Acute Care Surgery: Diverticulitis

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Modern Treatment of Diverticular Disease

- Increasing use of nonoperative treatments for diverticular abscesses
- Resection and primary anastomosis during emergency surgery for complicated diverticulitis
- Laparoscopic approach/ Hand Assist
- Better knowledge of the natural history of the disease

Natural History of Acute Diverticulitis

- Most episodes of acute diverticulitis are non-complicated
- Complicated attacks requiring emergency surgery are often the first manifestation of the disease
- The risk of recurrence after complicated and non-complicated attacks is lower than previously estimated
- The type of attack tends to repeat itself in the same individual

Optimal Nonoperative Treatment: CT? Admission?

Mizuki et al APT 2005
- 70 pts evaluated by ultrasound alone
- Hinchey I or II
- All given po 3d generation cephalosporin
- Sports drink for 3 days, if worse-admit
- All liquids for 7 days, if worse-admit
- 68/70 tolerated this regimen
- CT, IV antibiotics and Admission were not required for majority of patients
- Cost <20% of conventional inpatient care
Optimal Nonoperative Treatment: Antibiotics?

  - 317 patients with CT documented diverticulitis
  - Antibiotics given at discretion of surgeon
  - No Abx group had lower temp, WBC, CRP and milder CT findings
  - 186/193 patients resolved symptoms without antibiotics
  - Diverticulitis may be a self-limiting disease process

Optimal Nonoperative Treatment: IR Drainage?

- 15-20% of patients present with abscess
- Criteria for drainage is debated >2,3,4,5 cm?
  - 30/181 (17%) patients with diverticular abscess
  - 73% were abscesses <3cm and resolved with abx
  - 26% were >= 3 cm and only 50% resolved with abx
- Differentiate pelvic vs. mesocolic abscess
  - 76/465 (17%) pts with diverticular abscess
  - 28 pelvic abscess, 45 mesocolic abscess
  - Followed for median of 43 months
  - More likely to require surgery if pelvic abscess or mesocolic abscess >5cm
  - Those drained had better outcomes
  - IR drainage of all pelvic abscesses and mesocolic abscesses >5cm with elective colectomy

When to operate?

**Emergency**
- Free Perforation
- Diffuse Peritonitis
- Complete Colonic Obstruction

**Relative emergency**
- Fail medical therapy
- Recurrence in the same admission
- Partial colonic obstruction
- Immunocompromised patients
- Unable to rule out carcinoma

Risk of emergency surgery/colostomy

- Anaya, Flum Arch Surg 2005
- Ritz et al Surgery 2010
Treatment of Acute Diverticulitis

H&P - CT

"Fat Stranding" Partial Obstruction
Abscess (Hinchey I & II)
Complete Obstruction or Perforation (Hinchey III & IV)

Bowel rest Antibiotics
Bowel rest Antibiotics IR drainage

Improvement
No Improvement
Surgery Same Admission

Follow-up
Elective Surgery?

Surgical Goals in Complicated Diverticulitis

Removal of diseased colon
Elimination of complications (i.e. abscess/fistula)
Expeditious operation
Minimal morbidity
Minimal hospital stay
Maximal patient survival

Emergent Surgery for Diverticulitis

Significant morbidity or mortality from unresected pathology (first stage) or at time of colostomy closure
“Temporary” stoma becomes permanent
RCT of Primary vs. Secondary Resection

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Primary Resection (n=56)</th>
<th>Secondary Resection (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral colectomy only</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>Resection and unanastomosis</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Protected</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Not protected</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Hartmann procedure</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>Early resection</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Death</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Early</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Late</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Postoperative peritonitis</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Generalized</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Colonic</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Wound complications*</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>
| Median (range) preoperative duration of hospital stay (days) | 15 (1–155) | 24 (2–76) |}

Zeitoun, G. BJS 2000

Emergent Surgery for Diverticulitis

Two Stage

1- Resection + stoma
   Hartmann’s procedure
   Primary anastomosis + diverting stoma

2- Takedown stoma
   (Open/Laparoscopic)

Two Stage

- Emergent Laparoscopic Drainage/Lavage
- Elective colectomy (or NOT?)

Hartmann Procedure

Mayo Clinic
N = 132 patients
1983 - 1999

<table>
<thead>
<tr>
<th>Hinchey Classification</th>
<th>N (Percentage)</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinchey II</td>
<td>44 (32%)</td>
<td>2%</td>
</tr>
<tr>
<td>Hinchey III</td>
<td>64 (46%)</td>
<td>12%</td>
</tr>
<tr>
<td>Hinchey IV</td>
<td>30 (22%)</td>
<td>13%</td>
</tr>
</tbody>
</table>

### Results of Hartmann’s Procedure

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>Permanent</th>
</tr>
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<tbody>
<tr>
<td>Berry</td>
<td>1989</td>
<td>28%</td>
<td>69%</td>
<td>33%</td>
</tr>
<tr>
<td>Peoples</td>
<td>1990</td>
<td>19%</td>
<td>27%</td>
<td>-</td>
</tr>
<tr>
<td>Keck</td>
<td>1994</td>
<td>15%</td>
<td>26%</td>
<td>-</td>
</tr>
<tr>
<td>Wedell</td>
<td>1997</td>
<td>22%</td>
<td>26%</td>
<td>31%</td>
</tr>
<tr>
<td>Blair</td>
<td>2002</td>
<td>13%</td>
<td>28%</td>
<td>30%</td>
</tr>
<tr>
<td>Regenet</td>
<td>2003</td>
<td>12%</td>
<td>23%</td>
<td>31%</td>
</tr>
<tr>
<td>Salem</td>
<td>2004</td>
<td>19%</td>
<td>24%</td>
<td>-</td>
</tr>
<tr>
<td>Dumont</td>
<td>2005</td>
<td>14%</td>
<td>50%</td>
<td>23%</td>
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</table>

### Results of Hartmann’s Closure

<table>
<thead>
<tr>
<th>Author</th>
<th>#</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>Leak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keck</td>
<td>40</td>
<td>2%</td>
<td>26%</td>
<td>4%</td>
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<tr>
<td>Wigmore</td>
<td>178</td>
<td>0.6%</td>
<td>35%</td>
<td>4%</td>
</tr>
<tr>
<td>Isbister</td>
<td>41</td>
<td>2.5%</td>
<td>22%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Douglas</td>
<td>46</td>
<td>2%</td>
<td>24%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Darius</td>
<td>98</td>
<td>0</td>
<td>24%</td>
<td>3%</td>
</tr>
<tr>
<td>Regenet</td>
<td>20</td>
<td>0</td>
<td>24%</td>
<td>7%</td>
</tr>
<tr>
<td>Salem</td>
<td>787</td>
<td>0.8%</td>
<td>4.5%</td>
<td>4.3%</td>
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<tr>
<td>Aydin</td>
<td>121</td>
<td>1.7%</td>
<td>49%</td>
<td>3.3%</td>
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</table>

### Permanent Colostomy?

- California inpatient file in 1995
  - 11,582 patients admitted with diverticulitis
  - 24% had surgery
  - 42% of these patients had a Hartmann
  - More likely to be older and male
- Ostomy reversal 65%
- 26% Men and 44% Women remain with stoma at 4 yr follow up

Maggard, M et al. Am Surg 2004

### Reconstruction after Hartmann

Systematic Review

<table>
<thead>
<tr>
<th>Author, year</th>
<th>N</th>
<th>Conversion</th>
<th>Laparoscopy</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>Success</th>
<th>Secondary resection</th>
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<tbody>
<tr>
<td>O’Hallahan, 1996</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Soulen, 1997</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>Gagner, 1996</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td></td>
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<tr>
<td>Hinchey, 1997</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Garcea, 2007</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
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<tr>
<td>Beno, 2008</td>
<td>92</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>80</td>
<td></td>
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<tr>
<td>Faranda, 2008</td>
<td>48</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td></td>
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<tr>
<td>Hinchey, 2008a</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hinchey, 2008b</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td></td>
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<tr>
<td>Total</td>
<td>231</td>
<td>1</td>
<td>10</td>
<td>21</td>
<td>6</td>
<td>87</td>
<td></td>
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</table>

*US: 1 prospective cohort series, 9 retrospective reviews, 2 case reports

Toorenvliet et al Colorectal Disease 2010

A Ten-Year Audit of Perforated Sigmoid Diverticulitis: Highlighting the Outcomes of Laparoscopic Lavage

- 8/35 failed in hospital and required resection
- 4/35 had an additional laparoscopic washout
- 8/27 successes needed subsequent resection due to recurrence
- 8/27 had elective resections before symptoms could recur
- 12/35 were symptom free after a period of 6-60 mo
Treatment of Complicated Diverticulitis

H&P - CT

"Fat Stranding" Partial Obstruction

Abscess Hinchey I & II

Complete Obstruction or Perforation (Hinchey III & IV)

Bowel rest Antibiotics

Bowel rest Antibiotics IR drainage

Improvement

No Improvement

Surgery Same Admission

Follow-up

Elective Surgery?

Emergent Surgery for Diverticulitis

One Stage

– Resection + primary anastomosis
– +/-On table lavage
– Open/ Laparoscopic

Factors that increase the risk of anastomotic leak

LOCAL

• Peritoneal contamination
• Colon full of feces
• Bowel inflammation
• Quality of the tissue

SYSTEMIC

• Hemodynamic instability
• Malnutrition
• Immunosuppression

OTHER

• Experience of the surgical team
Contraindications to Primary Anastomosis

**ABSOLUTE**
- Hemodynamic instability
- Fecal peritonitis
- Ischemia or edema
- Immunosuppression
- Radiation

**RELATIVE**
- Unprepared colon
- Technical issues
- Chronic abscess
- Anemia and malnutrition
- Judgment of surgeon

Intraoperative Washout

Primary Anastomosis and Colonic Lavage

- **Leahy Clinic**
  - 33/62 pts with nonelective operations for diverticulitis had intraoperative colonic lavage
  - for obstruction, abscess/phlegmon, perforation
  - no Hinchey IV
  - Mortality 3%
  - Morbidity 42% (leak 3%, wound infection 18%)

- **France**
  - 27/60 pts with nonelective operations for diverticulitis had intraoperative colonic lavage
  - Hinchey III and IV
  - Mortality 11%
  - Morbidity 30% (leak 9%, wound infection 12%)

Is the colonic lavage really necessary? Even in elective cases with no bowel prep, enemas or intraop irrigation are done

Proximal extent: soft bowel, may have diverticula
Distal extent: **Proximal rectum** removing all of the distal sigmoid and rectosigmoid junction, mobilization of splenic flexure for a tension free anastomosis

Redundant Sigmoid

Postoperative Straightening of Colon
### Resection and Primary Anastomosis

<table>
<thead>
<tr>
<th>Author</th>
<th>#</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>Leak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen 1993</td>
<td>15</td>
<td>6.7%</td>
<td>40%</td>
<td>3%</td>
</tr>
<tr>
<td>Nespoli 1993</td>
<td>81</td>
<td>6%</td>
<td>-</td>
<td>9%</td>
</tr>
<tr>
<td>Lee 1997</td>
<td>33</td>
<td>3%</td>
<td>42%</td>
<td>3%</td>
</tr>
<tr>
<td>Biondo 2001</td>
<td>55</td>
<td>7.2%</td>
<td>45%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Blair 2002</td>
<td>33</td>
<td>9.1%</td>
<td>25%</td>
<td>3%</td>
</tr>
<tr>
<td>Zorcolo 2003</td>
<td>176</td>
<td>5.7%</td>
<td>-</td>
<td>5.1%</td>
</tr>
<tr>
<td>Regenet 2003</td>
<td>27</td>
<td>11%</td>
<td>29%</td>
<td>11%</td>
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</table>

### Primary Anastomosis vs. Hartmann (Hinchey III & IV)

**Current Status**


<table>
<thead>
<tr>
<th>Series</th>
<th>#</th>
<th>Mortality</th>
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</thead>
<tbody>
<tr>
<td>Hartmann</td>
<td>54</td>
<td>1051 19%</td>
</tr>
<tr>
<td>Primary Anastomosis</td>
<td>50</td>
<td>569 10%</td>
</tr>
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</table>


### Laparoscopic Surgery for Diverticular Disease

<table>
<thead>
<tr>
<th>Author</th>
<th>Patients</th>
<th>Morbidity</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bouillot, 1998</td>
<td>50</td>
<td>14 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Stevenson, 1998</td>
<td>100</td>
<td>21 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Bergamaschi, 1998</td>
<td>40</td>
<td>5 %</td>
<td>-</td>
</tr>
<tr>
<td>Köckerling, 1999</td>
<td>304</td>
<td>17 %</td>
<td>1.1 %</td>
</tr>
<tr>
<td>Vargas, 2000</td>
<td>69</td>
<td>10 %</td>
<td>-</td>
</tr>
<tr>
<td>Trebuchet, 2002</td>
<td>170</td>
<td>8 %</td>
<td>0 %</td>
</tr>
<tr>
<td>González, 2004</td>
<td>95</td>
<td>19 %</td>
<td>1 %</td>
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</table>

### Laparoscopic Surgery for Complicated Diverticulitis

<table>
<thead>
<tr>
<th># cases (N=192)</th>
<th>N</th>
<th>Complicated diverticulitis</th>
<th>Conversion rate</th>
<th>Morbidity</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>37</td>
<td>8%</td>
<td>7.7%</td>
<td>18.6%</td>
<td>0.4%</td>
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<td>30-100</td>
<td>50</td>
<td>9%</td>
<td>6.7%</td>
<td>16.6%</td>
<td>0.5%</td>
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<tr>
<td>&gt;100</td>
<td>105</td>
<td>21%</td>
<td>4.4%</td>
<td>15.9%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

Scheidbach et al DCR 2004
Increasing use of Laparoscopy

Stamos et al Arch Surg 2010

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"Fat Stranding" Partial Obstruction

Abscess Hinchey I & II

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