Intubation and Voice: Assessment and Management

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Disclosures

• Financial
  • Salary from VUMC

• Non-Financial
  • Author, *Voice Handicap Index*
  • Co-editor, *Medical Speech-Language Pathology: A Practitioner’s Guide*
Outline

• Landscape of intubation and the ICU
• How does laryngeal injury occur?
• What are potential sequelae?
• How can we assess laryngeal function?
• What are surgical & medical treatment options?
• How can the speech-language pathologist intervene?
Do you need to be a voice specialist to evaluate & treat post-intubation voice disorders?

NO!!!!!
The Landscape

• On average, >55,000 patients are hospitalized in the ICU every day in the U.S.
• Greater than a third of these are mechanically ventilated.
• This places a significant number of people at risk for airway injury and fibrosis.

Intubation and the ICU

• Complications at time of intubation
  • Dysphonia
  • Arytenoid dislocation
  • Cervical spine and spinal cord injuries
  • Traumatic dental injury

• Post-extubation complications
  • Vocal cord paralysis
  • Tracheomalacia
  • Laryngotracheal stenosis
Intubation & Swallowing Function


- 59 patients evaluation with FEES within 72 hours of extubation

- 44 patients were evaluated ≤ 24 hours post-extubation – 57% penetrated/aspirated

- 15 patient were evaluated ≥ 24 hours post-extubation – 60% penetrated/aspirated

- Heterogenous patient population
Axial cross section through the glottis demonstrating airflow. (Image courtesy of Professor Haoxing Luo. Vanderbilt Dept of Engineering)
ETT size selection
(Karmakar, et al., 2015)

• Evidence that height in males should be taken into consideration

• Women, in general, require a smaller size
  • Height is not a factor
ETT size distribution in 100 VUMC MICU Patients
(compared with historic controls)
Role of Provider Choice in ETT size Selection

ETT size distribution in 100 VUMC MICU Patients
(grouped by intubating provider type)
70% of LTS patients obtained their injury from an ETT

# Laryngeal Pathology Incidence (N=61)

(House, et al., 2011)

<table>
<thead>
<tr>
<th>Pathology</th>
<th>%</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arytenoid edema</td>
<td>95</td>
<td>58</td>
</tr>
<tr>
<td>Arytenoid erythema</td>
<td>96.7</td>
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<tr>
<td>Vocal fold edema</td>
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<tr>
<td>Vocal fold erythema</td>
<td>88.5</td>
<td>54</td>
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<tr>
<td>Interarytenoid edema</td>
<td>95</td>
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<tr>
<td>Subglottic edema/narrowing</td>
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<td>8</td>
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<tr>
<td>Vocal process ulceration, any</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>Vocal process granulation tissue, any</td>
<td>52.5</td>
<td>32</td>
</tr>
<tr>
<td>Vocal fold immobility, any</td>
<td>39</td>
<td>24</td>
</tr>
</tbody>
</table>
Ventilated in VUMC ICU
\( (n = 833) \)

Screened for Study Criteria
\( (n = 422) \)

Consented for Endoscopy
\( (n = 100) \)

ALgI
\( (n = 57) \)

No ALgI
\( (n = 43) \)
Results

• ALgi occurred in 57% of intubated patients.

• Patients who develop ALgi report significantly worse phonation and breathing at 10 weeks post-intubation ($p = 0.002$, $p = 0.001$).

• ALgi significantly associated with:
  - **Patient-specific** risk factors
    i. Elevated BMI ($p<0.01$)
    ii. Diabetes ($p=0.02$)
  - **Provider-specific** risk factors
    i. Larger Endotracheal Tube Size (>7.0) ($p<0.001$)
    ii. Worse Grade of View ($p=0.01$)
    iii. Longer Intubation Duration (<0.01)
ALgI: Pattern of Anatomic Injury

- Mucosal Ulceration (49%)
- Granulation Tissue (19%)
- UVFP (7%)
- Subglottic Ulceration (7%)
Incidence and Outcomes of Acute Laryngeal Injury After Prolonged Mechanical Ventilation. Submitted Lancet Respiratory Medicine. 2019
Relationship between ETT size and laryngeal injury
Normal exam
New Mobile Tools for Research

Video courtesy of Dr. Gelbard
Vocal fold paralysis - abduction
Vocal fold paralysis - adduction
Arytenoid Dislocation
Evaluation

• Goals –
  • Voice quality baseline
  • ? TVFP
  • Pain assessment

• Tasks
  • Sustained /i/
  • Pitch glide (ascending/descending)
    • Use ascending/descending count if no glide
  • Spontaneous conversation
  • Cough
  • Throat clear
Evaluation

• Sustained /i/
  • > 3 seconds
  • Normal = 18-20 seconds (no respiratory compromise)

• Glissando
  • Glide up into falsetto

• Voice quality
  • Clear, sex-appropriate, adequate prosody

• Good glottal coup
Other measures

• VHI, VHI 10
• VFI
Outcomes

• Reduced MPT
  • TVFP
  • Edematous TVFs, arytenoids

• Poor voice quality
  • Rough, breathy, inadequate loudness, pitch too high, absent high pitch
  • Edematous TVFs
  • Erythematous TVFs
  • Granuloma
  • RLN/SLN damage
  • Arytenoid dislocation
  • Arytenoid fixation (ankylosis)
FEES

• Your exam can be a screening instrument for TVF function

• Elicit these behaviors:
  • Sniff (TVF abduction)
  • Pitch glide/glissando
  • Maximum phonation

• MDs would ask you to get as close as possible to glottis, with emphasis on posterior commissure

• ?sensory testing
Otolaryngology Consult

• May only be possible if:
  • TVFP on FEES
  • Aphonia
  • Dysphagia

• Often patients will be referred for OP evaluation
Physician Intervention

- TVF Immobility
  - Cymetra injection
  - Direct laryngoscopy to differentiate TVFP from fixation/dislocation
    - ?EMG

- Thyroplasty
  - After 1 year of documented paralysis
Physician Intervention

• Granuloma
  • Steroid injection
  • Excision

• Other disorders (e.g. laryngotracheal stenosis)
  • Course of medical/surgical management
Treatment and Prevention – Short Term

• Avoid excessive voice use
  • No voice rest (in most situations)
• Gentle coughing/throat clearing
• Hydration
• If voice is breathy, avoid straining to produce voice

muscle tension dysphonia
Other Exercises – as indicated

- Semi-occluded vocal tract
  - Cup bubbles (with/without voice)
  - Straw phonation
- Resonance
  - Humming
  - Chanting
- Flow phonation (Stone-Casper)
Vocal hygiene

• Adequate hydration
• Gentle throat clear/cough
• Moist snacks
• Maintain conversational loudness
• Moderation in voice use
• Consider short term use of H2 blockers/PPIs