubation. **A**, Successful direct laryngoscopy for exposure of the glottic opening requires alignment of the oral, pharyngeal, and laryngeal axes. **B**, Elevation of the head about 10 cm with pads below the occiput and with the shoulders remaining on the table aligns the laryngeal and pharyngeal axes. **C**, Subsequent head extension at the atlanto-occipital joint creates the shortest distance and most nearly straight line from the incisor teeth to glottic opening.
Problems with Conventional Airway Evaluation

- Many patients disguise their disfigurement
- Mature scars with cosmetic treatment may not be apparent in the resting patients
- *Low sensitivity* of conventional airway measurement tools in predicting functional anomaly
- Fail to address the dynamics of pathological changes in the neck region
ASA Airway Management Guideline
Does Not Work in Burns!!!

Figure 42-23 Single-flowsheet version of the American Society of Anesthesiologists (ASA) Difficult Airway Algorithm. **, Always consider calling for help (e.g., technical, medical, surgical) when difficulty with mask ventilation and/or tracheal intubation is encountered; ***, Consider the need to preserve spontaneous ventilation; +, nonsurgical tracheal intubation choices consist of laryngoscopy with a rigid laryngoscope, blade (many types), blind orotracheal intubation, orotracheal technique, fiberoptic/styllet technique, retrograde intubation, illuminating stylet, rigid bronchoscope, and percutaneous dilational tracheal entry. Benumof offers a complete discussion of these types of intubation choices. (Adapted from Benumof JL: Laryngeal mask airway and the ASA difficult airway algorithm. Anesthesiology 84:1686, 1996.)
Airway Management Techniques

• Per oral intubation: require mouth opening
  – Direct laryngoscope
  – McGrath laryngoscope
  – Bullard laryngoscope
  – Lightwand
  – Shikani optic stylet
  – Fiberoptic intubation

• Per nasal blind or fiberoptic intubation: require nasal opening

• Special devices
  – Laryngeal mask airway
  – Perilaryngeal airway
  – Laryngeal tube

• Incision to airway
  – Scar release
  – Cricothyroidotomy
  – Tracheostomy
Placement may be hampered by anatomical abnormalities described, and airway maintenance may be jeopardized in operations which require turning the patients.
Difficult Airway Management in a Maxillofacial and Cervical Abnormality With Intubating Laryngeal Mask Airway

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FIGURE 1. Patient with facial burns showing contracture neck with limited mouth opening.

FIGURE 2. Showing introduction of ILMA.

FIGURE 3. Showing ETT being inserted through the ILMA and being connected to the breathing circuit.

FIGURE 4. Showing ILMA being removed over the stabilizing rod while the ETT is in situ.

FIGURE 5. Showing ILMA being removed while the ETT is being stabilized with the other hand.
Blind Nasal Intubation

Figure 5–22. Cephalad traction on the tube will help direct its tip along the floor of the nasal cavity.

Usually be successful, particularly when the base of the tongue is fixed anteriorly by the contracture process. However, positioning of the head and neck may be severely limited and repeated attempts risk nasal bleeding.
GlideScope
Flexible or Rigid Fiberoptic Intubation

Established as the safest and most effective alternative to direct laryngoscopy and has been described in patients with post-burn contractures of the neck.
Fiberoptic Intubation

- The highest success rate when performed electively in the awake, adult, well informed, cooperative patient

- Many burned patients are extremely anxious at induction and lack of cooperation is common

- Bronchoscopy itself can be difficult if the anatomy of the airway is distorted due to soft tissue contraction

- Repeated attempts to intubate can result in the presence of blood and secretions in the oropharynx
Surgical Release Scar Contracture

Can be performed as emergency or electively under inhalational and various intravenous anesthetics with maintenance of spontaneous breathing. This can be a rapid and effective method to ensure maintenance of a clear airway and to facilitate successful intubation in the paralyzed, anesthetized patient.

Figure 1. Diagram of a mid-sagittal plane through the neck with the head in maximal extension in the normal situation (a) and in a patient with severe postburn contracture of the neck (b).

Figure 2. A patient with postburn flexion contractures of the neck and concomitant microstomia before (a) and after the surgical neck release for intubation purposes. After successful intubation, the release was completed with a second incision (c).

Figure 3. Diagram of two types of release incisions of the same length. It demonstrates that a Y-shape at both ends of the incision (b) gains much more release than just a straight line (a).
Anesthetic Approach

• Judicious preoperative airway/scar evaluation
• Be prepared for difficult or failed intubation
• Maintain spontaneous ventilation
• *No* muscle relaxants!!!
• Surgeons should be available during anesthesia induction
• Always have plan B, C, D and more and more and more, …
• It is the *ventilation* that saves the lives, not intubation!!!
Have you figured out airway management plan?
Thank You for Your Attention!!!