Session V: Minimally Invasive Esophageal Surgery

Minimally Invasive Ivor Lewis Esophagectomy

James D. Luketich MD, FACS
Henry T. Bahnson Professor and Chairman,
Department of Cardiothoracic Surgery
University of Pittsburgh Medical Center
Overview

- Background information
- Definition of a Minimally Invasive esophagectomy
- Evolution of technique
- Esophagectomy: Results of MIE
Surgical Resection
Mortality from Esophagectomy in the U.S.

- National Medicare data base assessed outcomes from a variety of surgical procedures
- Esophagectomy mortality ranged from 8.1% at high-volume hospital to as high as 23% at low-volume hospitals (NEJM 2002)
- Published series from experienced centers lower this to less than 5%, significant morbidity
- Less invasive approaches may help Surgeons to lower morbidity
Why consider a less-invasive surgical approach for esophageal cancer?

• Improve the surgical standard of care
  • Decrease morbidity
  • Shorten hospital stay
  • More rapid return to daily activities

• However, we must not:
  – Take ill-advised technical short cuts leading to an increase in complications (leaks, conduit damage, omitting important technical steps)
  – Compromise oncologic principles of surgical resection
  – Lose sight of cost considerations

• Increase in early stage referrals from Barrett’s surveillance, seeking low-morbidity options
Early on Minimally Invasive Esophagectomy Lacked a Consistent Minimally Invasive Approach, What is a Minimally Invasive Esophagectomy?

- Right VATS, laparotomy and neck incision
- Laparotomy for gastric mobilization, thoracoscopic esophagectomy and intrathoracic anastomosis
- Laparoscopic gastric mobilization, thoracotomy with intrathoracic anastomosis
- Thoracoscopic esophagectomy, laparoscopic hand-assisted
- Totally laparoscopic mobilization, esophagectomy with neck anastomosis (Transhiatal)
- No advantages noted at that time, but clearly no consistent approach had emerged

Our Approaches: totally laparoscopic/thoracoscopic

- **Thoracoscopic esophagectomy, laparoscopic gastric mobilization and cervical anastomosis (McKeown)**
- **Laparoscopic gastric mobilization, thoracoscopy with intrathoracic anastomosis (Ivor Lewis)**

Law and Wong: Lancet Oncology 2002
## Technique: Laparoscopic-Transhiatal versus thoracoscopic/laparoscopic

<table>
<thead>
<tr>
<th>N=15, initial approach</th>
<th>N=&gt;500</th>
<th>N=&gt;500, current approach</th>
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<tbody>
<tr>
<td><strong>Lap-THE:</strong></td>
<td><strong>Lap/VATS:</strong></td>
<td><strong>MIE Ivor Lewis:</strong></td>
</tr>
<tr>
<td><strong>PRO:</strong></td>
<td><strong>PRO:</strong></td>
<td><strong>PRO:</strong></td>
</tr>
<tr>
<td>No repositioning pt</td>
<td>Better exposure /dissection of mediastinum</td>
<td>pros of lap/vats</td>
</tr>
<tr>
<td>No single lung ventilation</td>
<td>Better esophageal margins</td>
<td>No pharyngeal/RLN issues</td>
</tr>
<tr>
<td><strong>CON:</strong></td>
<td>? Survival/local recurrence benefit</td>
<td>Less gastric tip ischemia</td>
</tr>
<tr>
<td>small working space</td>
<td>repositioning required</td>
<td>Larger diameter anastomosis,</td>
</tr>
<tr>
<td>Limited access to thoracic nodes</td>
<td>double lumen tube required</td>
<td>less strictures</td>
</tr>
<tr>
<td>Gastric tip ischemia</td>
<td>Delayed abdominal assessment</td>
<td>Better gastric margins</td>
</tr>
<tr>
<td>RLN injury</td>
<td>Gastric tip ischemia</td>
<td><strong>CON:</strong></td>
</tr>
<tr>
<td></td>
<td>Gastric margins</td>
<td>Esophageal margins (SCC, or high Barrett’s</td>
</tr>
<tr>
<td></td>
<td>RLN injury</td>
<td>Technical challenge of VATS anastomosis</td>
</tr>
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</table>
Methods: Initial Series

- Initial selection included only T-1 tumors and high-grade dysplasia
- As experience was gained, T2 (n=71) and T3N1 (n=81) included
- Selection: resectable tumor by EUS and CT scanning, laparoscopic staging if questionable
- Prospective data base of standard outcomes
- Two quality of life (QOL) instruments
  - SF-36
  - Heartburn-related QOL

*James Luketich et al Ann Surg 2003*
Patient Population

- 222 patients (186 males, 36 females)
  - Totally laparoscopic with neck anastomosis (n=14)
  - VATS esophageal mobilization, laparoscopic gastric tube, neck anastomosis (McKeown n=208)
- Updated results on first 1000 MIEs presented
- Average age 66 years (39-89)
- 51% received preoperative chemo and/or radiotherapy
- Pathology
  - Barrett’s high-grade dysplasia (35)
  - Stage I (31)
  - Stage II (71)
  - Stage III (81)
  - Stage IV (4)

Quality of Life Results

• SF-36 Global QOL
  – Physical Component Score: 44 post-op, no significant difference compared to pre-op values or age-matched norms
  – Mental Component score: 51 post-op, no significant difference compared to pre-op values or age-matched norms

• Heartburn-Related QOL
  – Post-op score 4.6 consistent with normal population score
  – Only 4% of patients had a post-op score in the severe reflux range (>15)
Ivor Lewis Approach

- Less gastric tube needed, better margins for cardia involvement, less ischemia
- Avoid neck dissection and potential recurrent laryngeal nerve injury
- Less aspiration
- Downside: intrathoracic leak can be more difficult to manage, no third field of LN dissection
- Technique, Learning curve to the VATS intrathoracic anastomosis
Laparoscopic Port Placement

Self-retaining liver retractor

4 5-mm ports
one 10-mm port
Laparoscopic Gastric Tubularization (Video)
Other Steps

- Needle Catheter Jejunostomy (our standard)
- Pyloroplasty (our standard, but may not be necessary with narrow gastric tube)
- Celiac LN dissection (our standard)
Laparoscopic Steps: Gastric Tubularization, Celiac node dissection, stapling of left gastric vessels

GE junction tumor

Endo-GIA II (4.8 mm load)
Tack Gastric Tube to Mobilized GE-Junction Tumor For Neck Retrieval
Other Steps

- Needle Catheter Jejunostomy (our standard)
- Pyloroplasty (our standard, but may not be necessary with narrow gastric tube)
- Celiac LN dissection (our standard)
Typical Location of Surgeon and Assistant Instruments
Ivor Lewis: VATS Portion of Operation

- Standard LN dissection
- Open phrenoesophageal ligament and retrieve specimen and deliver gastric tube into chest
- Transect esophagus
- Remove specimen
- Insert anvil and perform intrathoracic EEA anastomosis (preferably 28 mm, or 25 EEA)
VATS Esophageal Lymph node Dissection (Video)
VATS Transection of Intrathoracic Esophagus, Specimen Removal, and EEA Anastomosis (Ivor Lewis Approach, 1 min 30 sec)
Updated Series U Pittsburgh
American Surgical Association 2011 (n=1011)
Approaches

- McKeown 3 incision Minimally invasive esophagectomy with neck anastomosis (n=481; 48%)
- Ivor-Lewis Minimally invasive esophagectomy with chest anastomosis (n=530; 52%)

Patient Population

- 1011 patients (80% men, 20% women)
- Average age 64 years (39-89)
- 31% received preoperative chemo and/or radiotherapy
- Malignant Disease 95%
- Pathology
  - Barrett’s high-grade dysplasia 95 (13%)
  - Stage I 135 (18%)
  - Stage II 239 (31%)
  - Stage III 241 (32%)
  - Stage IV 48 (6%)

Study Design

- Inclusion criteria
  - Elective MIE for any indication (n= 1011)
  - Time: 1996 to 2011

- Exclusion Criteria
  - Non-elective MIE (n=22)
  - Open or hybrid esophagectomy

- Stratified based on approach, location of anastomosis
  - 3 incision McKeown MIE = 481; Ivor- Lewis MIE-Chest = 530

- Demographics, preoperative variables, operative details and adverse outcomes compared

- Survival assessed
Preoperative Patient Demographics

- MIE-Neck (n=481; 48%)
- MIE-Chest (n=530; 52%)
- No differences in preoperative patient characteristics between MIE-Neck and MIE-Chest

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n=1011</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age (median, IQR)</td>
<td>64 (56, 72)</td>
<td>0.45</td>
</tr>
<tr>
<td>Male Sex</td>
<td>80%</td>
<td>0.21</td>
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<tr>
<td>Caucasian Race (n, %)</td>
<td>97%</td>
<td>0.502</td>
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<tr>
<td>BMI (kg/m^2; median, IQR)</td>
<td>28 (25, 32)</td>
<td></td>
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<tr>
<td>BMI less than 30</td>
<td>63%</td>
<td>0.144</td>
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<tr>
<td>BMI 30 or greater</td>
<td>37%</td>
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**Indication for Operation and Co-morbid Conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>n=980</th>
<th>p-value</th>
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<tbody>
<tr>
<td><strong>Malignant Disease (%)</strong></td>
<td>95%</td>
<td>0.13</td>
</tr>
<tr>
<td>Use of induction therapy</td>
<td>31%</td>
<td>0.668</td>
</tr>
<tr>
<td><strong>Co-morbid Conditions (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age-adjusted CCI &gt;3</td>
<td>49%</td>
<td>0.69</td>
</tr>
<tr>
<td>COPD/Emphysema</td>
<td>12%</td>
<td>0.054</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>23%</td>
<td>0.99</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>19%</td>
<td>0.95</td>
</tr>
<tr>
<td>GERD</td>
<td>71%</td>
<td>0.76</td>
</tr>
<tr>
<td>Chronic Renal Insufficiency (baseline Cr&gt;2 or HD)</td>
<td>3%</td>
<td>0.88</td>
</tr>
<tr>
<td>Prior gastric or esophageal surgery</td>
<td>11%</td>
<td>0.72</td>
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Operative Data

• Conversion to Open: 4%
• Median ICU stay: 2.0 days
• Median hospital stay: 8 days
• Median number of lymph nodes dissected: 21
• 98% with negative surgical margins
## Pathology

<table>
<thead>
<tr>
<th>Pathologic Results</th>
<th>MIE-Neck</th>
<th>MIE-Chest</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal/distal margins negative</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>0.62</td>
</tr>
<tr>
<td>Median Number of LN examined</td>
<td>19</td>
<td>23</td>
<td>21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Adenocarcinoma Tumor Type</td>
<td>68%</td>
<td>83%</td>
<td>76%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nodal metastasis at esophagectomy</td>
<td>39%</td>
<td>49%</td>
<td>44%</td>
<td>0.003</td>
</tr>
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Perioperative Outcomes

Mortality

• Mortality (30 day) for all patients (n=1011): 1.68%

• Ivor-Lewis MIE: 0.9%

Conclusions

• Our minimally invasive experience includes a 2-field lymph node dissection and is associated with a low mortality rate for Ivor-Lewis (0.9%), acceptable morbidity, short hospital stay (8 days) and preserved QOL (compares favorably to open surgery)
  – Survival, stage for stage no different from open surgery results
• We recommend aggressive staging (EUS/PET) followed by laparoscopic/thoracoscopic Ivor Lewis esophagectomy with two-field lymph node dissection for distal esophageal cancers Stage I and II
  – Stage III consider neoadjuvant therapy vs. resect and adjuvant
• Prospective, controlled trial of minimally invasive esophagectomy to assess outcomes in a multi-institutional setting (Eastern Cooperative Oncology Group 2202) results encouraging
Thank You