Salvage Surgery for Non-Surgical Treatment Failures: Oropharynx, Larynx/Hypopharynx

Dr. Patrick Gullane
Purpose of the Presentation

• Review the evidence with regard to the efficacy of salvage surgery after non-surgical treatment of the Oropharynx and Larynx/Hypopharynx
• Review our experience with complications following salvage surgery
• Present a treatment approach to reduce complications in patients undergoing salvage for recurrent or persistent oropharyngeal laryngeal/Hypopharyngeal cancer
Estimated HPV Contribution to Cancer – WHO

- **Cervix**: > 99%
- **Anus**: 84.2%
- **Vagina**: 69.9%
- **Penis**: 47.0%
- **Vulva**: 40.4%
- **Oropharynx**: 35.6%
- **Oral cavity**: 23.5%

HPV Contribution Summary:
- **Overall**: 78%
- **Anus**: 4.9%
Oral Cavity Cancer (OSCC)

Primary Surgery

Follow

Adjuvant

Radiation

RT + Chemo

Oropharynx Cancer (OPC)

Radiation

RT + Chemo

Treatment
Oral Cavity Cancer (OSCC) -> Primary Surgery

Follow

Adjuvant

Radiation

RT + Chemo

New Therapy

Oropharynx Cancer (OPC)

Radiation

RT + Chemo

New Therapy

MIS Robotic Surgery
Oropharyngeal Cancer - P.M.H

- HPV + OPC better outcome
- Biology poorly understood
- Treatment is the same as HPV- OPC

HPV(+) vs HPV(-)

- Actuarial Incidence Rate (%)
- Cause Specific Survival

87% vs 59%, $p<0.001$

UHN data from Bio-Clinical Anthology of Outcomes
Toxicity
So We Are Seeing A Shifting Landscape In Treatment to Minimize Toxicity

- **Surgery**
  - Open approach
  - Free tissue transfer
  - Minimally invasive
  - Laser, robotic

- **Radiotherapy**
  - Hyperfractionation
  - IMRT
    - 85% survival-PMH
  - Proton

- **Chemotherapy**
  - Concurrent
  - Induction
  - Biologics

*In your case, there’s a choice – elective surgery, outpatient radiation/chemotherapy, or you can be part of a protocol.*
Primary Oropharyngeal Treatment Outcome - Not all Cured

- 9-20% Develop Locoregional Recurrence
  - Oropharyngeal more challenging than any other Head and Neck site for complete resection due to the complex anatomy
- 30% Unresectable at presentation
- 7-10% Develop distant Metastases
Question

When primary therapy with Chemo/Radiation fails – Should we Consider Salvage Surgery?
Should we therefore consider Salvage Surgery?

“It Depends On”

- Stage of the Disease-early vs delayed
- Recurrent vs Persistent
- Clear Understanding of the original extent of disease
- Surgically resectable as no adjuvant available
- Carefully consider likely functional outcome relative to patients probability of survival including co-morbidities and life style expectations
- Time of recurrence < than or > than 1 year
The Role of Salvage Surgery in Patients With Recurrent Squamous Cell Carcinoma of the Oropharynx

Mark E. Zafereo, MD; Matthew M. Hanasono, MD; David I. Rosenthal, MD; Erich M. Sturgis, MD; Jan S. Lewin, PhD; Diana B. Roberts, PhD; and Randal S. Weber, MD
Zafereo et al *Cancer* 2009

- Retrospective review
- Population
  - 1681 OP patients → 168 local recurrences
  - 41 surgery, 18 RT, palliative chemo 70, supportive care 39
- Management
  - Planned restaging 6 weeks after completing RT or CRT
  - T3/T4 had operative restaging
Good, Bad and Ugly.
Disease free interval to recurrence: Important factor in outcome
Conclusions:
- Very select group can achieve long-term survival
- Despite careful selection of these 41 patients, outcomes were still poor (28% 5-year survival)
- Favorable candidates:
  - Younger
  - Disease-free interval after definitive therapy
  - Small recurrent tumors
  - Negative margins
  - No recurrent neck disease
Salvage Surgery of Locally Recurrent Oropharyngeal Cancer Princess Margaret Experience

Samip N. Patel MD, Marc A. Cohen MD, Babak Givi MD, Benjamin J. Dixon MD, Ralph W. Gilbert MD, Patrick J. Gullane MD, Dale H. Brown MD, Jonathan C. Irish MSc, John R. de Almeida MSc, Kevin M. Higgins MSc, Danny Enepekides MSc, Shao Hui Huang, John Waldron MD, Brian O’Sullivan MD, Wei Xu PhD, Susie Su MSc, David P. Goldstein MSc

This study aimed to determine the success rate of salvage surgery for locally recurrent oropharynx cancer and in addition factors influencing the outcome including p16 status.

Salvage Surgery for OPC

• **Primary Objectives**
  – Assess survival outcomes in salvage oropharyngectomy cases.
  – Determine the Permanent tracheotomy and G-tube rates.
  – Evaluate the incidence of perioperative complications.

• **Secondary Objectives**
  – The secondary objective was to assess predictors of outcome including HPV status (p16).
Salvage Surgery for OPC

- 2000-2012
- 1163 consecutive Oropharyngeal patients
- 122 pts Recurrent OPC
- 88 pts - “Non-Salvage”
  - distant mets, unresectable, poor performance, patient choice
- 34 pts - Salvage surgery
  - 28 (82%) ♂, 6 (18%) ♀
- Median age - 61.2 yrs (41.2-75.9)
## Salvage Surgery

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Tumor Site</strong></td>
<td></td>
</tr>
<tr>
<td>Tonsil</td>
<td>19 (55.9)</td>
</tr>
<tr>
<td>Base of Tongue</td>
<td>13 (38.2)</td>
</tr>
<tr>
<td>Soft Palate</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Posterior Wall</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Initial Tumor Classification</strong></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td>T2</td>
<td>10 (29.4)</td>
</tr>
<tr>
<td>T3</td>
<td>10 (29.4)</td>
</tr>
<tr>
<td>T4</td>
<td>9 (26.5)</td>
</tr>
</tbody>
</table>
## Salvage Surgery for OPC

<table>
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</tr>
<tr>
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<td>9 (26.5)</td>
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<tr>
<td><strong>Initial Nodal Classification</strong></td>
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<tr>
<td>N0</td>
<td>7 (20.6)</td>
</tr>
<tr>
<td>N1</td>
<td>9 (26.5)</td>
</tr>
<tr>
<td>N2</td>
<td>16 (47.1)</td>
</tr>
<tr>
<td>N3</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td><strong>Initial AJCC Stage</strong></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>II</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>III</td>
<td>9 (26.5)</td>
</tr>
<tr>
<td>IV</td>
<td>23 (67.7)</td>
</tr>
</tbody>
</table>
# Salvage Surgery

## Initial Nodal Classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Count (Percentage)</th>
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<tr>
<td>N0</td>
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<tr>
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<tr>
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</table>

## Initial AJCC Stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>Count (Percentage)</th>
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<tbody>
<tr>
<td>I</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>II</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>III</td>
<td>9 (26.5)</td>
</tr>
<tr>
<td>IV</td>
<td>23 (67.7)</td>
</tr>
</tbody>
</table>
### Salvage Surgery for OPC

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Treatment</strong></td>
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<tr>
<td>XRT alone</td>
<td>25 (73.5)</td>
</tr>
<tr>
<td>Concurrent CRT</td>
<td>9 (26.5)</td>
</tr>
<tr>
<td>RT dose (Gy) mean, (range)</td>
<td>65.2 (51-70)</td>
</tr>
<tr>
<td>RT dose mode, median</td>
<td>70, 64</td>
</tr>
<tr>
<td>RT fraction mean (range)</td>
<td>34 (20-40)</td>
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<tr>
<td>RT fraction mode, median</td>
<td>35, 35</td>
</tr>
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</table>
## Salvage Surgery

<table>
<thead>
<tr>
<th>Variable</th>
<th>n=34 (%)</th>
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<tbody>
<tr>
<td><strong>Persistent/Recurrent Disease</strong></td>
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</tr>
<tr>
<td>Persistent</td>
<td>10 (29.4)</td>
</tr>
<tr>
<td>Recurrent</td>
<td>24 (70.6)</td>
</tr>
<tr>
<td><strong>Surgical Oropharyngectomy</strong></td>
<td></td>
</tr>
<tr>
<td>+ Mandibulotomy</td>
<td>26 (76.5)</td>
</tr>
<tr>
<td>+ Mandibulectomy</td>
<td>5 (14.7)</td>
</tr>
<tr>
<td>+ Transoral</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>+ Total Laryngectomy</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td><strong>Flap Reconstruction</strong>*</td>
<td>33 (97)</td>
</tr>
<tr>
<td>None</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Pectoralis Muscle</td>
<td>6 (17.6)</td>
</tr>
<tr>
<td>Anterolateral Thigh Free Flap</td>
<td>13 (38.2)</td>
</tr>
<tr>
<td>Flap</td>
<td></td>
</tr>
<tr>
<td>Radial Forearm Free Flap</td>
<td>12 (35.3)</td>
</tr>
<tr>
<td>Latissimus Dorsi Free Flap</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Rectus Abdominis Free Flap</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Fibula Free Flap</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Length of Hospital Stay</strong></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>17</td>
</tr>
<tr>
<td>Mean</td>
<td>20.5</td>
</tr>
</tbody>
</table>

*One patient received 2 simultaneous free flaps

Table 2. Salvage Surgery
# Salvage Surgery for OPC

## Persistent/Recurrent Disease
- **Persistent**: 10 (29.4%)
- **Recurrent**: 24 (70.6%)

## Surgical Oropharyngectomy
- + Mandibulotomy: 26 (76.5%)
- + Mandibulectomy: 5 (14.7%)
- + Transoral: 1 (2.9%)
- + Total Laryngectomy: 2 (5.9%)

## Flap reconstruction
- None: 1 (2.9%)
- Pectoralis Muscle: 6 (17.6%)
- Anterolateral Thigh Free Flap: 13 (38.2%)
- Radial Forearm Free Flap: 12 (35.3%)
- Latissimus Dorsi Free Flap: 1 (2.9%)
- Rectus Abdominis Free Flap: 1 (2.9%)
- Fibula Free Flap: 1 (2.9%)

## Length of Hospital Stay
- **Median**: 17
- **Mean**: 20.5
## Post-op Complications

<table>
<thead>
<tr>
<th>Type of Complication</th>
<th>Number of Patients (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Complications</strong></td>
<td>15 (44.1)</td>
</tr>
<tr>
<td><strong>Wound Complications</strong></td>
<td></td>
</tr>
<tr>
<td>Minor Wound Infection/Cellulitis</td>
<td>7 (20.6)</td>
</tr>
<tr>
<td>Flap Dehiscence</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Exposed Hardware**</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Fistula</td>
<td>3 (8.8)</td>
</tr>
<tr>
<td>Chronic Wound Infection**</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Hematoma</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Compartment Syndrome</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td><strong>Systemic Complications</strong></td>
<td>4 (11.8)</td>
</tr>
<tr>
<td>Sepsis***</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Respiratory Failure***</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Myocardial Infarction***</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Cardiac Arrest***</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Syncope</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>1 (2.9)</td>
</tr>
</tbody>
</table>

*note - numbers represent number of patients affected by each complication. Some patients experienced more than one complication.**2 patients with osteoradionecrosis as a consequence of primary therapy
## Post Operative Complications

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<td>Pneumonia</td>
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<tr>
<td>Atrial Fibrillation</td>
<td>1 (2.9)</td>
</tr>
</tbody>
</table>
Overall Survival (OS) of Salvaged vs Non-Salvaged Patients (n=122)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>2y (%)</th>
<th>3y (%)</th>
<th>5y (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvage Surgery</td>
<td>34</td>
<td>62 (45-78)</td>
<td>41 (24-57)</td>
<td>25 (10-40)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No Salvage Surgery</td>
<td>88</td>
<td>19 (11-28)</td>
<td>9 (3-15)</td>
<td>2 (0-5)</td>
<td>1</td>
</tr>
</tbody>
</table>
5-Year Recurrence Free Survival (RFS) Stratified by p16 status

*HPV status determined by p16 immunohistochemistry testing
Salvage Surgery- Take home Message

- 34 patients underwent salvage surgery.
- 5 patients (14.7%) were tracheostomy dependent.
- 22 (64.7%) had permeant gastrostomy tube after salvage surgery.
- Post-operative complications occurred in 15/34 (44%) patients.
Salvage Surgery-Take home Message

• Recurrence-free survival after salvage surgery was 41% and 25% at 3 and 5 years, respectively.

• The presence of nodal disease at the time of local recurrence, close or positive margins and lymphovascular invasion were the only factors associated with worse survival on univariable analysis.

• HPV status based on p16 status was not associated with either overall or recurrence-free survival.
Salvage Surgery for OPC

- Overall **7/34 (20.50%)** alive at 5 years.
  - All >5yrs post initial treatment
- Other factors associated with failed salvage
  - Margin Status
    - p=0.007
  - rT3/T4 Staging – 100% failure
    - p=0.033
Surgical Principles-Take Home Message-Handling the Mandible

• What is the role of Rim Mandibulectomy in Salvage Surgery-Post RT or Chemo-RT failure

Rim mandibulectomy of radiated mandible

= High Risk for ORN
Surgical Principles of Mucosal Reconstruction - Take home Message

• Maintain Mobility of Remaining Tissues
• Restore Functional Characteristics
  – Movement
  – Sensation
Reconstructive Options in the Salvage Setting - Take Home Message

- Skin Graft
- Local Flaps - Tongue
- Regional Myocutaneous
- Free Tissue Transfer
**Free Tissue Options - Take Home Message**

<table>
<thead>
<tr>
<th>Flap Thickness</th>
<th>Volume Adjustment</th>
<th>Sensate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forearm</strong></td>
<td>++++</td>
<td>++</td>
</tr>
<tr>
<td><strong>Anterolateral Thigh</strong></td>
<td>+++</td>
<td>+++++</td>
</tr>
<tr>
<td><strong>Lateral Arm</strong></td>
<td>++</td>
<td>+++++</td>
</tr>
<tr>
<td><strong>Fibula</strong></td>
<td>+++</td>
<td>++</td>
</tr>
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</table>
Conclusions

Surgical salvage for OPSCC after failure of radiotherapy (+/- chemotherapy) is feasible. Patients that may benefit from surgery include those without regional recurrence and/or those in whom negative margins can be obtained. However, patients may be tracheotomy or gastrostomy tube dependent. HPV p16 status did not appear to have prognostic impact in the salvage setting, however larger series are required to assess this relationship.
Salvage Surgery for Non-Surgical Treatment Failures: Larynx/Hypopharynx

Dr. Patrick Gullane
Evolution of Organ Preservation Strategies
Cancer of the Larynx, Hypopharynx

- 1960’s – Laryngectomy/Pharyngectomy
- 1970’s – Laryngectomy alone
  Planned radiation with surgery for salvage
- 1980’s – Irradiation +/- Chemotherapy (5FU, Mitomycin C)
- 1990’s – VA Trial, (Neoadjuvant Chemo/Rad or Laryngectomy)
- 2000’s – Adoption of Organ Preservation Approaches

1960’s 2017

100% TL Functional Larynx? 40% TL

Quality of Life?

“I have seen the future and it doesn’t work.”
Robert Fulford
What about Surgical Salvage Following Organ Preservation Strategies?

• Increasing trend over the past decade to adopt organ preservation strategies using either concomitant chemoradiation or accelerated or hyperfractionated radiotherapy.

• While these approaches have increased the likelihood of primary control in certain head and neck mucosal malignancies, when this approach fails and surgical salvage is required the sequelae of the primary treatment creates major challenges for patients and their surgeons.
Salvage Surgery Following Irradiation ± Chemotherapy

Problems
- Extent of recurrence
  - neck only
  - neck & primary
- Hostile wound
- High fistula rate
- Need for flap repair
Grau C. Salvage laryngectomy & pharyngocutaneous fistulae after primary radiotherapy for head and neck cancer: a national survey from DAHANCA.

*Head & Neck.* 25(9):711-6, 2003

### Fistula Rate 9% to 57%

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>No. patients</th>
<th>Fistulae All</th>
<th>Fistulae Previous RT</th>
<th>RT significant risk factor for fistulae</th>
</tr>
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<tbody>
<tr>
<td>Sarkar 1990(^5)</td>
<td>1981–1985</td>
<td>242</td>
<td>35%</td>
<td>57%</td>
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<tr>
<td>McCombe 1993(^6)</td>
<td>1965–1990</td>
<td>357</td>
<td>23%</td>
<td>39%</td>
<td>Yes</td>
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<tr>
<td>Natvig 1993(^7)</td>
<td>1980–1987</td>
<td>197</td>
<td>14%</td>
<td>19%</td>
<td>Yes</td>
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<tr>
<td>Hier 1993(^8)</td>
<td>1981–1991</td>
<td>126</td>
<td>19%</td>
<td>20%</td>
<td>If short interval after RT</td>
</tr>
<tr>
<td>Papazoglu 1994(^9)</td>
<td>1980–1989</td>
<td>310</td>
<td>9%</td>
<td>14%</td>
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<tr>
<td>Celikkanat 1995(^14)</td>
<td>1985–1994</td>
<td>110</td>
<td>17%</td>
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<td>N/A</td>
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<td>Greisen 1997(^15)</td>
<td>1975–1989</td>
<td>107</td>
<td>12%</td>
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<td><strong>Parikh, Gullane 1998</strong></td>
<td><strong>1992–1996</strong></td>
<td><strong>125</strong></td>
<td><strong>22%</strong></td>
<td><strong>23%</strong></td>
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<tr>
<td>Soylu 1998(^13)</td>
<td>1975–1995</td>
<td>295</td>
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<td>19%</td>
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<td>de Zinis 1999(^17)</td>
<td>1988–1995</td>
<td>246</td>
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<td>16%</td>
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<tr>
<td>Herranz 2000(^18)</td>
<td>1980–1997</td>
<td>471</td>
<td>21%</td>
<td>—</td>
<td>(No RT given)</td>
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<tr>
<td>Virtaniemi 2001(^10)</td>
<td>1975–1995</td>
<td>133</td>
<td>15%</td>
<td>29%</td>
<td>Only for Co-60</td>
</tr>
<tr>
<td><strong>Grau 2003 (current series)</strong></td>
<td><strong>1987–1997</strong></td>
<td><strong>472</strong></td>
<td><strong>21%</strong></td>
<td><strong>21%</strong></td>
<td><strong>(All had RT)</strong></td>
</tr>
</tbody>
</table>

**Table 4.** The influence of previous radiotherapy on fistulae incidence after laryngectomy. Survey of reports published since 1990 with more than 100 patients.

Abbreviations: N/A, not available; RT, radiotherapy.
Primary and Salvage (Hypo)Pharyngectomy: Analysis and Outcome

- Jonathan Clark, John de Almeida, Ralph Gilbert, Jonathan Irish, Dale Brown, Peter Neligan, Patrick Gullane

Head and Neck 28:671 - 677, 2006
PMH Experience (Clarke et al 2006)

- Retrospective chart review 1992 – 2002
- N = 153
- Mean age 62 yrs
- 35 females, 118 males
- Mean follow up 3.2 yrs.
- All patients undergoing resection and flap reconstruction of the hypopharynx

- Analyse specifically
  - Initial treatment modality (salvage v primary surgery)
  - Defect extent
  - Type of flap reconstruction
  - Fasciocutaneous versus enteric free flap reconstruction
Indications for Surgery

Post definitive radiotherapy 80 (52%)
- Salvage for recurrence 75
- Stricture 5

Primary surgery 73 (48%)
- Prior radiotherapy (other site) 38
- Advanced disease 30
- Non-SCC 5
Reconstruction-153 Defects

- Pharyngeal defect extent
  - Partial 85 (56%)
  - Circumferential 68 (44%)

- Initial reconstruction
  - Pectoralis major 68

- Gastric transposition 21
  - Free flap 64
<table>
<thead>
<tr>
<th>Complication - Early</th>
<th>Frequency w/ Hypocalcemia</th>
<th>Frequency w/o Hypocalcemia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>84</td>
</tr>
<tr>
<td>Wound</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Dehiscence</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Infection</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Skin necrosis</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Vascular</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Hematoma</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Major vessel rupture</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Fistula</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td>Flap</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Necrosis</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Free flap failure</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Donor site</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Stent migration</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Cardiopulmonary</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>69</td>
<td></td>
</tr>
</tbody>
</table>
Predictors of Pharyngeal Complications

**Pharyngocutaneous Fistula**

**Effect of Radiotherapy**

<table>
<thead>
<tr>
<th>Initial Therapy</th>
<th>Fistula</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiotherapy</td>
<td>No</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>40</td>
</tr>
<tr>
<td>Surgery</td>
<td>No</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>20</td>
</tr>
</tbody>
</table>

**Stricture**

**According to Defect Extent**

<table>
<thead>
<tr>
<th>Extent of Defect</th>
<th>Stricture</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial</td>
<td>No</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>8%</td>
</tr>
<tr>
<td>Circumferential</td>
<td>No</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>24%</td>
</tr>
</tbody>
</table>
Effect of Initial Treatment
Salvage versus Primary Surgery

Salvage pharyngectomy (post-radiation) associated with increased
  – Pharyngocutaneous Fistula (p = 0.048)

Trend towards
  – Wound complications (p = 0.12)
  – Major vessel rupture (p = 0.07)
    • 1% v 8%
  – Length of stay (p = 0.07)
  – Time to oral intake (p = 0.07)
Conclusions

• Early and late morbidity following laryngopharyngeal reconstruction remains substantial despite technical advances.

• Morbidity can be predicted by:
  - initial treatment modality
  - method of reconstruction
  - extent of defect reconstruction
  - Patient co-morbidity
What are the options for laryngopharyngeal reconstruction in 2017?

• “between a rock and a hard place”

  - Rabinovich
# Phases in Development in Pharyngeal Reconstruction

## Regional Flaps
- **Cutaneous**
  - 1877 - Czerny
  - 1942 - Wookey
  - 1965 - Bakamjian
- **Myocutaneous**
  - 1979 - Ariyan

## Viscus
- **Gastric Pull Up**
  - 1912 - Jianu
  - 1949 - Ong & Lee
  - **1998 - Wei et al**
- **Colonic Interposition**
  - 1954 - Goligher

## Free Flap
- **Jejunal graft**
  - 1956 - Seidenberg
- **Tube Radial Forearm**
  - 1979 - Yang
- **Anterolateral Thigh**
  - 1984 - Song
- **Gastro-omental**
  - 1979 - Baudet
• Redesigned cervical flap
• Broad based pedicle
• More reliable 2 stage reconstruction
• 6 – 8 weeks


Dr. Harold Wookey
Head, Division of General Surgery
Toronto General Hospital
1935 – 1951
Problems with Wookey Flap

- Using tissue within radiation field
- Staged reconstruction
  - Aspiration
- > 90% complication rate
  - Fistula
  - Sepsis / Mediastinitis
- Length of esophagus resectable
- Mortality > 30%
Then 1970, Multiple Operations

Now 2017, One stage procedure

**Stricture rate**
- No stent 33%
- Stent < 10% (p=0.571)

“Then 1970, Multiple Operations

Anterolateral thigh flap

Gastro-omental flap

The person who has a disease is more important than the disease a person has.” — William Osler
Reconstructive Options Following Salvage Laryngopharyngectomy 2017

Pectoralis Major Pedicled Flap
Radial Forearm Flap
Free Jejunal Graft
Anterolateral Thigh Flap
Gastro-omental Flap
Gastric Transposition

How do we decide?
Methods of Reconstruction

Then

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omentral flap
Methods of Reconstruction

Now

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omenta flap
The Pectoralis Major Myocutaneous Flap

“You Can’t Tube the New York Yellow Pages”

Richard Hayden
When should we use a Pedicled Pectoralis Major Flap? 

In Repair of partial Pharyngeal defects

minimum of 1.5cm residual pharyngeal mucosa
Pharyngeal Reconstruction with PMMF

- 67 patients (1987-1999)
- 37-82 years
- 97% flap success
- 17% fistula rate
  - 12% spontaneous closure
  - 5% second flap
- Permanent G-tube 2%
- Vocal rehabilitation 74%

Primary role in 2017 is reconstruction of partial pharyngeal defects.

Methods of Reconstruction

*Now – on occasion*

- **Regional flaps**
  - cutaneous
  - myocutaneous
- **Viscus**
  - gastric pull up
  - colonic interposition
- **Free flap**
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omental flap
CURRENT STATUS OF PHARYNGOLARYNGO-ESOPHAGECTOMY AND PHARYNGOGASTRIC ANASTOMOSIS
William Wei, Lai Kun Lam, Po Wing Yue, John Wong
Department of Surgery, The University of Hong Kong, Queen Mary Hospital, Hong Kong
HEAD & NECK May 1998

When should we use a Gastric Transposition?

Table 1. Location of the primary tumor.

<table>
<thead>
<tr>
<th>Years</th>
<th>Patient no.</th>
<th>Larynx</th>
<th>Hypopharynx</th>
<th>Cervical esophagus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966–1979</td>
<td>157</td>
<td>83 (53%)</td>
<td>67 (43%)</td>
<td>7 (4%)</td>
</tr>
<tr>
<td>1980–1985</td>
<td>91</td>
<td>39 (43%)</td>
<td>41 (45%)</td>
<td>11 (12%)</td>
</tr>
<tr>
<td>1986–1995</td>
<td>69</td>
<td>0 (0%)</td>
<td>37 (54%)</td>
<td>32 (46%)</td>
</tr>
<tr>
<td>Total</td>
<td>317</td>
<td>122</td>
<td>145</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 2. Mortality and morbidity.

<table>
<thead>
<tr>
<th>Years</th>
<th>Patient no.</th>
<th>Anastomotic leakage</th>
<th>Hospital mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966–1979</td>
<td>157</td>
<td>36 (23%)</td>
<td>49 (31%)</td>
</tr>
<tr>
<td>1980–1985</td>
<td>91</td>
<td>10 (11%)</td>
<td>11 (12%)</td>
</tr>
<tr>
<td>1986–1995</td>
<td>69</td>
<td>6 (9%)</td>
<td>6 (9%)</td>
</tr>
<tr>
<td>Total</td>
<td>317</td>
<td>52</td>
<td>66</td>
</tr>
</tbody>
</table>
Series of Gastric Transpositions


- 41 patients (21 prior high dose RT)
- Mortality 14%
- Morbidity 46%
- Fistula 22%
- Mean LOS 31 days
- Overall 35% 2YS
Problems

- Perioperative mortality 10 – 20%
- Length of hospital stay
- Hemorrhage
- Anastomotic disruption and fistula >30%
- Resection extending to nasopharynx a limitation
- Gastric emptying and dumping
- Speech – poor
- Last resort form of reconstruction today
Methods of Reconstruction

Now – on occasion

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omental flap
Free Jejunum

Advantages
- Simple, extensive experience in most centres
- Reliable
- Length
- Donor Site Morbidity

Disadvantages
- Swallowing
  - In our experience unless radiated post-op average to poor swallowing results
- Speech
  - TEP speech is a major problem because wet patulous conduit

Methods of Reconstruction

Now – on occasion

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omentumal flap
Radial Forearm Flap

Savary Fistula tube vital
Tubed Forearm

**Pros**
- Minimal immediate donor morbidity
- Reliable
- Easy tubulation
- Speech better than jejunum?

**Cons**
- Stricture
  - ?overcome by salivary tube or Z plasty at distal skin-mucosal junction
- Fistula
- No peristalsis
  - ?advantage

Swallowing

Disa et al
Hypopharyngeal Reconstruction with Lining and Cover

Used as lining for salvage repair with second flap for cover
Methods of Reconstruction

Now – frequently

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omental flap
When should we use a Anterolateral Thigh Flap?

Most commonly used flap in our centre for repair of total circumferential defects.

**Stricture rate**
- No stent 33%
- Stent < 10% (p=0.571)
Tubed Anterolateral Thigh Flap
ANTTI MAKITIE, NIGEL BEASLEY, PETER C. NELIGAN, JOAN LIPA, PATRICK J. GULLANE, RALPH W. GILBERT. Head and neck reconstruction with anterolateral thigh flap *Otolaryngol Head Neck Surg* 2003;129:547-55.

### Table 3. Flap characteristics of 39 anterolateral free flaps

<table>
<thead>
<tr>
<th>Site of reconstruction</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngopharyngeal</td>
<td>3</td>
</tr>
<tr>
<td>Oral or oropharyngeal</td>
<td>20</td>
</tr>
<tr>
<td>External skin</td>
<td>14</td>
</tr>
<tr>
<td>Other (maxillectomy repair)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Recipient vessel</strong></td>
<td></td>
</tr>
<tr>
<td>Superior thyroid artery</td>
<td>19</td>
</tr>
<tr>
<td>Facial artery</td>
<td>13</td>
</tr>
<tr>
<td>Transverse cervical artery</td>
<td>5</td>
</tr>
<tr>
<td>Superficial temporal artery</td>
<td>2</td>
</tr>
<tr>
<td>Internal jugular vein</td>
<td>25</td>
</tr>
<tr>
<td>External jugular vein</td>
<td>2</td>
</tr>
<tr>
<td>Facial vein</td>
<td>6</td>
</tr>
<tr>
<td>Transverse cervical vein</td>
<td>3</td>
</tr>
<tr>
<td>Superficial temporal vein</td>
<td>2</td>
</tr>
<tr>
<td>Previously connected cephalic vein</td>
<td>1</td>
</tr>
<tr>
<td><strong>RFFF, Radial forearm free flap.</strong></td>
<td></td>
</tr>
</tbody>
</table>

2007- 89 anterolateral thigh flap repairs
Anterolateral Thigh Flap

- Tube anterolateral thigh flap appears to be the best reconstructive option in patients with appropriate anatomy.
- The flap can easily reconstruct a defect from nasopharynx to thoracic inlet.
- The Fascial Lata is a unique feature providing a second layer of closure not available in other flaps.
- Major disadvantage is the variable vascular anatomy, and potential difficulty in dissection.
Methods of Reconstruction

Now – on occasion

- Regional flaps
  - cutaneous
  - myocutaneous
- Viscus
  - gastric pull up
  - colonic interposition
- Free flap
  - jejunal graft
  - tubed radial forearm
  - anterolateral thigh
  - gastro-omental flap
Gastro-Omental Flap

In salvage pharyngectomy following organ preservation therapy in good performance patients.
Free Gastro-Omental Transfer

• Summary

• Advantages
  - One Stage, Low Morbidity
  - Unlimited tube diameter,
  - Swallowing
  - Speech
  - Harvest with Omentum

• Disadvantages
  - abdominal harvest, mucoid secretions
<table>
<thead>
<tr>
<th>Flap Selection</th>
<th>Swallow</th>
<th>Speech</th>
<th>Morbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterolateral Thigh + Stent</td>
<td>+++</td>
<td>+++</td>
<td>0</td>
</tr>
<tr>
<td>Forearm + Stent</td>
<td>++</td>
<td>+++</td>
<td>0</td>
</tr>
<tr>
<td>Free Gastro-Omental</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Free Jejunum</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Gastric Pullup</td>
<td>+++++</td>
<td>0</td>
<td>++++</td>
</tr>
</tbody>
</table>

IMAP: It’s Role to be evaluated
Algorithm of Pharyngeal Reconstruction in an Era of Organ Preservation 2010

Circumferential Defect

Primary Surgery
- Radial Forearm
- Anterolateral Thigh

Salvage Surgery
- Initial Therapy
  - Standard Radiotherapy
  - Chemoradiation/high dose altered fractionation

Thigh Thickness
- Poor
- Adequate

Performance
- Gastro-Omental Flap
Conclusions

• Organ preservation approaches clearly provide an opportunity for functional preservation of critical structures.

• Surgical Salvage of these primary treatment approaches is associated with extremely high rates of post operative complications particularly in open mucosal procedures.
Conclusions

• Patients are best served by liberal use of either regional myocutaneous flaps or free tissue transfer.

• This subset of patients are likely best managed in regional centres of excellence with well developed multidisciplinary programs for ablative and reconstructive head and neck surgery with ancillary rehabilitation services.