Surgical Aspects of Esophageal and Gastric Cancer

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Gastric Cancer Slides

• Kindly provided by Dr Rich Swanson
• Senior Cancer Surgeon BWH/DFCI
• Director of Hepatobiliary and Pancreatic Program BWH/DFCI

Surgical Aspects of Gastric Cancer

• Staging
  – Imaging
  – Laparoscopy
• Lymph Nodes
  – D1 vs D2
  – Why 15 LN’s
• Technical Aspects of Gastric Surgery
  – The Spleen
  – The Proximal Margin
  – Distal and Total Gastrectomies
  – Esophagogastrectomies
  – Laparoscopic vs. Open
Gastric Cancer Staging

• T Stage:
  – T1 invades lamina propria or submucosa
  – T2 invades muscularis propria or subserosa
    • T2a invades muscularis propria
    • T2b invades subserosa
  – T3 penetrates serosa (visceral peritoneum)
  – T4 invades adjacent structures

Gastric Cancer Staging

• N Stage
  – N1 1-6 regional nodes positive
  – N2 7-15 regional nodes positive
  – N3 >15 regional nodes positive

Gastric Cancer Staging

<table>
<thead>
<tr>
<th>Stage</th>
<th>TNM</th>
<th>5 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>T1N0</td>
<td>78%</td>
</tr>
<tr>
<td>IB</td>
<td>T1N1 or T2N0</td>
<td>58%</td>
</tr>
<tr>
<td>II</td>
<td>T1N2, T2N1, T3N0</td>
<td>34%</td>
</tr>
<tr>
<td>IIIA</td>
<td>T2N2, T3N1, T4N0</td>
<td>20%</td>
</tr>
<tr>
<td>IIIB</td>
<td>T3N2</td>
<td>8%</td>
</tr>
<tr>
<td>IV</td>
<td>T4N+, Any N3, or M1</td>
<td>7%</td>
</tr>
</tbody>
</table>
**Gastric Cancer Staging**  
**AJCC 7TH Edition, 2010**

### PRIMARY TUMOR (T)

- **T0**: No evidence of primary tumor
- **Tis**: Carcinoma in situ: intraepithelial tumor without invasion of the lamina propria
- **T1**: Tumor invades lamina propria, mucosa, or submucosa
- **T1a**: Tumor invades lamina propria
- **T1b**: Tumor invades mucosa
- **T2**: Tumor invades submucosa
- **T3**: Tumor invades muscularis propria
- **T4**: Tumor invades subserosal, contiguous tissue without invasion of visceral peritoneum or adjacent structures

### REGIONAL LYMPH NODES (N)

- **N0**: No regional lymph node metastasis
- **N1**: Metastasis in 1 to 2 regional lymph nodes
- **N2**: Metastasis in 3 to 6 regional lymph nodes
- **N3**: Metastasis in 7 or more regional lymph nodes
- **N3b**: Metastasis in 7 to 15 regional lymph nodes
- **N3c**: Metastasis in 16 or more regional lymph nodes

* A designation of pN0 should be used if all examined lymph nodes are negative, regardless of the total number removed and examined.

### STAGING GROUPS (M)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>T</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T0</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>2</td>
<td>T1</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>3</td>
<td>T2</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>4</td>
<td>T3</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>Any T</td>
<td>Any N</td>
<td>M0</td>
</tr>
</tbody>
</table>
NCCN Guidelines for the Evaluation of Gastric Cancer

- Abdominal CT scan with contrast
- Chest Imaging
- PET (optional)
- EUS (optional)
  - Accuracy of EUS:
    - T = 77%
    - N = 69%
    - Semin Oncol 1996; 23(3): 336-46

Staging Laparoscopy for Gastric Cancer

- Some would not operate if laparoscopy detected M1 disease
- Others would perform “palliative” gastrectomies in presence of M1 disease


Staging Laparoscopy for Gastric Cancer

<table>
<thead>
<tr>
<th>Institution</th>
<th>N</th>
<th>M1</th>
<th>M1 who req subseq surg</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDACC</td>
<td>71</td>
<td>23%</td>
<td>1 of 16</td>
</tr>
<tr>
<td>MSKCC</td>
<td>110</td>
<td>37%</td>
<td>0 of 24</td>
</tr>
</tbody>
</table>

Microscopically Positive Peritoneal Fluid is M1 Disease


<table>
<thead>
<tr>
<th>M stage before lavage</th>
<th>N</th>
<th>Positive Cytology</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>76</td>
<td>3 (4%)</td>
<td>All positive were T3 or T4</td>
</tr>
<tr>
<td>M1</td>
<td>51</td>
<td>30 (59%)</td>
<td></td>
</tr>
</tbody>
</table>
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• Staging
  – Imaging
  – Laparoscopy

• Lymph Nodes
  – D1 vs D2
  – Why 15 LN’s

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  – The Spleen
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D1 vs. D2 vs. D3 Lymph Node Dissections

• In general,
  – D1 = peri-gastric LN dissection (take N1 LN’s)
  – D2 = D1 plus LN’s of celiac and its 3 branches (take N1 and N2 LN’s)
  – D3 = D2 plus distant LN’s such as retropancreatic, mesenteric root, and para-aortic (take N1+N2+N3 LN’s)

• Most Western surgeons do a D2 or less
• D1 and D2 dissections differ according to the location of the primary
Randomized Study of D1 and D2 Dissection for Gastric Cancer

Bonekamp et al, NEJM 1999

711 patients undergoing curative resection of gastric cancer:

<table>
<thead>
<tr>
<th></th>
<th>Peri-Op Morbidity</th>
<th>Peri-Op Mortality</th>
<th>Median Hospital Stay (days)</th>
<th>5-Yr Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 Dissection</td>
<td>25%</td>
<td>4%</td>
<td>14</td>
<td>45%</td>
</tr>
<tr>
<td>D2 Dissection</td>
<td>43%</td>
<td>10%</td>
<td>16</td>
<td>47%</td>
</tr>
</tbody>
</table>

Randomized Trials of Lymph Node Dissection in Gastric Cancer

3 Randomized D1 vs. D2 Studies

- South Africa: N.S.
- United Kingdom: N.S.
- Netherlands: N.S.

Gastric Ca Path Report

PATHOLOGIC DIAGNOSIS:

B. DISTAL STOMACH (including FSA1, FSA2):
- ADENOCARCINOMA: mixed intestinal and diffuse type, composed of tubular and signet ring cell components, partially differentiated
- Tumor is located in the lesser curvature of the stomach
- Tumor is invading the muscularis propria
- Peritoneal dissemination is not present
- Lymphovascular invasion is not present
- Chronic active H. pylori gastritis with intestinal metaplasia
- Lymph nodes (negative for tumor)
- Invasive tumor is 4 cm in greatest dimension
- ENSG classification: pT2 N0 Mx

C. COMMON HEPATIC ARTERY, GASTRIC DUODENAL ARTERY, Celiac Artery:
- LEFT GASTRIC ARTERY, LUMINAL NODules (COMPLETION D2 DISSECTION): Fifteen lymph nodes, negative for tumor (0:15)
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5-year Survival as a Function of Stage and #LN’s Examined
Hundahl et al. Cancer 2000; 88: 921-932

<table>
<thead>
<tr>
<th>LN’s Exam</th>
<th>IA</th>
<th>IB</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>78%</td>
<td>58%</td>
<td>34%</td>
</tr>
<tr>
<td>2-6</td>
<td>75%</td>
<td>48%</td>
<td>26%</td>
</tr>
<tr>
<td>7-15</td>
<td>81%</td>
<td>60%</td>
<td>34%</td>
</tr>
<tr>
<td>&gt;15</td>
<td>79%</td>
<td>68%</td>
<td>44%</td>
</tr>
<tr>
<td>&gt;24</td>
<td>79%</td>
<td>68%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Median Survival Time According to Number of Positive Nodes vs. Number of Nodes Examined

<table>
<thead>
<tr>
<th>Nodes Examined</th>
<th>1-6 Positive Nodes</th>
<th>7-15 Positive Nodes</th>
<th>&gt;15 Positive Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15 Nodes Examined</td>
<td>23 mos.</td>
<td>12 mos.</td>
<td></td>
</tr>
<tr>
<td>&gt;14 Nodes Examined</td>
<td>46 mos.</td>
<td>22 mos.</td>
<td>13 mos.</td>
</tr>
</tbody>
</table>
U.S. Surgeons Take an Inadequate Number of LN's in 80% of Cases
Unpublished Data from NCDB December 3, 2004

<table>
<thead>
<tr>
<th>Number of LN's examined:</th>
<th>Number of Patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2,125</td>
<td>14.9%</td>
</tr>
<tr>
<td>1-9</td>
<td>4,622</td>
<td>32.4%</td>
</tr>
<tr>
<td>10-15</td>
<td>2,607</td>
<td>18.3%</td>
</tr>
<tr>
<td>&gt;15</td>
<td>3,009</td>
<td>21.1%</td>
</tr>
<tr>
<td>Unknown</td>
<td>1,884</td>
<td>13.2%</td>
</tr>
<tr>
<td>Total</td>
<td>14,247</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

How do you reliably get > 15 LN's assessed?

• Label your stomach specimen for the pathologist as: “Stomach plus > 15 lymph nodes”
• Do a D2 dissection without taking the splenic hilar LN’s (spare the spleen)
  – In 41% of D1 and in only 5% of D2 were there fewer than 15 LN’s. Cozzaglio. Tumori 2004.

D2 Dissection

[Image of D2 Dissection]
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Tumor Location and Surgical Margin

Tumors of cardia and middle third will generally require total gastrectomy to achieve a negative margin

- 2 cm gross (-) margin → 30% microscopically (+) margin
- 4–6 cm gross (-) margin → 10% microscopically (+) margin
- 6 cm gross (-) margin → 0% microscopically (+) margin

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GE Junction Tumors or Cardia Cancers Involving the GEJ

- Need 6 cm proximal margin (Brigham/DFCI and other studies)
- Requires going into the chest:
  - Left thoraco-abdominal esophagogastrectomy
  - Ivor Lewis thoraco-abdominal esophagogastrectomy (high right chest anastomosis)
  - Transhiatal esophagogastrectomy (anastomosis in left neck)
Laparoscopic vs. Open Gastrectomies
• If the same tissue is removed, laparoscopic is equivalent to open
  – But many “cheat” on the lymph node dissection when using the laparoscopic technique
• Still need incision to remove the specimen when done with the laparoscope

Surgical Aspects of Gastric Cancer: Conclusions
• Stage with:
  – EUS selectively
  – Staging Laparoscopy if palliative gastrectomy not necessary
• Work with medical and radiation oncologists to plan multi-modality treatment
  – ?Preop chemo
  – ?Postop chemorads

Conclusions - Gastric
• At surgery,
  – Strive to achieve 6 cm negative margin
  – Strive to remove/assess > 15 LN’s
    • D2 dissection NOT necessary for survival, but
    • D2 dissection should remove > 15 LN’s
  – Do not remove the spleen unless directly involved
Esophageal Cancer

- Issues are similar to those in GE junction cancer
- Surgical approach is variable
- Need complete resection
- Margins are important, 5 cm is ideal
- Nodes are important
- Technical expertise and volume are associated with better outcomes

Esophageal Cancer

- Surgical approaches:
  - Abdomen, right chest (Ivor Lewis)
  - Right chest, abdomen, left neck (modified McKeown or 3-Hole)
  - Transhiatal
    - Left thoraco-abdominal
  - Most can be done minimally invasively

Transhiatal vs Transthoracic

- Trans hiatal is not effective at removing lymph nodes
- Trans thoracic is a good operation for removing lymph nodes
- Newer techniques minimize the risk of the thoracic portion by using minimally invasive approach

Overall Survival Distal Esophageal Ca

Survival Distal Esophageal Ca
1-8 positive Lymph Nodes


BWH Thoracic Surgery

• 1989-2000 BWH
• 342 esophagectomies
• 250 consecutive resections with modified McKeown technique
  – Right chest
  – Abdominal and left neck incision

Three Hole Esophagectomy

• N = 250, median age 62.7 yrs (31-86)
• Induction therapy (T3/4 +/- N1)- 201 (81%)
• In-hospital or 30 d mortality – 9 (3.6%)
• LOS – 13d (5-330)
• Overall 3 yr survival – 44%
• Median Survival – 25 mos
• Mean follow-up - 24 mos
• By post treatment path stage
  – Stage 0 (n = 60) 56%
  – Stage I (n = 52) 65%
  – Stage IIa (n = 67) 41%
  – Stage IIb (n = 30) 46%
  – Stage III (n = 49) 17%

Three Hole Esophagectomy

BWH Thoracic Surgery
Three Hole Esophagectomy

Table 2. Major Complications (n = 250)

<table>
<thead>
<tr>
<th>Complication</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent laryngeal nerve injury</td>
<td>14% (35)</td>
</tr>
<tr>
<td>Chylothorax</td>
<td>9% (22)</td>
</tr>
<tr>
<td>Leak</td>
<td>8% (19)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>5% (13)</td>
</tr>
<tr>
<td>Postcapsular bleeding</td>
<td>2% (9)</td>
</tr>
<tr>
<td>Tracheosophageal fistula</td>
<td>1% (2)</td>
</tr>
<tr>
<td>Adult respiratory distress syndrome</td>
<td>1% (2)</td>
</tr>
<tr>
<td>Empyema</td>
<td>1% (2)</td>
</tr>
<tr>
<td>Pulmonary emboli</td>
<td>1% (2)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>0.4% (1)</td>
</tr>
<tr>
<td>Mediastinitis</td>
<td>0.4% (1)</td>
</tr>
</tbody>
</table>

VATS approach MIE

Minimally Invasive Esophagectomy. Outcomes in 222 patients.
MIE – Ivor Lewis

- Laparoscopic
- Right thoracoscopic
- Anastomosis in high right chest
- Over last 2+ yrs my experience is n=60
- Mortality 0%, leak over last 30 – 0%
  (1st 30 3/30 for 10% ), 1% chyle leak, pneumonia, RLN dysfunction
- Needs to stand test of time but does look like improved option


- SEER, 1988-2003, N = 838
- T1-T3
- Median followup 15 mos
- Overall 5 yr survival – 13.4%
- LN – number removed
  - 1-5 = 25%
  - 6-10 = 30%
  - 11-15 = 23%
  - >15 = 22%
- Mean number removed = 11.2 (1-56)
- Mean number of positive nodes = 3.4 (1-27)

Prognostic significance of number of lymph node metastases in esophageal cancer

- Survival- LN ratio 5 yr dis-spec survival
  - ≤ 0.2 30%
  - 0.21-0.5 16%
  - >0.5 13%

- Multivariable analysis – LNR
  independent of age, race, gender, histology, tumor-status and post-op radiotherapy
Effect of the number of lymph nodes sampled on postoperative survival of lymph node-negative esophageal cancer.

- SEER 1988-2003
- N = 972
- Number (-) LN’s 5 yr dis-spec survival
  - ≤10 55%
  - 11-17 66%
  - >18 75%

Prognostic significance of number of lymph node metastases in esophageal cancer.
BWH Thoracic Surgery
Best Operation for Esophageal Cancer Summary

- Induction therapy for locally advanced tumors to improve outcome and identify best outcome patients
- Must remove lymph nodes
- Must have low leak rate and complication rate
- Anastomosis in right chest or left neck
- Minimally invasive approach will minimize complications, improve functional recovery and permit more patients a surgical option

Gastric and Esophageal Cancer

- Surgical issues are important
- For locally advanced esophageal cancer (T3 and/or N1) induction therapy seems to be helpful
- Nodal resection and margins are important
- We must keep our leak rate and complication rates low

Thank You
Questions?