Outline

- Briefly review esophagectomy techniques
- Define minimally invasive esophagectomy (MIE)
- Endoscopic options to treat esophageal disease
- MIE technical details
  - Abdomen
  - Chest
  - Anastomosis
- Review Outcomes
Esophagectomy Approaches

- Transhiatal
- Ivor-Lewis
- McKeown / 3-Incision
- Left Thoraco-Abdominal
- Left Thoracotomy
- Trans-Abdominal
What is a Minimally Invasive Esophagectomy (MIE)?

- Use minimally invasive techniques to replace a laparotomy and/or thoracotomy for dissection and anastomosis
  - Laparoscopy
  - Thoracoscopy
  - Robotic
- The goal: less pain, less morbidity, faster recovery, better outcomes
Really Minimally Invasive - Endoscopic Treatment

- Ablation of High Grade Dysplasia
  - Photodynamic therapy (PDT)
    - Light activation of sensitizer porphyrin results in reactive O2 species
  - Radiofrequency ablation (RFA)
    - High-frequency current delivers energy to cause directed necrosis

- Endoscopic Mucosal Resection (EMR) for T1a Cancers
  - Local resection under visual guidance
Laparoscopic Abdominal Port Placement

- Place camera port above the umbilicus
- Two 5 ports on the left
  - One will eventually be the j-tube site
- One 5 port on the right
- Another more lateral 5 port – liver retractor
  - Retract left lateral segment away from the hiatus
- A12 Step port on the patient's right side lateral to the umbilicus
Abdominal Dissection

- Start dissection at the pars lucida and then perform hiatal dissection.
- Dissect greater curve of the stomach.
- Divide left gastric artery.
- Begin the esophagogastrectomy specimen.
- Place jejunostomy tube.
Abdominal Dissection
VATS Chest Port Placement

- Place camera port in the 8th intercostal space in the anterior axillary line.
- Anterior utility in the 5th intercostal space
- Posterior utility incision in the 10th intercostal space if performing an Ivor-Lewis and planning a chest anastomosis
  - Not necessary for McKeown, but can be helpful for mobilization
Chest Dissection

- Take down inferiorly pulmonary ligament, dissect Level 7, divide azygos vein
- Encircle esophagus and mobilize it from above the hiatus to:
  - above the azygos for an Ivor-Lewis
  - the thoracic inlet for a McKeown
Chest Mobilization
Esophagogastric Anastomosis

- Divide esophagus
  - Just above the azygos vein in the chest
- Bring stomach up into the chest/neck
  - Complete the specimen in the abdomen for a cervical incision
  - Can complete the specimen in the chest for an Ivor-Lewis
- Create anastomosis
  - Circular Stapler (chest only)
  - Handsewn
  - Stapler/Handsewn
- Scope at the End
  - Make sure anastomosis is appropriately patent
  - Put anastomosis in pool of saline
  - Look for and address any areas where there is bubbling
Deliver and Create the Gastric Conduit
Anastomosis – Circular Stapler
Anastomosis – Stapled + Suture
  › Retrospective reviews, highly selected patients

   2.9% mortality, 46% morbidity
     › 5.9% conversion rate
     › 8.8% leaks, 22% respiratory complications, 7.1% vocal cord palsy

Lymph node retrieval appeared worse than open procedures
  › Long-term oncologic data not available

54 procedures done robotically
  › 5.5% conversion rate, 14 day hospital stay, 2.6% mortality
  › 23% leaks, 31% respiratory complications, 10% vocal cord palsy
Outcomes After Minimally Invasive Esophagectomy
Review of Over 1000 Patients

Ann Surg 2012;256:95–103

1011 Elective MIE Procedures

5% conversion rate
481 (48%) had a cervical anastomosis
530 (52%) Ivor-Lewis
Median length of stay – 8 days
Leak requiring surgery – 5%
Vocal cord issues more common after neck incision
  8% versus 1%
1.7% operative mortality
  0.9% after Ivor-Lewis
Minimally Invasive Esophagectomy (MIE)

Studies from high-volume centers show that MIE:
• reduces length of stay (LOS).
• reduces postoperative major morbidity.
• yields equivalent or slightly reduced mortality.

Evidence of MIE benefits’ generalizability outside of specialized centers is limited.

Studies showing at least comparable results between MIEs and open esophagectomies are accumulating.
MIE Utilization – ACS National Surgical Quality Improvement Program
3263 open; 638 MIE

Annual Prevalence of MIE vs OE, 2005-2013

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<thead>
<tr>
<th>Year</th>
<th>OE (%)</th>
<th>MIE (%)</th>
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<tbody>
<tr>
<td>2005</td>
<td>1059 (90.1%)</td>
<td>105 (9.0%)</td>
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<tr>
<td>2006</td>
<td>1266 (81.9%)</td>
<td>279 (18.1%)</td>
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<tr>
<td>2007</td>
<td>532 (73.4%)</td>
<td>193 (26.6%)</td>
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Approach
- Transhiatal
- Ivor Lewis
- Three-Field

OE vs MIE

- OE (%) - OE (n, %)
- MIE (%) - MIE (n, %)

22.3%
MIE vs Open Procedures

Shorter Length of Stay

9 versus 10 day median length of stay for MIE (p<0.001)

No Differences in:

- Peri-Operative Mortality - 2.2% versus 2.5%
- Readmissions – 11.1% versus 11.0%
- Re-Operations – 14.7% versus 13.6%

Less Major Morbidity for MIE Approach (36.1% versus 40.5%)

Odds Ratio 0.83 (p=0.049)

This overall improvement was mainly driven by fewer blood transfusions

- 10.8% versus 16.7%

Other Complication Rates were Similar

- Deep Organ Space Infection (7.7% versus 6.7%)
- Pneumonia (13.2% versus 14.7%)
- Reintubation (11.9% versus 12.9%)
Minimally Invasive Versus Open Esophageal Resection
Three-year Follow-up of the Previously Reported Randomized Controlled Trial: the TIME Trial

115 patients randomized to open (n=56) or MIE (n=59) in 5 European centers

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<thead>
<tr>
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<th>Open (n=56)</th>
<th>MIE (n=59)</th>
<th>p-value</th>
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<tbody>
<tr>
<td>OR Time</td>
<td>295 minutes</td>
<td>326 minutes</td>
<td>0.02</td>
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<tr>
<td>Blood Loss</td>
<td>475 cc</td>
<td>200 cc</td>
<td>&lt;0.001</td>
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<tr>
<td>Conversion</td>
<td></td>
<td>8 (14%)</td>
<td></td>
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<tr>
<td>Pulmonary Complications</td>
<td>19 (34%)</td>
<td>7 (12%)</td>
<td>0.005</td>
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<tr>
<td>Leak</td>
<td>4 (7%)</td>
<td>7 (12%)</td>
<td>0.4</td>
</tr>
<tr>
<td>Reoperations</td>
<td>6 (11%)</td>
<td>8 (14%)</td>
<td>0.6</td>
</tr>
<tr>
<td>30-day Mortality</td>
<td>0</td>
<td>1 (2%)</td>
<td>0.3</td>
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<tr>
<td>Overall Survival</td>
<td>41.2%</td>
<td>42.9%</td>
<td>0.6</td>
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<tr>
<td>Disease Free Survival</td>
<td>37.3%</td>
<td>42.9%</td>
<td>0.6</td>
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Multicenter, open-label, randomized, controlled trial of transthoracic open esophagectomy (open procedure, n=104) or hybrid minimally invasive esophagectomy (hybrid procedure, n=103) for resectable cancer of the middle or lower third of the esophagus.

A total of 37 patients (36%) in the hybrid-procedure group had a major intraoperative or postoperative complication, as compared with 67 (64%) in the open-procedure group (odds ratio, 0.31; 95% confidence interval [CI], 0.18 to 0.55; P<0.001).

A total of 18 of 102 patients (18%) in the hybrid-procedure group had a major pulmonary complication, as compared with 31 of 103 (30%) in the open-procedure group.

At 3 years, overall survival was 67% (95% CI, 57 to 75) in the hybrid-procedure group, as compared with 55% (95% CI, 45 to 64) in the open-procedure group; disease-free survival was 57% (95% CI, 47 to 66) and 48% (95% CI, 38 to 57), respectively.
A random-effects meta-analysis of 55 relevant studies with adjustment for age, physical status, tumor stage, and neoadjuvant or adjuvant therapy.

Among all 14,592 patients, 7358 (50.4%) underwent MIE and 7234 (49.6%) underwent OE.

Pooled analysis revealed 18% lower 5-year all-cause mortality after MIE compared with OE (HR 0.82, 95% CI 0.76-0.88).

The long-term survival after MIE compares well with OE and may even be better. Thus, MIE can be recommended as a standard surgical approach for esophageal cancer.
Summary

- Minimally invasive techniques can be used to perform most esophagectomy procedures
- The procedure is still an esophagectomy
- Evidence of patient benefit is continuing to accumulate in both retrospective single-center studies and prospective, multi-center trials
  - Lower rates of major morbidity
  - Less chance of pulmonary morbidity
  - Shorter hospitalization
  - No compromise in long-term oncologic outcomes