Laryngeal Conservation Surgery - Evaluation of the Supracricoid Laryngectomy

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Learning Objectives
• Basics: Anatomy, Staging, Organ Preservation
• Trends: Incidence, survival, treatment strategies
• Chemoradiation: landmark trials, outcomes, pitfalls
• Supracricoid Laryngectomy: Technique, indications, contraindications
• Compare: oncologic and functional outcomes of laryngeal preservation strategies

Laryngeal Cancer Cases - 2013

<table>
<thead>
<tr>
<th>Site/Subsite</th>
<th>Estimated New Cancer Cases</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites &amp; pharynx</td>
<td>1,066,990</td>
<td>854,790</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>1,399,170</td>
<td>1,100,920</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>230,160</td>
<td>183,260</td>
</tr>
<tr>
<td>Hypopharynx</td>
<td>180,060</td>
<td>142,930</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>180,060</td>
<td>142,930</td>
</tr>
<tr>
<td>Larynx</td>
<td>180,060</td>
<td>142,930</td>
</tr>
<tr>
<td>Cancers &amp; unspecified sites</td>
<td>180,060</td>
<td>142,930</td>
</tr>
</tbody>
</table>

Risk Factors
• Smoking
• Alcohol
• Chronic GERD
• HPV 16 & 18
• Previous history of H&N cancer
> 95% of larynx cancers are SCC

Anatomy – Larynx Subsites

Laryngeal SCC (N=158,426)

- Supraglottis: 33%
- Glottis: 51%
- Subglottis: 2%
- Transglottic: 4%
- Cartilage: 1%
- NOS: 9%

Anatomy


Paraglottic Space


Paraglottic Space


Preepiglottic space


Barriers to Spread


-Quadrangular Membrane
-Conus Elasticius
-Thyrohyoid membrane
-Anterior commissure tendon
-Hyoepticlottic ligament
-Cricoarytenoid ligament

Cricoarytenoid is the functional unit

- Areytenoid
- CA Joint
- Post CA muscle
- Lat CA muscle
- RLN
- SLN
Staging – AJCC 8th ed.

<table>
<thead>
<tr>
<th>Staging</th>
<th>Glottis</th>
<th>Supraglottis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T1</strong></td>
<td>Limited to one subsite of supraglottis</td>
<td>Limited to one subsite of supraglottis</td>
</tr>
<tr>
<td><strong>T1a</strong></td>
<td>Limited to vocal cord(s)</td>
<td>Limited to vocal cord(s)</td>
</tr>
<tr>
<td><strong>T1b</strong></td>
<td>Limited to larynx</td>
<td>Limited to larynx</td>
</tr>
<tr>
<td><strong>T2</strong></td>
<td>Tumor invading adjacent, glottis or region outside the supraglottis (e.g., BOT, vallecula, medial wall of pyriform sinus)</td>
<td>Tumor invading adjacent, glottis or region outside the supraglottis (e.g., BOT, vallecula, medial wall of pyriform sinus)</td>
</tr>
<tr>
<td><strong>T2a</strong></td>
<td>Invasion of BOT, vocal cord(s)</td>
<td>Invasion of BOT, vocal cord(s)</td>
</tr>
<tr>
<td><strong>T2b</strong></td>
<td>Invasion of BOT, vocal cord(s)</td>
<td>Invasion of BOT, vocal cord(s)</td>
</tr>
</tbody>
</table>

Organ Preservation Options

- Endolaryngeal surgery
- Open Surgery
  - Vertical Partial Laryngectomy
- Horizontal Partial Laryngectomy
- Supracricoid Partial Laryngectomy
- Radiation
- Chemoradiation

Trends

All Cancer Survival

Laryngeal Cancer Survival Trend

Laryngeal Cancer Survival


- Review of 487 pts from SEER Database

<table>
<thead>
<tr>
<th></th>
<th>Non-Surgical</th>
<th>Surgery</th>
<th>Surgery + adj tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>5yr OS</td>
<td>36%</td>
<td>41%</td>
<td>41%</td>
</tr>
<tr>
<td>Trach &gt;1yr</td>
<td>32%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>G-Tube &gt;1yr</td>
<td>20.6%</td>
<td>18.5%</td>
<td>30.6%</td>
</tr>
</tbody>
</table>

- 14% of non-surgical pts required salvage TL


- 3 Arms:
  - Induction Chemo + RT
  - Concurrent cisplatin + RT
  - RT alone
- Endpoint: Larynx Preservation
RTOG 91-11: Patient Criteria
• Exclude T1 and large-volume T4 (thru cartilage or 1cm into BOT)
• Karnofsky > 60
• Stage III/IV supraglottis or glottis
• Failure was treated with TL

RTOG 91-11: Results
• Laryngeal preservation in 88% w/ concurrent group
  • 154/170 pts had complete response
  • 45% laryngectomy free survival at 5 years
  • 54% OS at 5 years
  • Addition of Chemo improved DFS

A deeper look…
• No consideration for partial laryngectomy
• No surgical arm
• No reporting of G-tube or trach rates
• 23% only able to swallow soft foods or liquids
• 5% treatment related deaths
• Study results applied too broadly to all larynx tumors

Best Evidence for early laryngeal CA
• 1 RCT (1990 from Eastern Europe)
• T1/T2 - open 5x vs RT
• “High risk of bias”
### Best Evidence for early laryngeal CA

<table>
<thead>
<tr>
<th></th>
<th>Open Surgery</th>
<th>Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>100%</td>
<td>91.7%</td>
</tr>
<tr>
<td>T2</td>
<td>97.4%</td>
<td>88.8%</td>
</tr>
<tr>
<td>Differences were non-significant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Five-year Overall Survival**
(n=234)

**Five-year Disease Free Survival**
(n=234)

<table>
<thead>
<tr>
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<th>Open Surgery</th>
<th>Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>100%</td>
<td>71.1%</td>
</tr>
<tr>
<td>T2</td>
<td>78.7%*</td>
<td>60.3%*</td>
</tr>
<tr>
<td>* Differences were significant</td>
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</table>

**Summary of main results**

There is no good evidence available from randomized controlled trials to guide treatment choice for patients with early-stage glottic cancer.

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Carotid: IMRT vs. Opposing Fields

Conventional RT IMRT

Radiotherapy Toxicity – Carotid dz
- Intimal thickening/Stenosis if >35 Gy
- 5.1 RR of stroke at median 10.9 years for early larynx SCC
- ~6.5% risk of any stroke
- 1.3% risk of fatal stroke
- 12% cumulative risk of stroke after neck RT after 15 years

IMRT vs. Opposing Fields

Tumor Dose

Conventional Carotid (IMRT)

Radiation First or Surgery First?

TLM vs. RT: Early Glottic Cancer

<table>
<thead>
<tr>
<th>Study</th>
<th>TLS</th>
<th>RT</th>
<th>Total</th>
<th>Weight</th>
<th>Risk difference M-H, Fixed, CI95</th>
<th>Risk difference M-H, Fixed, CI95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thurber (2009)</td>
<td>28</td>
<td>81</td>
<td>109</td>
<td>0.6%</td>
<td>-0.07 (0.10, 0.00)</td>
<td></td>
</tr>
<tr>
<td>Spigner (2008)</td>
<td>52</td>
<td>75</td>
<td>127</td>
<td>13.9%</td>
<td>-0.06 (0.10, 0.00)</td>
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<tr>
<td>Schrijver (2009)</td>
<td>4</td>
<td>49</td>
<td>53</td>
<td>0.7%</td>
<td>-0.09 (0.03, 0.03)</td>
<td></td>
</tr>
<tr>
<td>Puleston (2008)</td>
<td>7</td>
<td>50</td>
<td>57</td>
<td>12.1%</td>
<td>-0.05 (0.03, 0.03)</td>
<td></td>
</tr>
<tr>
<td>Young (2010)</td>
<td>2</td>
<td>72</td>
<td>74</td>
<td>14.8%</td>
<td>-0.06 (0.07, 0.05)</td>
<td></td>
</tr>
<tr>
<td>Mohler (2010)</td>
<td>41</td>
<td>188</td>
<td>229</td>
<td>34.0%</td>
<td>-0.06 (0.05, 0.03)</td>
<td></td>
</tr>
<tr>
<td>Total (Cmax)</td>
<td>513</td>
<td>521</td>
<td>1034</td>
<td>0.9%</td>
<td>-0.05 (0.03, 0.03)</td>
<td></td>
</tr>
<tr>
<td>Total of events</td>
<td>88</td>
<td>112</td>
<td>198</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity (Q=3)</td>
<td>0.5</td>
<td>45</td>
<td>0.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: 2 = 1.92 (P = 0.05)</td>
<td></td>
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</tbody>
</table>

Figure 2. Forest plot chart comparing microsurgery to radiotherapy in relation to overall survival.

RT vs Surgery for T1/T2 of Glottis
- 356 pts retrospectively reviewed
- T1 – 88% // T2 – 12%
- 5 yr survival – 84% (surgery) vs 78% (RT)
- Larynx preserved in 92% of surgery but 81% of RT
- Conclusions: survival is similar however more recurrences with RT. Voice with RT is better
Salvage after RT Failure
- 105 pts w/ RT failure of T1 (63%) or T2 (37%) lesion

<table>
<thead>
<tr>
<th>Procedure</th>
<th>69.5%</th>
<th>30.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Laryngectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservation Surgery</td>
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</tr>
</tbody>
</table>

12.3% -----Recurrence----- 15.6%

1) Conservation surgery is oncologic
2) Cannot rely on surgical salvage for organ preservation!

History of Procedure
- 1959 – Dr. Majer, Rieder (Vienna)
- 1970’s – Dr. Laccourreye, Piquet (Paris)
- 1990’s - English literature: Dr. Laccourreye, Weinstein
- Current – Series publications

Reconstruction
- Cricohyoidopexy (CHP)
- Cricohyoidopiglottopexy (CHEP)

Preop Evaluation
- Ensure good 3D tumor mapping
- Pulmonary function
- GERD treatment
- Consent for total laryngectomy
- Rigorous swallow rehab
- Consider G-tube if prior RT
- T1b-T4 tumors
Contraindications

• Arytenoid joint fixation
• Interaarytenoid involvement
• Cricoid cartilage invasion - Subglottic extension
• Hyoid invasion - major preepiglottic space invasion with clinical evidence of bulging beneath the vallecula mucosa and/or extension through the thyrohyoid membranes
• Extralaryngeal extension

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CHP

• Expose Field
• Cut Inf Constrictor
• Disarticulate Joint
• Enter Airway
• Tumor Resection
• Crack Cartilage
• Recon (CHP vs CHEP)

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CHP
- Expose Field
- Cut Inf Constrictor
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- Enter Airway
- Tumor Resection
- Crack Cartilage
- Recon (CHP vs CHEP)

Specimen

Defect

CHP
- Expose Field
- Cut Inf Constrictor
- Disarticulate Joint
- Expose Larynx
- Tumor Resection
- Crack Cartilage
- Recon (CHP vs CHEP)

Recon
- Expose Field
- Cut Inf Constrictor
- Disarticulate Joint
- Enter Airway
- Tumor Resection
- Crack Cartilage
- Recon (CHP vs CHEP)
Postop Management

• POD#:0
  • Deflate trach cuff
  • Antibiotics for aspiration
  • Oral hygiene
  • Anti-reflux

• POD#:1
  • Chest PT
  • Ambulation
  • Speech and swallow therapy

• POD#:3
  • Change trach

• POD#: Discharge Home

First Clinic Visit:
• Downsize and cap trach at night

Second Clinic Visit:
• Cap trach x 24 then decannulate

Third Clinic Visit:
• Decannulate trach
• Remove NG after trach decannulation

Flexible Laryngoscopy - CHP

Complications

• Aspiration pna – 8.5%
• Wound infection – 4.2%
• Pexis rupture – 1%
• Laryngocele – 3.1%
• Chondroradionecrosis – 0.5%
• Laryngeal Stenosis – 0.5 - 3.7%
• OSA

Management of Local Failure

- 15/322 (4.7%) w/ local recurrence
- Tx:
  - TL (11/12)
  - CO2 laser arytenoidectomy
  - 80% local control

Expected Outcomes

1) Temporary dysphagia
   • Swallowing returns in 2-3 wks (more if elderly or radiation history)

2) Temporary trach

3) Permanent hoarseness
   • Less efficient in range, jitter, shimmer, rate

- Weighted LC - 94% (98% if primary)
**Functional Outcomes (N=190)**
- Trach removal – 9 days
- NG removal – 16 days
- Mortality – 1%
- 98.4% trach and Gtube free by 1st year
- 23.4% w/ temporary aspiration

**Outcomes- Elderly**
- N=69 pts > 65 yo
- 0 periop deaths
- 1 aspiration pna death 3 yrs postop
- Laryngeal Stenosis 4.3%
- Permanent G-tube 1.4%
- Reduced by piriform resuspension (p=0.01)
- 93.0% 5 yr local control (salvaged w/ TL)

**SCPL for radiation failure – meta analysis**
- 11 papers – 251 patients
- rT2, AC extension, rT3
  - 2 year LC - 92%
  - 5 year OS – 79%
  - Larynx preservation rate – 85.2%
  - Trach Decannulation rate - 92.1%
  - PEG dependence – 3.5%

**SCPL Outcomes – N=96**
- Oncologic
- Functional

**SCPL Outcomes – N=96**
- Oncologic
- Functional

**SCPL Outcomes – N=96**
- Oncologic
- Functional

**Radiation trials**
- MEDICAL Treatments
  - 5 Yr LC
SCPL Outcomes – N=96

<table>
<thead>
<tr>
<th>Chemotherapy</th>
<th>Trach dependence</th>
<th>G tube dependence</th>
<th>Death</th>
<th>Infusion</th>
<th>Dysphagia</th>
<th>NPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication</td>
<td>10% (mean 43 days)</td>
<td>8% (mean 74 days)</td>
<td>6.9%</td>
<td>4%</td>
<td>23%</td>
<td>3%</td>
</tr>
<tr>
<td>Dehiscence</td>
<td>9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPO</td>
<td>3%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Should we change our treatment Strategy?

- Oncologic
  - Complications
    - Grade 3-5
    - Death: 6.9%
    - Trach dep: 8%
    - G tube dep: 8%
    - Dysphagia: 8%
    - NPO: 3%

- Functional
  - Complications
    - Grade 3-5
    - Death: 6.9%
    - Trach dep: 8%
    - G tube dep: 8%
    - Dysphagia: 8%
    - NPO: 3%

References

Questions?