Laparoscopic Pancreatectomy

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Laparoscopic Pancreatic Resection

Laparoscopy

- Gold standard for gallstones, GERD, achalasia
- May be preferred for bariatric, adrenal, spleen, colon, and hernia surgery
- Increasing utilization for pancreas and liver
Benefits of Laparoscopic Surgery

- Less post-operative pain
- Less post-operative ileus
- Preserved immune function
- Decreased stress response
- Decreased complications
- Shorter hospital stay
- Quicker return to activity/function
- Improved cosmesis
- Increased patient compliance
Drawbacks

- Learning curve
- Increased operative time
- ? Cost
- ? Risk
- ? Malignancy
  - Extent of resection
  - Adequate surgical margins
  - Lymph node basin dissection
  - Port site recurrence
Why the slow adoption of laparoscopic pancreatic surgery?

- Volume outcome relationships
- Technically challenging
- High morbidity procedures
- Long length of stay
- Close association with major vascular structures (PV, SMV, SV, SMA, Celiac)
- Need for complex reconstruction
Requirements for Laparoscopic Pancreatic Surgery

- Understanding of pancreatic disease (natural history, indications)
- Experience in open pancreatic surgery
- Advanced laparoscopic skill sets
- Intracorporeal suturing
- Ability to control bleeding
Laparoscopic Pancreatic Resections

- Enucleation
- Distal Panc + Spleen
- Pancreatecoduodenectomy
- Central Pancreatectomy
- Spleen Preserving Distal Panc
Indications for Laparoscopic Pancreatic Resections

- Cystic neoplasms
- Neuroendocrine tumors
- IPMN
- Adenocarcinoma ??
Laparoscopic Pancreatic Resection

Laparoscopic Enucleation
Laparoscopic Pancreatic Resection

Laparoscopic Pancreatic Enucleation

• Neuroendocrine tumors and benign cystic tumors
• No involvement of main pancreatic duct
• Associated with
  • Reduced operative time
  • Decreased blood loss
  • Fewer complications
  • Preserved pancreatic function
# Laparoscopic Pancreatic Resection

## Laparoscopic Pancreatic Enucleation

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Op time</th>
<th>Comp</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marbut</td>
<td>2005</td>
<td>21</td>
<td>120 min</td>
<td>24%</td>
<td>7 days</td>
</tr>
<tr>
<td>Fernandez-Cruz</td>
<td>2005</td>
<td>7</td>
<td>180 min</td>
<td>42%</td>
<td>5 days</td>
</tr>
<tr>
<td>Edwin</td>
<td>2004</td>
<td>6</td>
<td>120 min</td>
<td>-</td>
<td>5.5 days</td>
</tr>
<tr>
<td>Berends</td>
<td>2000</td>
<td>5</td>
<td>180 min</td>
<td>40%</td>
<td>7.0 days</td>
</tr>
</tbody>
</table>

- Marbut J. Surgery 137:597-605, 2005
- Fernandez-Cruz L. J Gastrointest Surg 9:381-388, 2005
Laparoscopic Pancreatic Resection

Laparoscopic Distal Pancreatic Resections

Distal pancreatectomy with splenectomy

Splenic vessel preserving distal pancreatectomy

Splenic preserving distal pancreatectomy without splenic vessel preservation (Warshaw technique)
Should the spleen be preserved with distal pancreatectomy?

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Op time</th>
<th>EBL</th>
<th>Infect Comp</th>
<th>Serious Comp</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenectomy</td>
<td>79</td>
<td>3.1 hrs</td>
<td>600 ml</td>
<td>28%*</td>
<td>11%*</td>
<td>9 days*</td>
</tr>
<tr>
<td>Spleen Preservation</td>
<td>46</td>
<td>2.9 hrs</td>
<td>350 ml</td>
<td>9%</td>
<td>2%</td>
<td>7 days</td>
</tr>
</tbody>
</table>

Spleen Preserving Distal Pancreatectomy for Cystic Neoplasms of the Pancreas

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Size (cm)</th>
<th>OP time (min)</th>
<th>EBL (ml)</th>
<th>Comp (%)</th>
<th>LOS (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic Vessel Preservation</td>
<td>11</td>
<td>5.3</td>
<td>222</td>
<td>496</td>
<td>27</td>
<td>5.5</td>
</tr>
<tr>
<td>Splenic Vessel Ligation</td>
<td>8</td>
<td>5.1</td>
<td>165</td>
<td>275</td>
<td>38</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Fernandez-Cruz L. J Gastrointest Surg 8:493-501, 2004
Laparoscopic vs. Open Distal Pancreatectomy

- Retrospective multicenter analysis
- Eight academic medical centers in the Central and Southeast United States
- Inclusion criteria:
  - 1/1/2002-12/31/2006
  - Formal resection
  - Hand-access approach included in LLP group
Left Pancreatectomy
667 cases at 8 centers over 5 years

<table>
<thead>
<tr>
<th>%LLP</th>
<th>6%</th>
<th>3%</th>
<th>18%</th>
<th>29%</th>
<th>47%</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLP</td>
<td>175</td>
<td>100</td>
<td>125</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>OLP</td>
<td></td>
<td>125</td>
<td>150</td>
<td>175</td>
<td>200</td>
</tr>
</tbody>
</table>

Number of operations

2002 2003 2004 2005 2006

LLP (n=159) OLP (n=508)
Indications for Surgery (n=667)

- Pancreatitis (10%)
- Solid (46%)
- Cystic (44%)

P=0.03

OLP
LLP

Percent
Histology (n=667)

- OLP 89%
- LLP 11%
- P<0.001
- Ductal Adenocarcinoma 23%
- Other malignant 23%
- Benign 54%
# Left pancreatectomy

## Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLP (N=508)</th>
<th>LLP (N=159)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op time (min)</td>
<td>226±101</td>
<td>232±99</td>
<td>NS 0.58</td>
</tr>
<tr>
<td>Blood loss (cc)</td>
<td>712±915</td>
<td>371±526</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Spleen preserved</td>
<td>50 (10%)</td>
<td>50 (31%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pancreas length (cm)</td>
<td>9.7±4.0</td>
<td>8.3±3.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Positive margin</td>
<td>41 (8%)</td>
<td>10 (6%)</td>
<td>NS 0.61</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>9.2±6.0</td>
<td>5.9±3.7</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
## Complications

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLP (N=200)</th>
<th>LLP (N=142)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>113 (57%)</td>
<td>57 (40%)</td>
<td>0.003</td>
</tr>
<tr>
<td>Major complication*</td>
<td>33 (17%)</td>
<td>14 (10%)</td>
<td>NS 0.08</td>
</tr>
<tr>
<td>Wound infection</td>
<td>29 (15%)</td>
<td>7 (5%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Any fistula</td>
<td>64 (32%)</td>
<td>37 (26%)</td>
<td>NS 0.28</td>
</tr>
<tr>
<td>Significant fistula**</td>
<td>36 (18%)</td>
<td>16 (11%)</td>
<td>NS 0.10</td>
</tr>
</tbody>
</table>

Bassi et al. Surgery. 2005;138:8-13*
Laparoscopic distal pancreatectomy is associated with:

- A higher splenic preservation rate
- Decreased blood loss
- Decreased complication rate
- Decreased hospital length of stay
## Laparoscopic Distal Pancreatectomy

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Conv (%)</th>
<th>Spleen Pres (%)</th>
<th>Op time (hrs)</th>
<th>fistula/absc (%)</th>
<th>Comp (%)</th>
<th>LOS (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patterson</td>
<td>2001</td>
<td>19</td>
<td>11</td>
<td>37</td>
<td>4.4</td>
<td>16</td>
<td>26</td>
<td>6.0</td>
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<tr>
<td>Park</td>
<td>2002</td>
<td>25</td>
<td>8</td>
<td>41</td>
<td>3.7</td>
<td>4</td>
<td>17</td>
<td>4.1</td>
</tr>
<tr>
<td>Edwin</td>
<td>2004</td>
<td>17</td>
<td>13</td>
<td>29</td>
<td>4.0</td>
<td>-</td>
<td>38</td>
<td>5.5</td>
</tr>
<tr>
<td>Dulucq</td>
<td>2005</td>
<td>21</td>
<td>5</td>
<td>76</td>
<td>4.6</td>
<td>14</td>
<td>23</td>
<td>10.8</td>
</tr>
<tr>
<td>Marbut</td>
<td>2005</td>
<td>96</td>
<td>15</td>
<td>71</td>
<td>3.3</td>
<td>27-38</td>
<td>41</td>
<td>7.0</td>
</tr>
<tr>
<td>Fernandez-Cruz</td>
<td>2007</td>
<td>82</td>
<td>7</td>
<td>64</td>
<td>3.3</td>
<td>8</td>
<td>22</td>
<td>7.0</td>
</tr>
<tr>
<td>Melotti</td>
<td>2007</td>
<td>58</td>
<td>0</td>
<td>55</td>
<td>2.7</td>
<td>28</td>
<td>53</td>
<td>9.3</td>
</tr>
<tr>
<td>Pryor</td>
<td>2007</td>
<td>12</td>
<td>17</td>
<td>75</td>
<td>3.4</td>
<td>25</td>
<td>41</td>
<td>4.0</td>
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<tr>
<td>Pierce</td>
<td>2007</td>
<td>18</td>
<td>6</td>
<td>44</td>
<td>3.9</td>
<td>27</td>
<td>45</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Laparoscopic Distal Pancreatectomy for Pancreatic Adenocarcinoma


- 13 patients
  - Conversion 23%
  - Op time 310 ± 20 min
  - EBL 720 ± 450 ml
  - Morbidity 23%
  - Size 5 cm (3 -6cm)
  - Lymph Node 14.5 + 3
  - Median survival 14 months
Pylorus Preserving Whipple
# Laparoscopic Pancreatic Resection

## Laparoscopic Pancreaticoduodenectomy

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Conv (%)</th>
<th>Lap Recon</th>
<th>Op Time (Min)</th>
<th>Comp (%)</th>
<th>LOS (days)</th>
<th>Panc Can</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gagner</td>
<td>1997</td>
<td>10</td>
<td>40</td>
<td>6</td>
<td>510</td>
<td>30</td>
<td>22.3</td>
<td>4</td>
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<tr>
<td>Staudacher</td>
<td>2005</td>
<td>7</td>
<td>43</td>
<td>0</td>
<td>416</td>
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<td>1</td>
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<td>Dulucq</td>
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<td>25</td>
<td>12</td>
<td>13</td>
<td>287</td>
<td>32</td>
<td>16.2</td>
<td>11</td>
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<td>Palanivelu</td>
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<td>42</td>
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<td>42</td>
<td>370</td>
<td>31</td>
<td>10.1</td>
<td>9</td>
</tr>
<tr>
<td>Pugliese</td>
<td>2008</td>
<td>19</td>
<td>31</td>
<td>6</td>
<td>461</td>
<td>37</td>
<td>18</td>
<td>11</td>
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</tbody>
</table>
Laparoscopic Pancreatecoduodenectomy

Potential Limitations

• Non-obese patients
• Minimal comorbidities
• Small tumors (< 3 cm)
  – Ampullary, distal bile duct cancers
• No evidence of vascular involvement
• No lymph node involvement
• No inflammation
Laparoscopic Pancreatic Surgery

- Can it be accomplished safely?
- What are the indications?
- Who should be doing it?
- Which procedures should we be doing?
- What is the volume-outcome relationship?
- Should we be treating adenocarcinoma?