Minimally Invasive McKeown Esophagectomy

Masters of Minimally Invasive Thoracic Surgery
Orlando
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Increasing Deaths from Esophagus Cancer in US

B. Esophageal adenocarcinoma

Males

Females

The Effect of a Multidisciplinary Thoracic Conference (MTC) on Treatment of Patients With Esophageal Carcinoma

<table>
<thead>
<tr>
<th>2001-2007</th>
<th>Before MTC (n=117)</th>
<th>MTC (n=138)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Staging Evaluation</td>
<td>67%</td>
<td>97%</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mult-D evaluation prior to Tx</td>
<td>72%</td>
<td>98%</td>
<td>0.0001</td>
</tr>
<tr>
<td>NCCN Guidelines adherence</td>
<td>83%</td>
<td>98%</td>
<td>0.0001</td>
</tr>
<tr>
<td>Days from Dx to Tx (mean)</td>
<td>27</td>
<td>16</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
Esophagogastrectomy: Standard Resections

- **Standard**
  - Ivor Lewis
  - 3-incision (McKeown)
  - Thoracoabdominal
  - Transhiatal

- **Minimally Invasive Esophagectomies (MIE)**
  - Ivor Lewis
  - McKeown
3-Incision (McKeown)

1. Thoracic esophageal mobilization; lymph node dissection; ligate thoracic duct (VATS or open)
2. Abdominal exploration; stomach mobilization; lymph node dissection; feeding jejunostomy
3. Left cervical incision for anastomosis

Advantages: less chance of local recurrence, anastomosis in neck easier to manage
Ivor Lewis

1. Abdominal exploration; stomach mobilization; lymph node dissection; feeding jejunostomy (laparoscopic or open)

2. Thoracic esophageal mobilization; lymph node dissection; anastomosis (VATS or open)

Advantages: lower stricture, leak, and aspiration rates
Lymph Node Dissection

1. All thoracic nodes
2. Left gastric pedicle nodes
3. Celiac axis nodes
4. Gastro-hepatic ligament nodes

Target: At least 16
Preoperative Chemoradiotherapy for Esophageal or Junctional Cancer


- Pts with resectable (T2-3N0-1M0) tumors
- Preop CRT (carboplatin/paclitaxel) + RT (41.4 Gy) followed by surgery vs. surgery alone
- 366 pts enrolled (2004-8); male 284, adeno 273
- Toxicities (grade ≥ 3) in the CRT arm: <5%
## CROSS Study

<table>
<thead>
<tr>
<th></th>
<th>CRT+Surgery</th>
<th>Surgery Alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resection Rate</td>
<td>90%</td>
<td>86%</td>
</tr>
<tr>
<td>R0 Resection Rate</td>
<td>92%*</td>
<td>69%</td>
</tr>
<tr>
<td>pCR</td>
<td>29%</td>
<td>NR</td>
</tr>
<tr>
<td>In-hospital Mortality</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Median OS</td>
<td>49 months*</td>
<td>24 months</td>
</tr>
<tr>
<td>1, 2, 3, 5 yr survival</td>
<td>82, 67, 58, 47%*</td>
<td>70, 50, 44 34%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Univariate Hazard Ratio (95% CI)</th>
<th>Adjusted Hazard Ratio (95% CI)</th>
<th>P Value for Adjusted Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>0.657 (0.495–0.871)</td>
<td>0.665 (0.500–0.884)</td>
<td>0.005</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.913 (0.482–1.729)</td>
<td>0.928 (0.487–1.766)</td>
<td>0.82</td>
</tr>
<tr>
<td>Male</td>
<td>0.612 (0.446–0.841)</td>
<td>0.614 (0.447–0.845)</td>
<td>0.003</td>
</tr>
<tr>
<td>Histologic type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.627 (0.056–6.970)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>0.732 (0.524–0.998)</td>
<td>0.741 (0.536–1.024)</td>
<td>0.07</td>
</tr>
<tr>
<td>Squamous-cell carcinoma</td>
<td>0.453 (0.243–0.844)</td>
<td>0.422 (0.226–0.788)</td>
<td>0.007</td>
</tr>
<tr>
<td>Clinical N stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.414 (0.234–0.732)</td>
<td>0.422 (0.239–0.747)</td>
<td>0.003</td>
</tr>
<tr>
<td>1</td>
<td>0.793 (0.567–1.108)</td>
<td>0.807 (0.576–1.130)</td>
<td>0.21</td>
</tr>
<tr>
<td>Could not be determined</td>
<td>0.552 (0.066–4.602)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHO performance score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.617 (0.452–0.844)</td>
<td>0.625 (0.456–0.857)</td>
<td>0.004</td>
</tr>
<tr>
<td>1</td>
<td>0.864 (0.433–1.726)</td>
<td>0.898 (0.753–1.631)</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Minimally Invasive Vs Open Esophagectomy for Patients With Esophageal Cancer

- Pts undergoing MIE or OE for cancer 1999-2007
- MIE 56 pts; OE 98 pts
- Morbidity and mortality not significantly different
- OR time longer in MIE (250 vs 209 m, \( p < 0.001 \))
- ICU stay shorter in MIE (3.0 vs 6.8 d, \( p = 0.022 \))
- No difference in survival
- Conclusions: The MIE is comparable with the OE
Minimally Invasive Esophagectomy For Cancer

- Systematic literature search: 128 publications, 46 original series (1932 patients)
- Analyzed for surgical and oncological outcomes
- Retrospective series of highly selected patients, excluding high-risk patients and locally advanced (T3) tumors
- Pulmonary complications 22%, leak 8.8% and vocal cord palsy 7.1%
Minimally Invasive Esophagectomy For Cancer

- MIE LN retrieval was inferior to open surgery
- F/u too short to draw conclusions regarding long-term survival
- Based on the available literature, the morbidity and mortality of MIE is substantial and comparable to radical open esophagectomy
- Oncological outcome of MIE remains unknown
- MIE: investigational and still evolving
Short-term outcomes following open vs minimally invasive esophagectomy for cancer in England

• UK NHS 2005-2010
• 30-day mortality, cx, and surgical reintervention
• 7502 esophagectomies: 15.4% MIE
• In 2009–2010, 24.7% of resections were MIE
• Mortality (4.3% vs 4.0%; P = 0.61) and
• Cx (38% vs 39%; P = 0.46) in open and MIE groups, respectively
Short-term outcomes following open vs minimally invasive esophagectomy for cancer in England

- A higher reintervention rate was associated with the MIE group than with the open group (21% vs 17.6%, P = 0.006; odds ratio, 1.17; 95% confidence interval, 1.00–1.38; P = 0.040).
- Short-term outcomes are similar
Esophageal Cancer: Improving Outcomes

Short-term outcomes following open vs minimally invasive esophagectomy for cancer in England


<table>
<thead>
<tr>
<th>Medical Complication</th>
<th>Open (n = 6347)</th>
<th>MIE (n = 1155)</th>
<th>Total (n = 7502)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Angina</td>
<td>187</td>
<td>2.9</td>
<td>28</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>45</td>
<td>0.7</td>
<td>4</td>
</tr>
<tr>
<td>Congestive cardiac failure</td>
<td>61</td>
<td>1.0</td>
<td>7</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>611</td>
<td>9.6</td>
<td>102</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1181</td>
<td>18.6</td>
<td>230</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>1026</td>
<td>16.2</td>
<td>148</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>238</td>
<td>3.7</td>
<td>46</td>
</tr>
<tr>
<td>Other respiratory complications†</td>
<td>219</td>
<td>3.5</td>
<td>28</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>39</td>
<td>0.6</td>
<td>6</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>92</td>
<td>1.4</td>
<td>19</td>
</tr>
<tr>
<td>Stroke</td>
<td>14</td>
<td>0.2</td>
<td>2</td>
</tr>
<tr>
<td>Renal failure</td>
<td>126</td>
<td>2.0</td>
<td>17</td>
</tr>
</tbody>
</table>
Trends in Hospital Volume and Operative Mortality for High-Risk Surgery
Finks JF, et al. NEJM 2011; 364:2128-2137

- Median hospital volumes of 4 cancer resections analyzed using Medicare database 1999-2008
- Lung, esophagus, pancreas, and bladder
- Operative mortality declined for all procedures
- Higher volumes explained a large portion of the decline in mortality for pancreatectomy (67%), cystectomy (37%), and esophagectomy (32%), but not for the other procedures
Risk-Adjusted Mortality Associated with Cancer Resections among Medicare Patients, 1999 -2008


*Esophageal Cancer: Improving Outcomes*
Esophageal Cancer: Improving Outcomes
Comprehensive Evaluation for Aspiration After Esophagectomy Reduces the Incidence of Post-Operative Pneumonia
Berry et al, J Thorac Cardiovasc Surg 2010; 140: 1266-72

• We started a comprehensive evaluation prior to oral feedings following esophagectomy after demonstrating that pneumonia strongly predicts mortality: HR for death=20
• Rigorous swallowing evaluation with clinical observation, cineradiography, and fiberoptic endoscopy was used prior to oral feedings
Comprehensive Evaluation for Aspiration After Esophagectomy Reduces the Incidence of Post-Operative Pneumonia
Berry et al, J Thorac Cardiovasc Surg 2010; 140: 1266-72

- 799 patients (379 early era, 420 later era)
- 30-day mortality = 3%
- Postop aspiration 12%; pneumonia 14%
- Age (p<0.0001), cervical anastomosis (p=0.0009) predicted aspiration (multivariable model)
- Incidence of postop pneumonia was significantly decreased (10% vs 18%, p=0.002) in the later era
Modern Esophageal Resection

- Multidisciplinary evaluation is essential
- Induction therapy esophagogastrectomy is the best option for most patients with $\geq$T2N0
- Centers with experience have the best outcomes
- Approaches that avoid thoracotomy are preferable
- Perioperative mortality $\leq$ 2%
- Best predictor of post-operative outcome: pneumonia
Minimally Invasive McKeown

- Thoracoscopic mobilization
- Lymph node dissection
- Ligation of thoracic duct
- Gastric mobilization and lymph node dissection
- No pyloroplasty
- Feeding jejunostomy
- Stapled cervical anastomosis: 4-5 techniques
Esophageal Cancer: Improving Outcomes

Stomach

Esophagus