SURGICAL MANAGEMENT OF GASTRIC CANCER

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Morbidity and Mortality
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Case Presentation

• 60 yo M admitted to medicine on 10/24/2010 with c/o persistent N/V x 3 weeks, weight loss 40lb/1 year
• HPI: diagnosed with gastric cancer at Brookdale in 12/2009, refused surgery
• PMH: GERD, PUD, CKD, PVD
• PSH: LIHR
• Meds: nexium
• SH: denies x3
• FH: gastric cancer - parent, ovarian cancer - sister
Physical Exam

- VS: 98.7, 111/77, 96, 16, 100%
- On exam
  - cachectic
  - bitemporal wasting
  - palpable abdominal mass
  - umbilical nodule
  - guaiac +
Labs

- CBC - 6.01/14.2/40.7/423
- BMP - 142/3.1/78/47/44/3.97/112
- LFTs - 7.0/4.0/31/17/59/0.4
- Coags - 10.6/28.2/1.0
- VBG - 7.50/68.9/38.3/49.5/28
- Lipase 120
Imaging

- CXR (10/24) - neg
- CT Abd (10/25) - thickening in the gastric antrum, limited evaluation for hematogenous metastasis w/o IV contrast, no bulky intra-abdominal LAD
- CT Chest (10/27) - no evidence of metastatic disease, limited w/o IV contrast, nonspecific lucent lesion within L2 vertibral body
- RUQ US (10/28) - heterogeneous liver
Hospital Course

- Management: NPO, IVF, nexium drip, GI/Surgery
- EGD (10/28) - copious dark liquid in the stomach, attempt at aspiration -> vomiting -> patient refused NGT -> procedure aborted
- Transferred to surgery, scheduled for OR
- NGT placed - 600cc of clear fluid
- Brookdale records
  - 11/09 gastric biopsy: adenoca w/signet ring cells
  - 10/18/10 bone scan: neg
• Ex-lap, no gross mets
• Palpable mass in pylorus/antrum
• Enter lesser sac after dividing omentum from transverse colon
• Stomach mass extending along lesser curvature to GE junction
• Mobilized pylorus and 1st portion of duodenum
• Large firm LNs posterior to mid stomach
• Large left gastric artery suture ligated
Operation

- Mobilized greater curvature to splenic hilum, short gastrics preserved
- Transected 1st portion of duodenum and proximal stomach for subtotal gastrectomy
- Billroth II reconstruction (retrocolic)
- Left 2 JPs (duodenal stump, anastomosis site)
- Excision of umbilicus and closure
- EBL 1L, transfusion 2 Units PRBC, 7L crystalloids
Pathology

- Gastric adenocarcinoma
- Poorly differentiated
- Some signet ring cells
- Diffuse type
- Tumor invades through serosa (T4)
- 12/17 lymph nodes positive (N2)
- Metastasis in umbilical tissue (M1)
- Stage IV
Post-op Course

• POD 0 - SICU intubated
• POD 1 - extubated
• POD 2 - transfer to floor, NGT not draining
  — Esophagram: intact anastomosis, no leak or obstruction
• POD 3 - advanced to clears
• POD 4-6 - diet slowly advanced to solids
• POD 6 - JPs removed
• POD 7 - discharged home
Outpatient Follow-up

• Surgery
  – POD 19: asymptomatic, good appetite, gained weight, wound healing well, staples removed

• Oncology
  – POD 20: reluctant to receive any chemo, wants to wait until symptoms for palliative chemotherapy
Gastric Cancer

- Adenocarcinoma (95%)
- Squamous cell carcinoma
- Adenoacanthoma
- Carcinoid tumors
- GI stromal tumors
- Lymphoma
# Risk Factors

## Nutritional
- Low fat or protein consumption
- Salted meat or fish
- High nitrate consumption
- High complex-carbohydrate consumption

## Environmental
- Poor food preparation (smoked, salted)
- Lack of refrigeration
- Poor drinking water (well water)
- Smoking

## Social
- Low social class

## Medical
- Prior gastric surgery
- *Helicobacter pylori* infection
- Gastric atrophy and gastritis
- Adenomatous polyps
- Male gender
<table>
<thead>
<tr>
<th><strong>INTESTINAL</strong></th>
<th><strong>DIFFUSE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>Familial</td>
</tr>
<tr>
<td>Gastric atrophy, intestinal metaplasia</td>
<td>Blood type A</td>
</tr>
<tr>
<td>Men &gt; women</td>
<td>Women &gt; men</td>
</tr>
<tr>
<td>Increasing incidence with age</td>
<td>Younger age group</td>
</tr>
<tr>
<td>Gland formation</td>
<td>Poorly differentiated, signet ring cells</td>
</tr>
<tr>
<td>Hematogenous spread</td>
<td>Transmural/lymphatic spread</td>
</tr>
<tr>
<td>Microsatellite instability</td>
<td>Decreased E-cadherin</td>
</tr>
<tr>
<td>APC gene mutations</td>
<td></td>
</tr>
<tr>
<td><em>p53, p16</em> inactivation</td>
<td><em>p53, p16</em> inactivation</td>
</tr>
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</table>
## TNM Classification

### Primary Tumor (T)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>TX</td>
<td>Primary tumor cannot be assessed</td>
</tr>
<tr>
<td>T0</td>
<td>No evidence of primary tumor</td>
</tr>
<tr>
<td>Tis</td>
<td>Carcinoma in situ: intraepithelial tumor without invasion of the lamina propria</td>
</tr>
<tr>
<td>T1</td>
<td>Tumor invades lamina propria or submucosa</td>
</tr>
<tr>
<td>T2</td>
<td>Tumor invades muscularis propria or subserosa</td>
</tr>
<tr>
<td>T2a</td>
<td>Tumor invades muscularis propria</td>
</tr>
<tr>
<td>T2b</td>
<td>Tumor invades subserosa</td>
</tr>
<tr>
<td>T3</td>
<td>Tumor penetrates serosa (visceral peritoneum) without invasion of adjacent structures</td>
</tr>
<tr>
<td>T4</td>
<td>Tumor invades adjacent structures</td>
</tr>
</tbody>
</table>

### Regional Lymph Nodes (N)

<table>
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<th>Description</th>
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<tr>
<td>NX</td>
<td>Regional lymph node(s) cannot be assessed</td>
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<tr>
<td>N0</td>
<td>No regional lymph node metastasis</td>
</tr>
<tr>
<td>N1</td>
<td>Metastasis in 1 to 6 regional lymph nodes</td>
</tr>
<tr>
<td>N2</td>
<td>Metastasis in 7 to 15 regional lymph nodes</td>
</tr>
<tr>
<td>N3</td>
<td>Metastasis in more than 15 regional lymph nodes</td>
</tr>
<tr>
<td>Stage</td>
<td>T</td>
</tr>
<tr>
<td>---------</td>
<td>----</td>
</tr>
<tr>
<td>0</td>
<td>Tis</td>
</tr>
<tr>
<td>1A</td>
<td>T1</td>
</tr>
<tr>
<td>IB</td>
<td>T1</td>
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<tr>
<td></td>
<td>T2a/b</td>
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<tr>
<td>II</td>
<td>T1</td>
</tr>
<tr>
<td></td>
<td>T2a/b</td>
</tr>
<tr>
<td></td>
<td>T3</td>
</tr>
<tr>
<td>IIIA</td>
<td>T2a/b</td>
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<tr>
<td></td>
<td>T3</td>
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<td>T4</td>
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<td>T3</td>
</tr>
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<td>IV</td>
<td>T4</td>
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<tr>
<td></td>
<td>T1-3</td>
</tr>
<tr>
<td></td>
<td>Any T</td>
</tr>
</tbody>
</table>
Clinical Presentation

- Early symptoms
  - vague epigastric discomfort, indigestion
- Advanced disease
  - weight loss, anorexia, fatigue, vomiting
- Physical Exam
  - palpable abdominal mass
  - Virchow's lymph node
  - Sister Mary Joseph's node
  - Blummer's shelf
  - Krukenberg's tumor
Preoperative Evaluation

- EGD with multiple biopsies
- EUS for staging (some centers)
- Labs
  - CBC, BMP, LFTs, Coags
- Imaging
  - CXR, CT Abd, CT Chest (proximal tumors)
- Laparoscopy (for T3-T4 tumors) - can identify unsuspected metastatic disease in 13-57%

www.downstatesurgery.org
Surgical Treatment

• In the absence of distant mets: goal - R0 resection
• Proximal tumor – total gastrectomy
  – Norwegian Stomach Cancer Trial morbidity and mortality rates for
    • Proximal gastric resection - 52% and 16%
    • Total gastrectomy - 38% and 8%
• Distal tumor – subtotal or total gastrectomy
  – 5-6 cm luminal margin recommended
• Reconstruction: Billroth II or Roux-en-Y
Lymph Nodes

• Japanese Classification for Gastric Carcinoma
  – 16 lymph node stations or echelons
  – stations classified into groups that correspond to the location of the primary tumor
  – presence of metastasis to a lymph node group determines the N classification

• metastases to group 1 lymph nodes (and absence of disease in more distant lymph node groups) is classified as N1
<table>
<thead>
<tr>
<th>LYMPH NODE STATION (NO.)</th>
<th>DESCRIPTION</th>
<th>LOCATION OF PRIMARY TUMOR IN STOMACH</th>
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<tbody>
<tr>
<td></td>
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<td>Upper Third</td>
</tr>
<tr>
<td>1</td>
<td>Right paracardial</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Left paracardial</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Lesser curvature</td>
<td>1</td>
</tr>
<tr>
<td>4sa</td>
<td>Short gastric</td>
<td>1</td>
</tr>
<tr>
<td>4sb</td>
<td>Left gastroepiploic</td>
<td>1</td>
</tr>
<tr>
<td>4d</td>
<td>Right gastroepiploic</td>
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</tr>
<tr>
<td>5</td>
<td>Suprapyloric</td>
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<tr>
<td>6</td>
<td>Infrapyloric</td>
<td>3</td>
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<tr>
<td>7</td>
<td>Left gastric artery</td>
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<tr>
<td>8a</td>
<td>Anterior comm. hepatic</td>
<td>2</td>
</tr>
<tr>
<td>8p</td>
<td>Posterior comm. hepatic</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Celiac artery</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Splenic hilum</td>
<td>2</td>
</tr>
<tr>
<td>11p</td>
<td>Proximal splenic</td>
<td>2</td>
</tr>
<tr>
<td>11d</td>
<td>Distal splenic</td>
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</tr>
<tr>
<td>12a</td>
<td>Left hepatoduodenal</td>
<td>3</td>
</tr>
<tr>
<td>12b,p</td>
<td>Posterior hepatoduodenal</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Retropancreatic</td>
<td>M</td>
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<tr>
<td>14v</td>
<td>Superior mesenteric vein</td>
<td>M</td>
</tr>
<tr>
<td>14a</td>
<td>Superior mesenteric artery</td>
<td>M</td>
</tr>
<tr>
<td>15</td>
<td>Middle colic</td>
<td>M</td>
</tr>
<tr>
<td>16al</td>
<td>Aortic hiatus</td>
<td>3</td>
</tr>
<tr>
<td>16a2,b1</td>
<td>Para-aortic, middle</td>
<td>M</td>
</tr>
<tr>
<td>16b2</td>
<td>Para-aortic, caudal</td>
<td>M</td>
</tr>
</tbody>
</table>
Lymphadenectomy

• D1 resection - removal of group 1 lymph nodes
• D2 resection - removal of group 1 & 2 lymph nodes
• D3 resection - D2 resection plus removal of para-aortic lymph nodes
• Japanese surgeons perform splenectomy and partial pancreatectomy during D2 resections
• Western surgeons do not typically resect the spleen or pancreas because of the increased morbidity
• NCCN guidelines - minimum of a D1 resection with excision of at least 15 lymph nodes
Operative Technique

• Avascular plane between the greater omentum and transverse colon is incised
• Dissection continues along the avascular plane between the anterior and posterior sheaths of the transverse mesocolon to the level of the pancreas
• Lateral attachments of the stomach and short gastric vessels are divided
Operative Technique

• Splenic artery and nodal tissue is dissected down to the level of splenic hilum
• Duodenum is identified and divided
• Nodal dissection proceeds from the porta hepatis toward the celiac axis, left gastric artery is divided at its origin
• Nodal dissection continues along the right diaphragmatic crus and esophageal hiatus
Palliative Treatment

• 20 - 30% of patients present with stage IV disease
• Goal - relief of symptoms with minimal morbidity
• Surgical palliation - resection or bypass
• Other techniques
  – percutaneous, endoscopic, radiotherapy
• Palliation of bleeding or proximal gastric obstruction
  – laser recanalization
  – endoscopic dilation
  – stent placement
Outcomes

- Overall 5-year survival 10 - 21%
- 5-year survival for patients who undergo a potentially curative resection 24 - 57%
- Recurrence rates after gastrectomy 40 - 80% (most within 3 years)
  - locoregional failure rate 38 - 45% (gastric remnant at the anastomosis, gastric bed, regional nodes)
  - peritoneal dissemination in 54%
  - isolated distant metastases are uncommon
- Hematogenous spread occurs to the liver, lung, and bone
Total vs. Subtotal Gastrectomy RCTs

  - 618 patients with distal gastric cancer underwent TG or STG with at least 6cm margin

  - 169 patients with antral gastric cancer underwent TG or STG

- Both studies showed no 5-year survival difference
Extended Lymph Node Dissection for Gastric Cancer: Who May Benefit? Final Results of the Randomized Dutch Gastric Cancer Group Trial


- Prospective RCT of 711 patients with gastric adenocarcinoma who underwent D1 or D2 lymph node dissection and were followed > 10 years
- Morbidity (25% vs 43%; $P < 0.001$) and mortality (4% vs 10%; $P = 0.004$) were significantly higher in the D2 dissection group
- After 11 years there is no overall difference in survival (30% vs 35%; $P = .53$)
Nodal dissection for patients with gastric cancer: a randomized controlled trial
Chew-Wun Wu, Chao A Hsiung, Su-Shun Lo, et al

- Single institution trial of 335 patients who underwent D1 and D3 surgery with median follow-up of 94.5 months
- Overall 5-year survival was in D3 group compared to D1 group was 59.5% vs 53.6% (difference between groups 5.9%, log-rank p=0.041)
- Patients who had R0 resection had recurrence at 5 years of 50.6% for D1 surgery and 40.3% for D3 surgery, results not statistically significant
Principles of Gastric Cancer Surgery

- Tis-T1a tumors: candidates for endoscopic resection
- T1b-T3: distal, subtotal or total gastrectomy to achieve R0 resection (typically $\geq 4\text{cm}$ from gross tumor)
- T4 tumors: en bloc resection of involved structures
- Gastric resection should include the regional lymphatics – perigastric (D1) and those along the named vessels of the celiac axis (D2), with a goal of examining $\geq 15$ nodes
- Routine or prophylactic splenectomy is not required
Principles of Gastric Cancer Surgery

- Criteria for unresectability for cure:
  - Locoregionally advanced
  - Distant metastases or peritoneal seeding

- Unresectable tumors:
  - Palliative resection should not be performed unless patient is symptomatic
  - Lymph node dissection is not required
  - Gastric bypass with gastrojejunostomy may be useful in palliating obstructive symptoms