Trauma And Airway

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Disclosures

• None
• To classify non-iatrogenic airway trauma according mechanism and level of injury
• To recognize airway trauma as an anesthetic emergency, where immediate intervention may alter outcome
• To suggest management options for the various airway injury patterns and reduce serious sequelae
Introduction

• Incidence: 0.2%-4.5%\textsuperscript{1,2}

• Mortality rate: 28-30%

• Major challenge to anesthesia providers
  \begin{itemize}
  \item Advancing ETT blindly beyond vocal cords may do more harm than good
  \item Difficult airway algorithms make no provision for difficult non-iatrogenic airway trauma
  \end{itemize}

\textsuperscript{1} Verschueren et al; J Oral Maxillofac Surg 2006
\textsuperscript{2} Bhojani et al; J Thorac Cardiovasc Surg 2005
Non-latrogenic Airway Trauma

1. Blunt Trauma
2. Penetrating and Blast Injuries
3. Burns
Anatomy of the Neck

Larynx in Cross Section

- epiglottis
- hyoid bone
- fat body
- vocal ligament
- thyroid cartilage
- arytenoid cartilage
- cricoid cartilage

Duke Airway Lab
Blunt Airway Trauma
Blunt Airway Trauma

- Blunt airway injury is \(~0.4\%\)
- Mortality rate \(~63\%\) (injuries below level of vocal cords)
- Bronchial disruption (<1% chest trauma)-High Mortality
- Independent risk factor- Airway management

References:
1 Kummer et al; Injury 2007
2 Bhojani et al; J Thorac Cardiovasc Surg 2005
Mechanisms of Injury in Blunt Trauma

1. Sudden A-P compression of Chest & Sternum
   - Traverse stretching of thoracic cage
   - Lateral movement of T-B tree above carina
   - Compressive forces > Elasticity of T-B tree
   - Airway Rupture (2-2.5cm above carina)

2. External Compressive Forces on Chest wall
   - Build up of Airway Pressure against closed glottis
   - Rupture of Posterior Tracheal Membrane

3. Sudden Deceleration
   - Excessive Shearing Forces
   - Airway Rupture at Cricoid and Carina
     (Sites airway anchored)

References:
1. Chu et al; Anaesth Intensive Care 2002
### Table 1 The mechanisms of injury associated with blunt trauma to the airway

<table>
<thead>
<tr>
<th>Type of trauma</th>
<th>Mechanism of injury</th>
<th>Airway injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic collision</td>
<td>Severe flexion/extension</td>
<td>Tracheal tears</td>
</tr>
<tr>
<td>Fall</td>
<td>Rapid deceleration</td>
<td>Fractures of the larynx</td>
</tr>
<tr>
<td>Hanging</td>
<td>Direct blows</td>
<td>Laryngotracheal separation</td>
</tr>
<tr>
<td>Accidental strangulation</td>
<td></td>
<td>Fractured thyroid or cricoid cartilages, or both</td>
</tr>
<tr>
<td>‘Clothesline’ mechanism</td>
<td></td>
<td>Laryngotracheal separation</td>
</tr>
<tr>
<td>Assault</td>
<td></td>
<td>Tracheobronchial disruption</td>
</tr>
<tr>
<td>Crush</td>
<td>Crush injuries to chest</td>
<td>Transection at carina or cricotracheal junction</td>
</tr>
<tr>
<td>Pedestrian vs vehicle</td>
<td>Sudden, explosive increase in intrathoracic pressure</td>
<td>Transection at carina or cricotracheal junction</td>
</tr>
<tr>
<td></td>
<td>against a relatively closed glottis</td>
<td>Transection at carina or cricotracheal junction</td>
</tr>
<tr>
<td></td>
<td>Rapid deceleration shears airways at fixed points:</td>
<td>Transection at carina or cricotracheal junction</td>
</tr>
<tr>
<td></td>
<td>cricoid cartilage and carina</td>
<td>Transection at carina or cricotracheal junction</td>
</tr>
<tr>
<td></td>
<td>Pulmonary compression tears the airway at the level of the carina</td>
<td>Carinal tear</td>
</tr>
</tbody>
</table>
Sites of Laryngotraacheal Trauma


Fig. 5. Epiglottic hematoma causing airway obstruction.

Fig. 6. Fracture of the hyoid bone. Acromionomastic insects require no specific treatment. Pains and odynophagia are treated by open reduction and internal fixation or partial hyoid resection.

Fig. 7. Fracture of the thyroid cartilage with associated goiter injuries resulting in vocal cord asymmetry, endolaryngeal lacerations, or elevation from the anterior commissure. Shortening of the vocal cords is associated with seemingly minimal displacement of the thyroid cartilage and has the potential for significant vocal changes. Injuries are usually closed.

Fig. 8. Laryngotraacheal separation causes upward retraction of the larynx and downward retraction of the trachea and commonly results in fatal airway obstruction.
Sites of Laryngotracheal Trauma

Jain et al; Anesthesiology 2016
Blunt Airway Trauma

a. Maxillofacial Trauma
b. Laryngotracheal trauma
c. Disruption of Trachea and Bronchi
Maxillofacial Trauma

- Main issues to consider are
  - Airway Hemorrhage
  - Hypoxia
  - Risk of aspiration
  - Difficult airway- Trismus +/- Impacted condylar head fracture
Patterns of Maxillofacial Injury

Strength of the skull and face bones

Le Fort 1 - Tooth bearing upper jaw free to move
Le Fort 2 - Maxilla & Nose as a block
Le Fort 3 - Facial bones move separately from base of skull

The ‘matchbox’ structure of the mid-facial skeleton provides a ‘crumple zone’ which cushions the effect of impact force B on the brain. Impact force A is transmitted directly to the brain producing the most severe injury. Impact force C is transmitted indirectly to the cranial base via the rigid structure of the mandible (represented here as a bent baseball bat).


Le Fort fracture lines

a Le Fort 1 fracture
b Le Fort 2 fracture
c Le Fort 3 fracture

a The Le Fort 1 fracture line passes through the inferior wall of the antrum and allows the tooth-bearing segments of the upper jaw to move in relation to the nose. b In a Le Fort 2 fracture the maxilla and nose can move as a block in relation to the frontal bone and zygoma. c In a Le Fort 3 fracture the facial bones are able to move separately from the base of the skull. Le Fort 2 and 3 fractures may be associated with a dural tear resulting from fracture of the cribriform plate of the ethmoid bones. In Le Fort 3 fracture the base of skull bones (sphenoid and /or temporal) are involved.
Fractures of different areas associated with particular head and neck injuries\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Area Involved</th>
<th>Associated Injuries</th>
</tr>
</thead>
</table>
| Upper Face             | • Mid Lower Cervical Spine  
                         | • Intracranial Injury  
                         | (High Mortality)     |
| Unilateral Midface     | • Basilar Skull Fracture  
                         | • Intracranial Injuries |
| Bilateral Midface      | • Basilar Skull Fracture  
                         | (High Mortality)     |
| Unilateral Mandibular  | • Upper Cervical Spine |

\textsuperscript{1} Curran et al; Anaesth ICU 2014  
\textsuperscript{2} Mithani et al; Plast Reconstr Surg 2009
Airway Management - Maxillofacial Trauma

- Call for Help Early
- Anesthesia Team
- Otolaryngology Team

DIFFICULT AIRWAY ALGORITHM

Burns and maxillofacial trauma
(Blunt and penetrating)

Cooperative patient

- Not time critical
  - Perform diagnostic imaging and formulate plan
  - Risk vs benefit analysis: Transfer to theatre

- Time critical
  - Awake tracheostomy under local anaesthesia

Uncooperative patient

- Time critical
  - Plan A: Standard RSI
  - Plan B: Surgical cricothyroidotomy

Mercer et al; BJA 2016
Blunt Airway Trauma

a. Maxillofacial Trauma
b. Laryngotracheal Trauma (LTT)
c. Disruption of Trachea and Bronchi

Laryngotracheal Trauma (LTT)

- Cricoid & Cricothyroid membrane- 50% cases
- Laryngotracheal separation- 63% cases
- Early Diagnosis A Challenge

1 Francis et al; J Natl Med Assoc 2002
Initial Endoscopy in the Operating Room Following Awake Tracheostomy

WV Initial Operative Endoscopy 9-11-15
TABLE 3. Univariate and multivariate analysis of 71 patients by a logistic regression model according to mortality

<table>
<thead>
<tr>
<th>Variable</th>
<th>Relative risk</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than median age vs less than median age</td>
<td>1.296</td>
<td>0.452-3.714</td>
<td>.6290</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male vs female</td>
<td>2.830</td>
<td>0.575-13.930</td>
<td>.2006</td>
</tr>
<tr>
<td>Trauma type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blunt vs penetrating</td>
<td>11.020</td>
<td>3.234-37.552</td>
<td>.0001</td>
</tr>
<tr>
<td>Associated injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present vs absent</td>
<td>1.485</td>
<td>0.514-4.289</td>
<td>.4650</td>
</tr>
<tr>
<td>Emergency airway requirement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present vs absent</td>
<td>26.569</td>
<td>3.291-214.469</td>
<td>.0021</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larynx vs trachea</td>
<td>2.787</td>
<td>0.529-14.668</td>
<td>.2262</td>
</tr>
<tr>
<td>Larynx + trachea vs larynx or trachea</td>
<td>3.237</td>
<td>1.085-9.661</td>
<td>.0352</td>
</tr>
</tbody>
</table>
Classification of Laryngeal Injury

- Various classification systems exist
  1. Schaefer Classification System
  2. LEHHC Classification System

- Based upon symptoms, flexible fiberoptic endoscopy, & radiographic findings

- Direct airway and surgical management
## Schaefer Classification System

<table>
<thead>
<tr>
<th>Group</th>
<th>Severity of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor endolaryngeal hematomas or lacerations without detectable fractures</td>
</tr>
<tr>
<td>2</td>
<td>More severe edema, hematoma, minor mucosal disruption without exposed cartilage, or non-displaced fractures</td>
</tr>
<tr>
<td>3</td>
<td>Massive edema, large mucosal lacerations, exposed cartilage, displaced fractures or vocal cord immobility</td>
</tr>
<tr>
<td>4</td>
<td>Same as group 3, but more severe with disruption of anterior larynx, unstable fractures, two or more fracture lines, or severe mucosal injuries</td>
</tr>
<tr>
<td>5</td>
<td>Complete laryngotracheal separation</td>
</tr>
</tbody>
</table>

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2. Moonsamy et al; Ann Cardiothorac Surg 2018
# LEHHC Classification System

<table>
<thead>
<tr>
<th>Stage</th>
<th>Clinical Presentation</th>
<th>Diagnostic Findings</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor airway symptoms ± voice changes</td>
<td>Minor hematomas Small lacerations No detectable fractures</td>
<td>Observation Humidified Air Head of bed elevation</td>
</tr>
<tr>
<td>2</td>
<td>Airway compromise Voice changes ± subcutaneous emphysema</td>
<td>Edema/hematoma Nondisplaced fracture Minor mucosal disruption No cartilage exposure</td>
<td>Awake tracheostomy Direct laryngoscopy ± ORIF</td>
</tr>
<tr>
<td>3</td>
<td>Airway compromise Palpable laryngeal fracture Subcutaneous emphysema Voice changes</td>
<td>Massive edema Mucosal tears Exposed cartilage Vocal cord immobility</td>
<td>Awake tracheostomy Direct Laryngoscopy Exploration/ORIF</td>
</tr>
<tr>
<td>4</td>
<td>Airway compromise Palpable laryngeal fracture Subcutaneous emphysema Voice changes</td>
<td>Massive edema Mucosal tears Multiple displaced fractures Skeletal instability Exposed cartilage Vocal cord immobility</td>
<td>Awake tracheostomy Direct laryngoscopy Exploration/ORIF Consider Stent</td>
</tr>
</tbody>
</table>

Stage 2-4 receive immediate **Awake Tracheostomy** if airway not already secured

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1Verschueren et al; J Oral Maxillofac Surg 2006
Blunt Airway Trauma - Investigations

• Nasendoscopy ¹
  ✔ VC movement, laryngeal mucosa integrity & airway patency

• Computed Tomography
  ✔ Gold Standard ²
  ✔ Detects site of injury in 94% of cases with blunt trauma

• Bronchoscopy

¹ Francis et al; J Natl Med Assoc 2002
² Scaglione M et al; Eur J Radiol 2006
<table>
<thead>
<tr>
<th>Type</th>
<th>Location of TAI (n)</th>
<th>Mortality from TAI</th>
<th>Overall mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt</td>
<td>Upper airway injuries (28)</td>
<td>0</td>
<td>8 (29%)</td>
</tr>
<tr>
<td></td>
<td>Lower airway injuries (8)</td>
<td>5 (63%)</td>
<td>5 (63%)</td>
</tr>
<tr>
<td>Penetrating</td>
<td>Upper airway injuries (62)</td>
<td>3 (5%)</td>
<td>7 (11%)</td>
</tr>
<tr>
<td></td>
<td>Lower airway injuries (6)</td>
<td>2 (33%)</td>
<td>4 (66%)</td>
</tr>
</tbody>
</table>

Mortality TAI: mainly caused by airway injury. For both groups (blunt and penetrating), $p < 0.05$ when comparing upper and lower airways in each category of mortality.
Airway Management in Blunt Trauma$^{1,2,3}$

1. Awake Surgical Tracheostomy

2. Awake Fiberoptic Intubation

3. Direct Laryngoscopy & Intubation under direct vision

$^1$Gussack et al; Laryngoscope 1986
$^2$Atkins et al; J Trauma Acute Care Surg 2004
$^3$Kiser et al Ann Thorac Surg 2001
Airway Management in Blunt Trauma

- **Awake Surgical Tracheostomy**

- Cricothyrotomy contraindicated
Airway Management in Blunt Trauma

- **Awake Fiberoptic Intubation**¹,²
  - Maintains spontaneous ventilation
  - Allows for simultaneous airway assessment
  - Placement of ETT distal to any pericarinal defect
  - Care with bevel of ETT (Parker tip ETT)

¹ Perdikis et al; J Trauma Acute Care Surg 2000
² Demetriades et al; World J Surg 2001
Airway Management in Blunt Trauma

• Direct Laryngoscopy & Intubation
  ➢ Videolaryngoscopy + Fiberoptic Bronchoscopy

1 Schaefer et al; Ann Oto Rhinol Larungol 1989
2 Fuhrman et al; J Trauma Acute Care Surg 1990
Possible Injury from Supraglottic Intubation

Fig. 8. Cervical tracheal injury secondary to blunt trauma. Parasagittal reformatted 16-row MDCT image depicts displacement of the endotracheal cervical tube (arrowheads) through a wall defect consistent with a cervical tracheal injury. This finding was confirmed by bronchoscopy.

Fig. 1. Illustration of potential disruption of the airway by the endotracheal tube separating the tenuous continuity afforded by the tracheal and cricoid ligaments. Patients with such injuries are best managed by tracheotomy under local anesthesia. Insert: sagittal cadaver section showing larynx and trachea—1) epiglottis, 2) thyroid cartilage, and 3) first tracheal ring. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
Airway Management in LTT

Call for Help Early
✓ Anesthesia team
✓ Otolaryngology team

Laryngotracheal trauma
(Blunt and penetrating)

Cooperative patient

Not time critical
- Perform diagnostic imaging and formulate plan
- Risk vs benefit analysis
- Transfer self ventilating to theatre
- Perform awake fiberoptic intubation

Time critical
- Awake Tracheostomy under local anaesthesia.
  - Fiberoptic scope to identify distal lesion,
    - Tracheal tube advanced under direct vision.
  - (Surgical and percutaneous cricothyroidotomy are contraindicated)

Uncooperative patient

Time critical

Plan A:
- RSI
- Fibreoptic scope assisted direct laryngoscopy or videolaryngoscopy.
- Avoid cricoid pressure and positive pressure ventilation until Tracheal tube cuff inflated distal to lesion.
  - (Tracheal tube placed at introitus of cords and only advance under direct vision via fibrescope)

Plan B:
- Emergency tracheostomy
- Fibreoptic scope to identify distal lesion, Tracheal tube advanced under direct vision.

Mercer et al; BJA 2016
Recommendations

• Minor trauma or simple mucosal disruption with stable airway (LEHHC Stage 1) managed medically on ICU
• Awake Tracheostomy in LEHHC and Schaefer stages 2 to 4 injuries
• Oral intubation considered hazardous
• Use of flexible laryngoscopy for functional evaluation
• Cricothyrotoomy contraindicated
Blunt Airway Trauma

1. Maxillofacial Trauma
2. Laryngotracheal Trauma
3. Disruption of Trachea & Bronchi
Sites of Tracheobronchial Injuries

Fig. 8. Laryngotracheal separation causes upward retraction of the larynx and downward retraction of the trachea and commonly results in fatal airway obstruction.
Fig. 2. Blunt bronchial injury after motor vehicle crash. (a) Supine chest radiograph shows enlargement of the right main bronchus (arrows). (b) Axial CT scan confirms the enlargement of the right main bronchus (arrow). (c) Frontal MIP CT-reformation image shows longitudinal extension of injury and also depicts a bronchial pseudodiverticulum (arrow). (d) SSD reformation image gives optimal representation of the injury surface.
Airway Management in Tracheobronchial Trauma

- **Call for Help Early**
- **Anesthesia Team**
- **Otolaryngology Team**

**DIFFICULT AIRWAY ALGORITHM**

**Trachea and bronchi trauma**
(Blunt and penetrating)

- **Cooperative patient**
  - Not time critical
    - Perform diagnostic imaging and formulate plan
    - Risk vs benefit analysis
    - Transfer self ventilating to theatre
  - Time critical
    - Perform awake fiberoptic intubation

- **Uncooperative patient**
  - Time critical
    - Plan A:
      - RSI: Fibreoptic scope assisted direct laryngoscopy or videolaryngoscopy.
      - (Tracheal tube placed at introitus of cords and only advance under direct via fibroscope)
    - Plan B:
      - Emergency surgical cricothyroidotomy or Tracheostomy
      - Fibreoptic scope to identify distal lesion, Tracheal tube advanced under direct vision.
      - (If a lesion is at the level of carina, or distal, extending into a unilateral main bronchus - consider using a double lumen tube or advancing a standard uncut Tracheal tube into opposite bronchus and perform one lung ventilation)

Mercer et al; BJA 2016
Penetrating and Blast Trauma
Penetrating & Blast Trauma

- Density of vital structures within the neck\textsuperscript{1,2}

- Gunshot or Blast injuries - Consider likely trajectory of projectiles or fragments and their potential airway effects

- Hemorrhage from great vessels can impact airway patency with high mortality\textsuperscript{3}

\textsuperscript{1} Glapa et al; World J Surg 2007
\textsuperscript{2} Gussack et al; Laryngoscope 1986
\textsuperscript{3} Kotsev et al; Eur J Anaesthesiol 2005
Penetrating Airway Trauma
### Zone Analysis in Penetrating and Blast Injuries

<table>
<thead>
<tr>
<th>Anatomical territory</th>
<th>Associated problems</th>
<th>Caution: red flag signs and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 3</td>
<td>Cranial nerve injury Oesophageal injury Vascular injury (to branches of the external carotid artery, internal carotid artery, vertebral artery, and internal jugular and facial veins)</td>
<td>Neurological deficit Neurogenic shock Odynophagia Haematemesis Air bubbling from wound</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Oesophageal injury Vascular injury (to common carotid, carotid bifurcation, vertebral arteries, and jugular veins)</td>
<td>Massive surgical emphysema Expanding or pulsatile haematoma Active bleeding Cardiovascular collapse</td>
</tr>
<tr>
<td>Zone 1</td>
<td>Oesophageal injury Vascular injury (to subclavian and innominate vessels, common carotid and lower vertebral arteries, and jugular veins)</td>
<td>Haemoptysis</td>
</tr>
</tbody>
</table>
Airway Management in Penetrating Trauma\textsuperscript{1,2,3}

1. Awake Surgical Tracheostomy

2. Awake Fiberoptic Intubation

3. Direct Laryngoscopy & Intubation under direct vision

\textsuperscript{1}Gussack et al; Laryngoscope 1986
\textsuperscript{2}Atkins et al; J Trauma Acute Care Surg 2004
\textsuperscript{3}Kiser et al Ann Thorac Surg 2001
Airway Management in Penetrating Trauma

Call for Help Early
✓ Anesthesia team
✓ Otolaryngology team

Laryngotracheal trauma (Blunt and penetrating)

Cooperative patient

Not time critical
- Perform diagnostic imaging and formulate plan
- Risk vs benefit analysis
  - Transfer self ventilating to theatre.
- Perform awake fibreoptic intubation

Time critical
- Awake Tracheostomy under local anaesthesia.
  - Fibreoptic scope to identify distal lesion, Tracheal tube advanced under direct vision.
  - (Surgical and percutaneous cricothyroidotomy are contraindicated)

Uncooperative patient

Time critical
- Perform awake fibreoptic intubation

Plan A:
- RSI
  - Fibreoptic scope assisted direct laryngoscopy or videolaryngoscopy.
  - Avoid cricoid pressure and positive pressure ventilation until Tracheal tube cuff inflated distal to lesion.
  - (Tracheal tube placed at introitus of cords and only advance under direct vision via fibroscope)

Plan B:
- Emergency tracheostomy
  - Fibreoptic scope to identify distal lesion, Tracheal tube advanced under direct vision.

Mercer et al; BJA 2016
Burns

- Direct or steam injury, electrocution or contact with corrosive chemicals

- Larynx most commonly involved structure\(^1,2\)

- 60% of patients with central facial burns - Inhalational Injury

- Mortality 30% vs 2% (Burns with and without smoke inhalation)\(^4\)

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\(^1\) Clark et al; World J Surg 1992
\(^2\) Sobel et al; J Burn Care Rehabil 1992
\(^3\) Madnani et al; Ear Nose Throat J 2006
\(^4\) Mutlu et al; NEJM 2006
Inhalational Injury - Mechanisms & Putative Agents

- Direct injury to Midface and Upper Airway from steam +/- hot gases.
- Edema of face, pharynx & larynx

Chemical Injury to Tracheobronchial & Alveolar Lining

Impaired O₂ transport & utilization (Cyanide & CO)

Bittner et al; Anesthesiology 2015
Tracheal intubation difficulties in the setting of face and neck burns: Myth or Reality?¹

- Incidence of Difficult intubation 11.2%
- Burn to Pre-Burn Center (16.9% vs 3.5%)
- Higher incidence in FNB >11.2%)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>77 (57)</th>
<th>13 (87)</th>
<th>64 (54)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intubation at burn center (%)</td>
<td></td>
<td></td>
<td></td>
<td>.015</td>
</tr>
<tr>
<td>Delay between burn and intubation (min)</td>
<td>120 (60-210)</td>
<td>210 (105-290)</td>
<td>120 (60-180)</td>
<td>.047</td>
</tr>
<tr>
<td>Associated inhalation injury (%)</td>
<td>34 (25)</td>
<td>6 (40)</td>
<td>28 (23.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of mechanical ventilation (d)</td>
<td>9.5 (3-22)</td>
<td>9 (3-21)</td>
<td>9.5 (3-28.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Early-onset pneumonia (%)</td>
<td>58 (43)</td>
<td>7 (47)</td>
<td>51 (43)</td>
<td>NS</td>
</tr>
<tr>
<td>Tracheostomy (%)</td>
<td>24 (18)</td>
<td>3 (20)</td>
<td>21 (18)</td>
<td>NS</td>
</tr>
<tr>
<td>BICU length of stay (d)</td>
<td>19 (6-31)</td>
<td>20 (12-33)</td>
<td>19 (6-31)</td>
<td>NS</td>
</tr>
<tr>
<td>Burn center mortality (%)</td>
<td>14 (10.4)</td>
<td>2 (13)</td>
<td>12 (10)</td>
<td>NS</td>
</tr>
</tbody>
</table>

¹Esnault et al; Am J Emerg Med 2014
Airway Management in Burns

- Call for Help Early
- ✔ Anesthesia Team
- ✔ Otolaryngology Team

Burns and maxillofacial trauma (Blunt and penetrating)

Cooperative patient
- Not time critical
  - Perform diagnostic imaging and formulate plan
  - Risk vs benefit analysis: Transfer to theatre

Uncooperative patient
- Time critical
  - Awake tracheostomy under local anaesthesia

  Plan A: Standard RSI
  - Plan B: Surgical cricothyroidotomy

DIFFICULT AIRWAY ALGORITHM

YES

Mercer et al; BJA 2016
Summary

• Classify non-iatrogenic airway trauma according mechanism and level of injury
• Recognize airway trauma as an anesthetic emergency, where immediate intervention may alter outcome
• Management options for the various airway injury patterns and reduce serious sequelae