Voice Outcomes after Cricotracheal Resection for Adult Laryngotracheal Stenosis

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CTR Surgical Technique

- Removal anterior cricoid cartilage
  - Preserving arytenoid function
- Removal of stenosed tracheal rings
- Primary end-to-end anastomosis
- Release maneuvers

Source: Ashiku et al., 2004

Voice Findings After CTR

Voice characteristics after CTR
- Lower pitch
- Huskiness
- Hoarseness
- Unable to shout or project voice
- Unable to sing
- Fatigue with sustained use
- Weak voice

Hermes Grillo, MD

Measures

- Functional outcomes
  - Voice Handicap Index
  - Questionnaire
- Acoustic measures
  - MPT
  - Pitch
  - Intensity
- Videostroboscopic findings
- Perceptual measures
  - Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)
Sample Demographics

<table>
<thead>
<tr>
<th>Gender</th>
<th>CTR Group (n=13)</th>
<th>Dilation Group (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>11 F, 2 M</td>
<td>7 F</td>
</tr>
<tr>
<td>Mean Age (at last procedure)</td>
<td>55.1 (Range: 35-80)</td>
<td>50.6 (Range: 37-62)</td>
</tr>
<tr>
<td>Time Post Op</td>
<td>3 years (1-6)</td>
<td>16.8 wks (5-36)</td>
</tr>
<tr>
<td>Etiology of stenosis</td>
<td>Idiopathic: 9/13</td>
<td>Idiopathic: 6/7</td>
</tr>
<tr>
<td></td>
<td>Wegener's: 2/13</td>
<td>Wegener's: 1/7</td>
</tr>
<tr>
<td></td>
<td>Inflammatory: 1/13</td>
<td>Prolonged intubation: 1/13</td>
</tr>
<tr>
<td>Hx of tracheotomy</td>
<td>1/13 (remote)</td>
<td>None</td>
</tr>
<tr>
<td>Procedure details</td>
<td>No. of tracheal rings removed: 0 (n=2), 1 (n=1), 2 (n=7), 3 (n=3)</td>
<td>No. of dilations: 1 (n=4), 4 (n=2), 5 (n=1)</td>
</tr>
<tr>
<td></td>
<td>Suprahyoid release: 3/13</td>
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Acoustic Data

(Female participants only)

<table>
<thead>
<tr>
<th></th>
<th>CTR (n=9)</th>
<th>Dilation (n=7)</th>
<th>P-value</th>
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<tr>
<td>MPT (sec)</td>
<td>14.40 ± 7.19</td>
<td>16.51 ± 4.75</td>
<td>NS</td>
</tr>
<tr>
<td>F0 vowel (Hz)</td>
<td>190.95 ± 12.48</td>
<td>208.20 ± 15.25</td>
<td>.03</td>
</tr>
<tr>
<td>Min F0 (Hz)</td>
<td>138.09 ± 22.59</td>
<td>141.62 ± 23.15</td>
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<td>Max F0 (Hz)</td>
<td>298.38 ± 48.06</td>
<td>549.22 ± 64.31</td>
<td>.001</td>
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<tr>
<td>Freq. Range (Hz)</td>
<td>160.30 ± 39.34</td>
<td>407.60 ± 71.04</td>
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<td>184.46 ± 21.42</td>
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<td>Low dB</td>
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<td>High dB</td>
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VHI Scores

(All participants)

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<tr>
<td>Voice Handicap Index Score</td>
<td>37.05 ± 29.92</td>
<td>3.86 ± 5.15</td>
<td>.002</td>
</tr>
</tbody>
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VHI Normative Data

Mild Impairment: 33.69 ± 5.60
Moderate Impairment: 44.37 ± 3.88
Severe Impairment: 61.30 ± 4.21
Subjective Ratings by Group

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<td>9.00</td>
<td>8.29</td>
</tr>
<tr>
<td>Seating</td>
<td>5.02</td>
<td>8.02</td>
</tr>
<tr>
<td>Voice</td>
<td>5.77</td>
<td>7.39</td>
</tr>
<tr>
<td>Overall</td>
<td>9.00</td>
<td>6.05</td>
</tr>
</tbody>
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**Questionnaire Data: Voice Change**

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</thead>
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<tr>
<td>Better</td>
<td>57%</td>
<td>57%</td>
</tr>
<tr>
<td>Same</td>
<td>7%</td>
<td>29%</td>
</tr>
<tr>
<td>Worse</td>
<td>36%</td>
<td>14%</td>
</tr>
</tbody>
</table>

**Case Study #1**

- 57 yo woman with SGS
- Elementary school secretary
- Several dilations prior to CTR
- Preop voice –
  - mild breathiness
  - and roughness
  - audible stridor w/ connected speech
- Preop strobe –
  - normal VF ROM
  - chasing asymmetry
  - moderate A-P squeeze during speech and phonation

**Case Study #1**

- Post-op voice complaints
  - hoarse, effortful voicing
  - pain
  - weak voice
  - poor voice projection
  - difficulty singing
- Post-op vocal quality
  - mild-moderately rough, breathy
  - low pitch
  - reduced loudness for projection
- Post-op strobe
  - foreshortened VF
  - VF ROM WNL
  - chasing asymmetry
  - absent VF elongation
  - moderate-severe A-P squeeze
Video Clip: Pre & Post-Op Samples

Fundamental Frequency

Voice Handicap Index

Summary

• Both groups were very satisfied with airway procedure
• CTR group noted poorer voice than Dilation group
• 57% felt voice was better after CTR
• 36% felt voice was worse after CTR
• Significant difference between CTR and the Dilation
  ➢ fundamental frequency in vowel
  ➢ pitch range (10 Semitones)
  ➢ max loudness
  ➢ VHI scores
• Voice may change over time after CTR

Voice Handicap Index

Preop 2 Months Post 8 Months Post 12 Months Post

F0 READING

F0 VOWEL

Preop 2 Months Post 8 Months Post 12 Months Post

Voice Handicap Index

Preop 2 Months Post 8 Months Post 12 Months Post

0 10 20 30 40 50 60 70

0 50 100 150 200 250
What's next?

- Complete data collection for Dilation group
- Continue to collect pre op and long term post op data for CTR patients
- Videostroboscopic assessment
- Perceptual assessment - CAPE-V

References


Thank You

References

- Pearson, FG, Cooper, JD, Nelems, JM, Van Norstrand, AWP. Primary tracheal anastomosis after resection of the cricoid cartilage with preservation of recurrent laryngeal nerves. Journal of Thoracic and Cardiovascular Surgery. 1975:70-806-815.