The emerging role of TransOral Robotic Surgery (TORS)

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Disclosure

• Intuitive Surgical, Inc.
  – Proctor/Honoraria

Organ preservation in the management of head and neck cancer

Access
RCT’s: A shift towards organ-preserving non-surgical treatment
Long-term Toxicity of Radiation

Machtay et al.
JCO 2008

Long-term morbidity from RT, chemoRT in three prospective clinical trials
99 / 230 (43%) pts: “severe” late toxicity

The HPV and the oropharynx: an opportunity for de-intensification (RTOG 0129)

HPV + tumors
- 56% reduction in the risk of death
- 51% reduction in the risk of relapse or death

The HPV and the oropharynx: an opportunity for de-intensification (RTOG 0129)

Head and Neck Cancer: Vital Statistics

Estimated new cases (USA), 2012 |
Deaths
Oral cavity, pharynx 40,250 7,850
Larynx 12,360 3,650
Total 52,140 11,460

*CA Cancer J Clin 2012 (January) Siegel et al.

Human Papillomavirus and Rising Oropharyngeal Cancer Incidence in the United States
Demographics are changing!

- Age

| Table 1. Explanatory Variables for Patients with Oropharyngeal Cancer and Control Patients.a |
|-----------------------------------------------|----------------------------------|------------------|
| Explanatory Variable               | Patients with Oropharyngeal Cancer (N=100) | Control Patients (N=200) | Unadjusted Odds Ratio (95% CI) |
| Age                               | 85% (84) | 48 (48) | 1.0 |
| ≥65 yrs                           | 51 (51) | 101 (51) | 1.0 (0.4-1.7) |
| <65 yrs                           | 34 (16) | 48 (16) | 1.0 |

The race for de-intensification in the era of HPV

- Treatment De-Intensification for Squamous Cell Carcinoma of the Oropharynx
  - Harry Quon, M.D., Principal Investigator, The Johns Hopkins University School of Medicine
  - De-intensification of Radiation and Chemotherapy for Low-Risk Human Papillomavirus-related Oropharyngeal Squamous Cell Carcinoma
    - Bhishamjit Chera, MD, Principal Investigator, University of North Carolina, Chapel Hill
  - RTOG 1016
    - Gillison et al: Phase III Trial of Radiotherapy Plus Cetuximab Versus Chemoradiotherapy in HPV-Associated Oropharynx Cancer
  - ECOG311
    - Ferris et al: Phase II Randomized Trial of Transoral Surgical Resection followed by Low-dose or Standard-dose IMRT with Biomarker Correlatives in Resectable p16+ Locally Advanced Oropharynx Cancer
    - First surgical trial to assess de-intensification for HPV+ patients

Organ-sparing surgery

- As a result of these advances and associated toxicities, surgeons were called to develop surgical alternatives that emphasized function and healing
  - Speech and swallow
- Endoscopic-assisted transoral surgery: preservation function and healing is achieved by
  - minimizing size of resection
  - nerve preservation

Transoral endoscopic-assisted surgery: Steiner revolution

- Rationale
  - Endoscopic microresection of laryngeal tumors achieved equivalent local control to open approaches, but with superior functional outcomes
    - Keep margins tight
    - Preserve sensation
First Human Report of Robotic H&N Surgery

- ENT Journal: March 2005
  - McCloud & Melder, 2003
  - Walter Reed Army Medical Center

Resection of a vallecular cyst, via slotted laryngoscope

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Endoscopic-assisted Transoral Surgery: Concept

- For TORS: da Vinci System is a TOOL that builds on the principles of transoral surgery and allow us to broaden the indications of it

- Goals of transoral surgery (TORS or otherwise):
  - For stage I/II disease: deliver unimodality, organ-preserving surgical treatment
  - For stage III/IV disease — reduce the need for adjuvant treatment

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The Hardest Part about Transoral Robotic Surgery is Not The Robot

- Exposure, Exposure, Exposure
  - Crowe-Davis retractor
    - Palate/tonsil; selected base of tongue
  - FK retractor
    - Everything else...
    - GP Sulcus
    - Base of tongue
    - Supraglottis
    - Hypopharynx

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da Vinci Robotic Surgery

- Three dimensional visualization
- Tremor filtration
- Wristed instrumentation
Base of tongue tumor

- 48 y.o. female presented with dysphagia. Work-up revealed base of tongue squamous cell carcinoma.
  - HPV+
  - Clinical Stage II/III: T2N0 vs N1M0

Base of tongue resection

Open transmandibular approach
Robotic surgery: 24 hrs Post-op

Base of tongue tumor: postoperative healing – 3 months

Tonsil tumor

Radical Tonsillectomy

Proposed by Pierre-Charles Huet
Radical Tonsillectomy

Transoral Robotic Surgery (TORS) for Oropharyngeal Cancer

- Prior case series have established feasibility and safety of TORS

Myths...

- Organ preservation means better quality of life
  — It depends on the organ you are trying to preserve!
- HPV status dictates treatment modality
- Since the patient will likely need chemo, we should start with chemoradiation therapy from the start
  — Bernier et al, Head and Neck, 2007: only positive margins and ECS where predictors of better survival with chemotx.
  — CT scan/MRI not ideal to accurately identify extracapsular spread: Don DM, Anzai Y et al, Laryngoscope, 1995: 957
- Resecting up to half of the base of the tongue will cause significant swallowing impairment

Functional Outcomes with TORS

- 0 to 9.5% G-tube dependence after 1yr
UW experience: Gastrostomy Tube Dependence

Two institution study (UW and UMinn): Gastrostomy Tube Dependence

Myths...

• Organ preservation means better quality of life
• HPV status dictates treatment modality
• Since the patient will likely need chemo, we should start with chemoradiation therapy from the start
  — Bernier et al, Head and Neck, 2007: only positive margins and ECS where predictors of better survival with chemotx.
  — Often rooted in the ability for a CT scan to call extracapsular spread
• Resecting up to half of the base of the tongue will cause significant swallowing impairment
• When post-operative radiation is required, surgery first can only de-escalate from 66Gy to 54-60Gy, so what is the big deal?

Radiation response curve
Chemotherapy radiosensitization

Outcomes with TORS

- 89% 2-yr disease-free survival

Weinstein et al. 2007
- 20 extubated, 6 intubated (average of 2.7 days), 1 planned tracheostomy
- 96% of patients were no longer using enteral feeding at last follow-up
- 100% locoregional control!

TORS: “Radical Tonsillectomy”

Are we deintensifying therapy?

- 89% of patients had post-operative XRT
  - 56% RT alone
  - 33% RT with chemotherapy
- Excellent functional outcomes reported: 0% G-tube dependence after 1 yr

Mean blood loss 189 mL

Weinstein et al., 2007
Two institution study (UW and UMinn): Are we de-intensifying therapy

Characteristics of matched patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-surgical treatment (n=72)</th>
<th>TORS (n=25)</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Neck Dissection</td>
<td>10 (14%)</td>
<td>20 (80%)</td>
<td>&lt;0.001</td>
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<tr>
<td>Radiation Therapy</td>
<td>72 (100%)</td>
<td>22 (88%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Radiation Dose (in Grays, median [IQR])</td>
<td>70 (70-70)</td>
<td>60 (60-63)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>66 (92%)</td>
<td>7 (28%)</td>
<td>&lt;0.001</td>
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</table>

- TORS group underwent neck dissections more frequently
- TORS group underwent radiation less frequently
- TORS group had lower total radiation dose delivered
- Up to 2/3 of patient who underwent TORS avoided chemotherapy

Kaplan-Meier survival estimates

<table>
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<th>Months</th>
<th>Survival Probability</th>
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<tr>
<td>12</td>
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<tr>
<td>24</td>
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<tr>
<td>36</td>
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<tr>
<td>48</td>
<td>0.75</td>
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<tr>
<td>60</td>
<td>0.75</td>
</tr>
<tr>
<td>72</td>
<td>0.75</td>
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</tbody>
</table>

Two institution experience (UW and UMinn): Disease-Free Survival matched by T-stage

Applications of robotic-assisted surgery in head and neck cancer
Role of TORS for the work-up and treatment of metastatic HNSCC of unknown primary site

- Improved visualization
- Potential for deeper excisional biopsies
- Definitive treatment of the primary site

Pre-operative workup is variable, includes physical exam, including flexible fiberoptic exam, and radiographic imaging.

Examination under general anesthesia: use of endoscopes to evaluate upper aerodigestive tract, tonsillectomy with random biopsies of the base of tongue.

Treatment for unidentified primary and wide field radiation therapy to Waldeyer’s ring.

Work-up of the unknown primary site

Rates of identifying the primary site

- Per Cianchetti et al. (2009): with pan-endoscopy, identification ranges from 29.2% to 64% (those without to those with suspicious pre-operative workup, respectively)

Multi-institution case series: Efficacy of TORS in indentifying primary site

- After TORS, the primary tumor site was identified in 34/47 (72%) patients.
  - Base of tongue for 20 (59%); palatine tonsil for 13 (38%); one case had 2 synchronous lesions, in the base of tongue and the palatine tonsil.
  - Size ranged from 0.3-3.0 cm (mean=1.2cm).

### Surgical Management

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<tr>
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<th>Unilateral Tonsillectomy</th>
<th>Bilateral Tonsillectomy</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>-</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Unilateral BOT Resection</td>
<td>7</td>
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<td>16</td>
</tr>
<tr>
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<td>8</td>
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<tr>
<td>TOTAL</td>
<td>20</td>
<td>13</td>
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</tr>
</tbody>
</table>

BOT = base of tongue

Of the 34 tumor sites that were identified, 29/34 achieved clear surgical margins.

Patel and Méndez et al., JAMA Otolaryngology: Head and Neck Surgery, In Press

### Applications of robotic-assistance in combination with open approaches to minimize morbidity

Lateral tongue carcinoma

![Lateral tongue carcinoma image]
Transoral Flap Inset: parachute technique

Flap harvest with monitor paddle
Lateral tongue carcinoma

Robotic-assisted Transcervical Approach

Robotic-assisted flap inset

3 weeks post op
Conclusions

• Organ preservation includes both surgical and non-surgical modalities
• We currently lack evidence to claim one modality is superior than another
  — Literature filled with case series
  — RCT’s?
  — Cohort Studies

Conclusions

• Patients have options
  — All patients deserve an opinion from experts at each option
  — Patients deserve to be part of the decision-making process: when there is equipoise, we need to recognize our own practice-specific biases

Indications/Patient selection

• In December 2009, FDA approved the use of the da Vinci system for:
  — “Transoral otolaryngology surgical procedures of benign and malignant tumors classified as T1 and T2” — broad!
  • Contraindicated in base of tongue tumors which cross-midline or invade past the hyoid bone/deep tongue musculature
  — Exposure, exposure, exposure – assess for trismus, cervical/neck extension issues, tongue hypertrophy, etc.
Base of tongue tumor

• 48 y.o. female presented with dysphagia. Work-up revealed base of tongue squamous cell carcinoma.
  — HPV+
  — Clinical Stage II/III: T2N0 vs N1M0