Acute Care Surgery: Diverticulitis

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Section of Colorectal Surgery
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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

**Elective**
- Multiple episodes
- Strictures, Fistulas
- Comorbidities

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
  - Bowel rest
  - Antibiotics
  - Improvement
  - Follow-up
  - Elective Surgery?
- Abscess Hinchey I & II
  - Bowel rest
  - Antibiotics
  - IR drainage
  - No Improvement
- Complete Obstruction or Perforation (Hinchey III & IV)
  - Surgery
  - Same Admission

PERFORATED DIVERTICULAR DISEASE
Recommended Therapy

Stage III
1. Primary Resection without Anastomosis
2. Occasionally Anastomosis If Criteria Met

Stage IV
- Feces
- Perforation or Exteriorization Mandatory
- No Anastomosis

Fluid collections
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

Three Stage
1- Diversion
2- Resection
3- Restoration of bowel continuity

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>First procedure</th>
<th>Primary resection (n=55)</th>
<th>Secondary resection (n=46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral colostomy only</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>Resection and anastomosis</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 reoperation</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

Death
- Early: 15
- Late: 9

Preoperative peritonitis
- Generalized: 1
- Localized: 0

Wound complications:
- Elective: 13

Median (range) postoperative duration of hospital stay (days): 15 (1–150) vs. 24 (2–78)

Zeitoun, G. BJS 2000

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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

Predictors of perioperative mortality
• Sepsis (relative risk 18.9)
• ≥ 2 co-morbid conditions (relative risk 8.3)
• Obstruction
• Steroids
• Age > 70 years

<table>
<thead>
<tr>
<th>N</th>
<th>Mortality</th>
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</thead>
<tbody>
<tr>
<td>Hinchey II</td>
<td>44 (32 %)</td>
</tr>
<tr>
<td>Hinchey III</td>
<td>64 (46 %)</td>
</tr>
<tr>
<td>Hinchey IV</td>
<td>30 (22 %)</td>
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</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>
</thead>
<tbody>
<tr>
<td>Salem</td>
<td>2004</td>
<td>19%</td>
<td>24%</td>
<td>-</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>Salem 04</td>
<td>787</td>
<td>0.8%</td>
<td>4.5%</td>
<td>4.3%</td>
</tr>
</tbody>
</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

Washington, 1987-2002

% 87% 32%

Age

Mortality of Hartmann's Take-Down
Washington, 1987-2002

Laparoscopic Approach to Hinchey III and IV

- Emergency laparoscopy
- Peritoneal lavage (15L)
- Adhesions left untouch
- "Glue" of the perforation
- Drain
- Antibiotics (7 days)
- Bowel rest
- Delayed elective resection

Faranda et al, Sur Laparosc Endosc Tech, 2000
Da Rold et al, Chir Ital, 2004
Mutter et al, Colorectal Dis, 2006
Table 3  Pooled outcome data for laparoscopic peritonal lavage in 231 patients.

<table>
<thead>
<tr>
<th>Author, year</th>
<th>N</th>
<th>Conversion to</th>
<th>Laparotomy failure</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>Stoma</th>
<th>Secondary resection</th>
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<tbody>
<tr>
<td>O'Sullivane, 1996</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Avand, 1997</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Faranda, 2000</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>De Kold, 2004</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Taylor, 2006</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Murer, 2000</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Guillevic, 2007</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lieps, 2007</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Myers, 2008</td>
<td>92</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Franklin, 2008</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Janor, 2008</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Berganug, 2008</td>
<td>24</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Faranz, 2009</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>231</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>24</td>
<td>4</td>
<td>87</td>
</tr>
</tbody>
</table>

Percentage |
| 0.4 | 4.3 | 1.7 | 10.4 | 1.7 | 37.7 |

*no major morbidity.

2 prospective cohort series
9 retrospective reviews
2 case reports

Toorennviet et al Colorectal Disease 2010

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

Stephen L. White, M.B.B.S., F.R.A.C.S.,1,2 Brett Frankel, B.B.Sc.,3
Peter J. Martin, M.B.B.S., F.R.A.C.S.1,2
1 Department of General Surgery, The Prince of Wales Hospital, Randwick, New South Wales, Australia
2 Department of General Surgery, John Hunter Hospital, Newcastle, New South Wales, Australia
3 Bond University, Gold Coast, Queensland, Australia

Table 1. Patient data on an intention-to-treat basis

<table>
<thead>
<tr>
<th>Laparoscopic lavage (n = 120)</th>
<th>Rejection (n = 80)</th>
<th>Total (n = 200)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range (years)</td>
<td>65-86 (55)</td>
<td>52-69 (76)</td>
<td>65-86 (55)</td>
</tr>
<tr>
<td>Male patients</td>
<td>115 (96%)</td>
<td>76 (95%)</td>
<td>191 (96%)</td>
</tr>
<tr>
<td>History of perforation</td>
<td>6 (5%)</td>
<td>8 (10%)</td>
<td>14 (7%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>68-74 (68)</td>
<td>65-78 (76)</td>
<td>68-78 (74)</td>
</tr>
<tr>
<td>Male patients</td>
<td>71 (94%)</td>
<td>53 (94%)</td>
<td>124 (94%)</td>
</tr>
<tr>
<td>Complications</td>
<td>0</td>
<td>5 (6%)</td>
<td>5 (3%)</td>
</tr>
</tbody>
</table>

Note: numbers include cases of postoperative drainage.

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 reoccur
12/35 were symptom free after a period of 6-60mo

DCR Nov 2010
Treatment of Complicated Diverticulitis

H&P - CT

"Fat Stranding" Partial Obstruction

Bowel rest Antibiotics

Improvement

Follow-up

Elective Surgery?

Abscess Hinchey I & II

Bowel rest Antibiotics IR drainage

No Improvement

Surgery Same Admission

Complete Obstruction or Perforation (Hinchey III & IV)
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

<table>
<thead>
<tr>
<th>ABSOLUTE</th>
<th>RELATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemodynamic instability</td>
<td>Unprepared colon</td>
</tr>
<tr>
<td>Fecal peritonitis</td>
<td>Technical issues</td>
</tr>
<tr>
<td>Ischemia or edema</td>
<td>Chronic abscess</td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>Anemia and malnutrition</td>
</tr>
<tr>
<td>Radiation</td>
<td>Judgment of surgeon</td>
</tr>
</tbody>
</table>

## Intraoperative Washout

- Cecum
- Ileum
- Appendix
- OR
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%)

Lee et al. DCR 1997

Regenet et al Int J Colorect Dis 2003

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</td>
<td>15</td>
<td>6.7%</td>
<td>40%</td>
<td>3%</td>
</tr>
<tr>
<td>Nespoli</td>
<td>81</td>
<td></td>
<td>6%</td>
<td>-</td>
</tr>
<tr>
<td>Lee</td>
<td>33</td>
<td>3%</td>
<td>42%</td>
<td>3%</td>
</tr>
<tr>
<td>Biondo</td>
<td>55</td>
<td>7.2%</td>
<td>45%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Blair</td>
<td>33</td>
<td>9.1%</td>
<td>25%</td>
<td>3%</td>
</tr>
<tr>
<td>Zorcolo</td>
<td>176</td>
<td>5.7%</td>
<td>-</td>
<td>5.1%</td>
</tr>
<tr>
<td>Regenet</td>
<td>27</td>
<td>11%</td>
<td>29%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Primary Anastomosis vs. Hartmann (Hinchey III & IV)

Current Status

Literature search - 98 series - Hinchey III & IV
1957 – 2003

<table>
<thead>
<tr>
<th>Series</th>
<th>#</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartmann</td>
<td>54</td>
<td>1051</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19% (0-100)</td>
</tr>
<tr>
<td>Primary Anastomosis</td>
<td>50</td>
<td>569</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% (0-75)</td>
</tr>
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</table>

### Laparoscopic Surgery for Diverticular Disease

<table>
<thead>
<tr>
<th></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>
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<td>Köckerling, 1999</td>
<td>304</td>
<td>17 %</td>
<td>1.1 %</td>
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<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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### 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>
</tr>
<tr>
<td>30-100</td>
<td>50</td>
<td>9%</td>
<td>6.7%</td>
<td>16.6%</td>
<td>0.5%</td>
</tr>
<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

![Graph showing increasing use of laparoscopy over years.](image)

Stamos et al Arch Surg 2010

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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
  - IR drainage

- **Improvement**
  - Follow-up
  - Elective Surgery?

- **No Improvement**
  - Surgery Same Admission

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19