Conservation Laryngeal Surgery

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Grand Rounds Presentation
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Introduction

- Definition: Maintains physiologic speech and swallow without need for tracheostoma
- Goal: Preserve function without compromising cure rate
- 4 basic functions of larynx
  - Deglutition
  - Respiration
  - Phonation
  - Airway protection
Introduction

• Four Basic Principles
  – Must know extent of tumor
  – Cricoarytenoid unit is basic functional unit of larynx
  – Resection of normal tissue is necessary
  – Must consent patient for total laryngectomy
Anatomy

• Lymphatic drainage sparse anteriorly and at glottis
• Rich lymphatics in supraglottis, subglottis, posterior half
• Barriers to spread
  – Conus Elasticus inferiorly
  – Quadrangular Membrane laterally
  – Thyrohyoid Membrane superiorly
Anatomy

Foramen for superior laryngeal vessels and int. laryngeal m.

Epiglottis

Quadrangular membrane

Thyroepiglottic ligament

Vestibular ligament

Vocal ligament

Conus elasticus

Arytenoid

Cricoid

Thyroid cartilage
Anatomy

• Broyles’ Tendon: Weak area
• Cricoarytenoid Unit=Arytenoid cartilage + Cricoid cartilage + Musculature + SLN + RLN
Pathophysiology

- Limitation of TVC mobility implies worse prognosis
- Early glottic carcinoma
  - 25% to anterior Commissure
  - 1/5 5mm or more below TVCs
  - 1/5 to supraglottis
  - T1 and T2: 5% incidence of cervical metastasis, always to ipsilateral neck
  - Skip lesions rare
Pathophysiology

• Supraglottic SCCA
  – Higher incidence of cervical metastasis
  – 19% develop second respiratory tract primary within 5 years
  – Epiglottic cancer tends to involve preepiglottic space; usually involves broad front with pseudocapsule
  – Suprahyoid epiglottis: Cervical mets and preepiglottic involvement rare
Pathophysiology
Endoscopic Management of Glottic Lesions

- **Treatment options:** Open conservation surgery, XRT, microendoscopic CO2 laser excision
- **Local Control**
  - T1a: 94%
  - T1b: 71%
  - T2: 83%
- **Favor laser:** Tumor bulk, P-53 overexpression
- **Do not favor laser:** Previous XRT
Endoscopic Management of Glottic Lesions

• Use of CO2 laser introduced in 1972

• Preoperative workup:
  Flexible laryngoscopy and videostroboscopy
  – Must assess for presence of mucosal wave
Endoscopic Management of Glottic Lesions

- Excise with solitary laser bursts
- Orient specimen and send for frozen section
- Extend resection if margins positive
- “Safe” margin = 2-5 mm
- Only appropriate when close follow-up possible and adjuvant therapy available
Endoscopic Management of Glottic Lesions

• Exclusion criteria:
  – Deep involvement at AC
  – Vocal process involvement
  – Ventricle involvement (debated)
  – Subglottic extension (debated)
  – Impaired TVC mobility (debated): University of Utah
    91% 5-year survival with technique of “uncapping” paraglottic space
Endoscopic Management of Glottic Lesions

- Complications (Moreau, n=124)
  - Granuloma formation at AC (most common) – spontaneous resolution after months
  - Laryngeal hemorrhage
  - Pneumothorax
  - Aspiration pneumonia
  - Subcutaneous air
  - Prelaryngeal abscess
  - Anterior webs
### Table I.
Endoscopic Cordectomy: Classification by European Laryngological Society.

<table>
<thead>
<tr>
<th>Subepithelial cordectomy</th>
<th>Type I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subligamental cordectomy</td>
<td>Type II</td>
</tr>
<tr>
<td>Transmucosal cordectomy</td>
<td>Type III</td>
</tr>
<tr>
<td>Total or complete cordectomy</td>
<td>Type IV</td>
</tr>
<tr>
<td>Extended cordectomy encompassing the controlateral vocal fold</td>
<td>Type Va</td>
</tr>
<tr>
<td>Extended cordectomy encompassing the arytenoid</td>
<td>Type Vb</td>
</tr>
<tr>
<td>Extended cordectomy encompassing the ventricular fold</td>
<td>Type Vc</td>
</tr>
<tr>
<td>Extended cordectomy encompassing the subglottis</td>
<td>Type Vd</td>
</tr>
</tbody>
</table>
Endoscopic Management of Glottic Lesions
Endoscopic Management of Glottic Lesions

<table>
<thead>
<tr>
<th>T Stage</th>
<th>Type of Cordectomy</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tis</td>
<td>Type I</td>
<td>Depending on the extension of the involved area and the results of preoperative investigation (i.e., videoendoscopy)</td>
</tr>
<tr>
<td></td>
<td>Type II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type III</td>
<td></td>
</tr>
<tr>
<td>T1a</td>
<td>Type III</td>
<td>Small superficial tumor involving the middle third of true vocal fold (Ø 0.5–0.7 mm)</td>
</tr>
<tr>
<td>T1a</td>
<td>Type IV</td>
<td>Tumor size &gt; 0.7 mm and/or deep infiltrative pattern and/or extension to the anterior commissure</td>
</tr>
<tr>
<td>T1b</td>
<td>Type Va</td>
<td>Involvement of the anterior commissure or horseshoe lesions</td>
</tr>
<tr>
<td></td>
<td>Bilateral cordectomy</td>
<td>Multifocal cancer</td>
</tr>
</tbody>
</table>
Endoscopic Management of Glottic Lesions

• Greater than Type III cordectomy should be observed overnight; otherwise, DSU appropriate

• Microdebrider
  – Use tissue trap
  – Advantages: Improved access to AC and subglottis, eliminates thermal injury
  – Disadvantages: No margin control, cannot orient specimen
  – “Debulking” for exposure or to avoid trach prior to excision with margin control
Endoscopic Management of Glottic Lesions
Endoscopic Management of Supraglottic Lesions

• Some form of supraglottic laryngectomy *always* favored in supraglottic SCCA unless
  – Precluded by patient factors
  – Involvement at glottic level
  – Invasion of cricoid or thyroid cartilage
  – Tongue base involvement within 1 cm of circumvallate papillae
Endoscopic Management of Supraglottic Lesions

- Must optimize exposure
- Boyce-Jackson position optimal: Extension at occipitoatlantic joint, flexion of neck on chest
Endoscopic Management of Supraglottic Lesions

- Lesions amenable to resection lie perpendicular to distal lumen of supraglottoscope
  - Suprahyoid epiglottis
  - Aryepiglottic fold
  - False vocal fold

- Clear margins usually obtained at time of laser excision because of pseudocapsule

- Complete excision of primary before XRT yields 20-35% tx advantage over XRT alone
Endoscopic Management of Supraglottic Lesions

- Complications rare
- Patients with normal preoperative swallow do not have permanent deficits
- Laryngeal protection relatively good with laser
  - SLN not disturbed proximal to larynx
  - Laryngeal elevation not impaired
  - Healing results in favorable scarring with new supraglottic valve
Endoscopic Management of Supraglottic Lesions

- Poor candidates for open supraglottic laryngectomy still generally good candidates for laser
- Typically requires 1-3 day hospitalization post-op
- Open supraglottic laryngectomy remains standard surgical management for early supraglottic SCCA
Vertical Partial Laryngectomy

• Contraindications to VPL:
  – Fixed TVC
  – Involvement of PC
  – Bilateral arytenoid invasion
  – Bulky transglottic lesion
  – Thyroid cartilage invasion
  – >15 mm subglottic extension anteriorly; >5 mm posteriorly
  – Lesions extending beyond free edge of FVC superiorly
Vertical Partial Laryngectomy

- Aging and COPD increase risk of postoperative atelectasis/pneumonia
- PFTs controversial
  - $\text{FEV}_1 < 50\text{-}60\%$ of expected for age predicts high risk of pulmonary complications
  - Ability to walk up 2 flights of stairs better predictor of post-op complications than PFTs
- Chronic cough, purulent sputum predictors
Vertical Partial Laryngectomy

- Tracheotomy required
- Avoid injury to SLNs
- Examine subglottic area via incision in cricothyroid membrane
- Reconstructive options with intact thyroid lamina: Skin graft, buccal mucosa, FVC advancement
Vertical Partial Laryngectomy

- Reconstructive options with ipsilateral thyroid lamina removed: Composite septal cartilage/perichondrial free graft, inferiorly and laterally rotated epiglottis
- Most popular reconstructive option in either case = Bipedicled strap muscle flap
  - Preserved external perichondrium used to line laryngeal lumen
  - Should anticipate 30% muscle atrophy
Vertical Partial Laryngectomy

- Resection specimen to include lower ½ of FVC and all of TVC (including arytenoid as needed)
- May be extended to include entire endolarynx except for single cricoarytenoid unit and PC
- Keel must be placed at anterior commissure if both sides of endolarynx involved
- Central segment of thyroid cartilage may be removed if AC involved
Vertical Partial Laryngectomy

- Reconstructive options for AC: Advancement of epiglottic petiole, bilateral omohyoid muscle flaps
Vertical Partial Laryngectomy
Vertical Partial Laryngectomy

A
- Pharynx
- Arytenoids
- Thyroid cartilage
- Thyrohyoid m.
- Omohyoid m.
- Sternohyoid m.
- Tumor
- Incision
- Laryngeal ventricle

B
- Omohyoid m.
- Perichondrium

C
- Bilateral omohyoid muscle flaps
Vertical Partial Laryngectomy
Vertical Partial Laryngectomy

- **Imbrication**
  Laryngectomy: Overlapping of cut thyroid ala with approximation of endolaryngeal mucosa
Vertical Partial Laryngectomy

• Decannulation at 1-2 weeks post-op
• Functional phonation by 4 weeks post-op
• Indications: T1 and T2 glottic lesions
• Local control 89-100%; worse when AC involved
• Most common recurrence site with AC involvement is subglottis
• VPL and XRT outcomes same except VPL better for T2b lesions (73-90% vs. 64-76%)
Vertical Partial Laryngectomy

- Factors favoring VPL over XRT
  - T1 lesions extending to AC
  - Obese patients
  - Radioresistant tumors (e.g., verrucous)
  - Salivary gland malignancies
  - Benign laryngeal tumors
  - Unreliable follow-up
  - Young patients
  - Neck nodes >2 cm in size
Vertical Partial Laryngectomy

- VPL following XRT
  - Lesion must be limited to 1 TVC
  - Body of arytenoid free of tumor
  - Subglottic extension <5-10 mm
  - Entire area of pre-XRT tumor involvement must be encompassed by resection
  - Lesion must extend no higher than lateral wall of ventricle
Vertical Partial Laryngectomy

• Early Complications generally tracheostomy related
  – Infection
  – Aspiration and dysphonia (should not persist for > 3 weeks)

• Late Complications
  – Aspiration (Injection laryngoplasty at 6-8 weeks
  – Chondritis
  – Laryngeal stenosis (Must rule out local recurrence)
  – Severe hoarseness
  – Granulation tissue (CO2 laser and keel)
  – Tumor recurrence
Voice

• Ultimate voice preservation better following conservation laryngeal surgery than primary XRT (97% vs. 90%)

• Presence of even minimal mucosal wave pre-op predicts good voice post-op

• Key factors in maximizing voice:
  – Limiting amount of mucosa resected
  – Maintaining straight vocal fold edge
  – Preserving vocal ligament
Voice

• Voice following XRT: Most pt’s pleased, voice tends to improve gradually, but voice not perfect

• Voice following laser: Immediate post-op voice breathy and rough, mucosal wave preserved in 1/3

• Voice following VPL: Most experience incomplete glottic closure and supraglottic hyperfunction; post-op voice highly unpredictable; tends to be rough, breathy, and strained
## Voice

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of Patients</th>
<th>Posttreatment Evaluation</th>
<th>XRT Dose</th>
<th>Amount of Vocal Fold Resected</th>
<th>Voice Analysis</th>
<th>Drawbacks</th>
<th>Voice Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGuirt et al.</td>
<td>24</td>
<td>&gt;6 mo</td>
<td>6600 cGy</td>
<td>≦ half of cordal mass</td>
<td>acoustic + subjective</td>
<td>—</td>
<td>no difference</td>
</tr>
<tr>
<td>Hirano et al.</td>
<td>31</td>
<td>&gt;3 mo</td>
<td>6000 cGy</td>
<td>≦ half of cordal mass in 88% of patients</td>
<td>acoustic subjective</td>
<td>almost 50% of surgical group had XRT postoperatively no statistical analysis</td>
<td>no difference</td>
</tr>
<tr>
<td>Cragle &amp; Brandenburg</td>
<td>34</td>
<td>&gt;5 mo</td>
<td>6600 cGy</td>
<td>unknown</td>
<td>acoustic</td>
<td>XRT postoperatively no statistical analysis no difference</td>
<td>no difference</td>
</tr>
<tr>
<td>Epstein et al.</td>
<td>77</td>
<td>not stated</td>
<td>6600 cGy</td>
<td>unknown</td>
<td>subjective/ chart review</td>
<td>65% of cordecomy group had more than one surgery speech therapy in XRT better</td>
<td></td>
</tr>
<tr>
<td>Rydell et al.</td>
<td>36</td>
<td>3 mo and 2 y</td>
<td>6400 cGy</td>
<td>unknown</td>
<td>acoustic + subjective</td>
<td>XRT postoperatively only 38% of cordecomy patients</td>
<td>XRT better</td>
</tr>
</tbody>
</table>
Discussion

- Open conservation laryngeal surgery recurrence rate: 5% for early glottic CA
- XRT recurrence rate: 10% for T1 to 30% for T2b
- Treatment of recurrence following XRT frequently involves TL
- Treatment of recurrence following laser: many options, TL rarely required
- Other advantages of laser: Decreased cost, decreased morbidity
Discussion

• Advantages of XRT: Superior voice, no in-house stay, no surgical complications

• Major problem with supraglottic SCCA = cervical metastasis
  – Open SGL: Possible to tx both primary and necks with single modality
  – Ideal laser patient: Lesion limited to suprahypoid epiglottis with N0 necks
References

- References