Minimally Invasive Esophagectomy

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ESOPHAGEAL CANCER

1. Epidemiology of Esophageal Cancer
2. Operative Strategies
3. Minimally Invasive Esophagectomy
4. Video

ESOPHAGEAL CANCER INCIDENCE

Incidence in white-males in 1996 - 7.1 per 100,000

SURGICAL TREATMENT

1. “en-bloc” Esophagectomy 2 or 3 field
2. Vagal sparing Esophagectomy
3. Trans-hiatal Esophagectomy
4. Ivor Lewis Esophagectomy
5. Subtotal Esophagectomy L thoracoabdominal inc.

Milestones in Minimally Invasive Esophagectomy

1993: First series: DePaula et al. (Brazil): 12 patients
2003: First large series Dr. Luketich (222 patients)
- Low mortality, morbidity, reduced hospital stay
2003-present: modifications in technique
- Ivor Lewis/ Trans Hiatal/ Hand assisted / Inversion techniques
Principles of Treatment Regardless of Incision size

- Resection of Tumor with
  - Adequate margin
  - No tumor spillage
  - Minimal manipulation
  - Functional Reconstruction

- Specimens with
  - En bloc resection of draining lymph nodes and venous drainage (Azygous resection)
  - En bloc resection of involved contiguous structures
  - Grossly negative margins

Minimally Invasive Esophagectomy Series

<table>
<thead>
<tr>
<th>Series</th>
<th>Year</th>
<th>n</th>
<th>Type</th>
<th>OR time (h)</th>
<th>LOS</th>
<th>Mort.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DePaula</td>
<td>1995</td>
<td>12</td>
<td>Lap THE</td>
<td>4.3</td>
<td>7.6</td>
<td>0</td>
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<tr>
<td>Swanstrom</td>
<td>1997</td>
<td>9</td>
<td>Lap THE</td>
<td>6.5</td>
<td>6.4</td>
<td>0</td>
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<tr>
<td>Luketich</td>
<td>2003</td>
<td>222</td>
<td>MIE</td>
<td>NR</td>
<td>7</td>
<td>1.4</td>
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<tr>
<td>Berrisford</td>
<td>2008</td>
<td>77</td>
<td>MIE</td>
<td>6.9</td>
<td>12</td>
<td>1</td>
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<tr>
<td>Nguyen</td>
<td>2009</td>
<td>103</td>
<td>MIE</td>
<td>4.5</td>
<td>8</td>
<td>2.9</td>
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<tr>
<td>Campos</td>
<td>2009</td>
<td>35</td>
<td>MIE</td>
<td>6.5</td>
<td>11</td>
<td>0</td>
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</table>

TABLE 3. Outcomes According to Type of Minimally Invasive Esophagectomy (MIE)

<table>
<thead>
<tr>
<th>Demographics and Outcomes</th>
<th>MIE With Cervical Anastomosis</th>
<th>MIE With Thoracic Anastomosis</th>
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</thead>
<tbody>
<tr>
<td>No. operations</td>
<td>47</td>
<td>51</td>
</tr>
<tr>
<td>Gender: males (%)</td>
<td>83</td>
<td>65</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>65 ± 10</td>
<td>64 ± 12</td>
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<tr>
<td>Operative time (min)</td>
<td>333 ± 75</td>
<td>249 ± 72</td>
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<tr>
<td>Estimated blood loss (ml)</td>
<td>263 ± 170</td>
<td>146 ± 117</td>
</tr>
<tr>
<td>Length of hospital stay (d)</td>
<td>12.1 ± 12.2</td>
<td>9.7 ± 8.1</td>
</tr>
<tr>
<td>Length of ICU stay (d)</td>
<td>4.8 ± 0.1</td>
<td>2.0 ± 1.1</td>
</tr>
<tr>
<td>Major complications (%)</td>
<td>12.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Patients requiring transfusion (%)</td>
<td>12.8</td>
<td>9.8</td>
</tr>
<tr>
<td>Anastomotic stricture (%)</td>
<td>23.4</td>
<td>27.5</td>
</tr>
<tr>
<td>Leaks (%)</td>
<td>6.4</td>
<td>9.8</td>
</tr>
</tbody>
</table>

*Blood-assisted procedures were excluded from this group.
*P < 0.05 compared to MIE Ivor Lewis, z-test ± wts.
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Campos GM, Theodore P, Jablons D, Kukreja J

- **35 patients** (mean age 68 years; range 42 to 84)
- Esophageal cancer (n=31) or high-grade dysplasia in Barrett’s Esophagus (n=4)
- 15 patients received neo-adjuvant therapy.
- Completed laparoscopically in 30 patients (80%).
- Mini-thoracotomy 20 patients (57%) thoracoscopic 15 (43%).

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- Proximal and distal **margins were negative** for all patients.
- **Median of 16 LN** (range 8 to 35) dissected, median 2 (range 0 to 15) histologically positive nodes.
- No leaks, pleural space infections, or deaths occurred.
- 18 general complications occurred in 12 patients (34%);
- Most common was atrial fibrillation (8 patients - 23%).
- **LOS - 11 days** (range 8 to 17).
- **Anastomotic Stricture** - 2 patients (6%) 21 and 25 days post-op, and treated with a one and three endoscopic dilations.

Patient positioning

Abdominal Lymph node dissection

- Left Gastric routinely divided at base of celiac axis
- Nodal packet dissected along common hepatic artery
- D-2 Dissection
Abdominal Dissection

- Attention to Right Gastroepiploic
- Division of Esophageal H hiatus
- Separation from thoracoabdominal Aorta
- Limited transmediastinal dissection

Conduit Formation

- Partial formation of Gastric conduit to ensure proper lymphadenectomy
- Penrose drain to facilitate thoracoscopic portion
- 3-5 cm conduit

Thoracic Positioning

- 4 thoracoscopic incisions
- Lateral toward prone position
- Single lung ventilation

Eosophageal mobilization

- Penrose for eosophageal retraction
- Harmonic Scalpel
- Endoscopic clipping of segmental aortic branches
- Division of azygous vein (without resection)
Anastomotic Technique

- Orringer (linear stapling)
- Peroral
  - EEA circular staplers
- Peri-anastomotic drains (Chest tube vs. Jackson-Pratt)

Orringer Type

EEA Anastomosis
Minimally Invasive Esophagectomy

1. Similar Resection & oncologic results Open Surgery
2. Shorter LOS and less Post-operative Pain
3. Technically Demanding
4. Robotic Technology for Thoracic Dissection