Changing Concepts in the Surgical Management of Perforated Sigmoid Diverticular Disease

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مرحبا بكم
Disclosures

None

Diverticulitis

- 298,000 admissions/yr – US
- 5th most expensive GI disease
- 1.5 million inpt days/yr
  http://hcupnet.ahrq.gov
- 1/3 of colectomies and colostomies in the US
  – Salem et al J Surg Research 2005
### Many Controversies Still Surround the Management of Sigmoid Diverticulitis

1. Indications for percutaneous management of localized diverticulitis
2. Indications for surgical resection after successful percutaneous management
3. Numbers of episodes of uncomplicated diverticulitis needed to warrant elective resection
4. Surgical options for the management of complicated diverticulitis, open vs laparoscopic, Hartmann vs primary anastomosis?
5. Role of laparoscopic wash-out for diverticulitis

### Inflammatory Complications

- Peritonitis
  - Local, general
- Free perforation
- Fistula
- Fibrosis (obstruction)
Hinchey Classification of Complicated Diverticulitis

Nomenclature/Grading

- Hinchey
- Ambrosetti
- Complicated vs. uncomplicated
Ambrosetti CT Classification of Diverticulitis

Patrick Ambrosetti, MD
Consultant Surgeon
University Hospital of Geneva
Geneva, Switzerland

Ambrosetti CT Classification of Diverticulitis

<table>
<thead>
<tr>
<th>Moderate Diverticulitis</th>
<th>Severe Diverticulitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localized thickening of colonic wall ≥ 5mm</td>
<td>Moderate findings PLUS</td>
</tr>
<tr>
<td>Signs of inflammation in pericolonic fat</td>
<td>Abscess +/- extraluminal air +/- contrast extravasation</td>
</tr>
</tbody>
</table>

Ambrosetti CT Classification of Diverticulitis

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<tr>
<td><img src="552.0x732.0" alt="Image" /></td>
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</table>

Horton et al, RSNA 2000

Phlegmon versus Abscess on CT

<table>
<thead>
<tr>
<th>Phlegmon</th>
<th>Pelvic Abscess</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="552.0x732.0" alt="Image" /></td>
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</tr>
</tbody>
</table>

Classification Acute Diverticulitis
Modified Hinchey

Hinchey 0
Uncomplicated diverticulitis
(clinical diagnosis)

Hinchey I
Ia phlegmon
Ib pericolic abscess
< 5 cm

Hinchey III
Purulent peritonitis

Hinchey II
II pelvic, intra-abdominal or retroperitoneal abscess

Hinchey IV
Fecal Peritonitis

Modified Hinchey Classification of Diverticulitis

• Includes the spectrum of diverticulitis
  – Uncomplicated
  – Complicated
• Differentiates phlegmon from pericolic abscess
• Useful classification for management and clinical reporting
Evolving Practice Patterns

- Population based retrospective cohort study
  Ontario
- Emergency admission 2002 - 2012

**Diverticulitis – Role of Antibiotics**

- Perforation vs. inflammation?
- Retrospective audit - inpatients
- 118 pts with antibiotics vs. 193 patients without
- 3% with antibiotics require operation and 4% without are subsequently given antibiotics
- Future events 29% with versus 28% without

*Hjern Scand J Gastro 2007:42;41-47*
Medical Treatment of Acute Diverticulitis

- 623 patients
- CT confirmed uncomplicated left sided diverticulitis
- IV fluids vs. IV fluids and antibiotics

**RESULTS**

Antibiotics **did not**:
- Prevent complications
- Accelerate recovery
- Prevent recurrences


Antibiotics vs. Observation for Hinchey 1a - 1b (non-inferiority design)

**Primary endpoint** - time-to-recovery (n=570)

**Full recovery criteria** - patient diary
- Outpatient
- Normal diet: solid food + min. 1 L fluid orally
- T < 38° C
- VAS < 4 (without extra pain medication)
- Resuming to pre-illness (working) activities

Daniels L et al. Submitted
Uncomplicated Diverticulitis Antibiotics?

- 2 RCTs comparing antibiotics with no antibiotics
  - AVOD Study Group (623 patients, 1a): Antibiotic therapy does not prevent surgical complications or recurrence and does not shorten hospital stay
  - DIABOLO (570 patients, 1a-b): a.b. can be omitted without short and long term repercussions

Practice Parameters 2014 American Society of Colon & Rectal Surgeons

Non-operative treatment typically includes oral or intravenous antibiotics and diet modification.

Grade of Recommendation:
Strong recommendation based on low-quality evidence
## Antibiotic Choice and Length of Therapy

<table>
<thead>
<tr>
<th>Intravenous:</th>
<th>Oral:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin – Tazabactam</td>
<td>Ciprofloxacin/Levofloxacin</td>
</tr>
<tr>
<td>Carbapenems</td>
<td>Metronidazole</td>
</tr>
<tr>
<td><em>3rd Generation Cephalosporins</em></td>
<td></td>
</tr>
</tbody>
</table>

Length of antibiotic therapy – arbitrary no guidelines exist

Can safely stop once symptoms resolved

## Antibiotics vs. Supportive Care

- The jury is still out

- ASCRS Practice Parameters:
  “Future research is required before adopting an antibiotic-free treatment strategy”.

  DCR-2014; 57:284-294
132 pts randomized after CT diagnosis
- One shot iv ab
- Lower costs (€ > 1100)
- Failure 5% (similar)

**Acute Management**

- The acute management of uncomplicated diverticulitis is non-operative
  - > 95% Success Rate
- No reasonable argument for primary surgical intervention in the 21st century
- The current focus is on where to treat, how to treat and how long
Where to Treat

Traditional Approach:
- Inpatient
- IV Fluids
- IV Antibiotics

Outpatient Therapy:
- Diet as tolerated
- Oral Antibiotics
- Success Rate 94-97%
- Cost Savings 35-83%

DCR – 2010
Ann. Surg 2014

Inpatient Admission

- Dehydration and per oral intolerance
- Need for serial exams
- Frailty
- Lack of support at home

DCR 2010: 53;861-65
Ann. Surg 2014; 29;38-44
Uncomplicated & Hinchey 1a Diverticulitis

**Conclusions**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Effect on disease outcome</th>
<th>Level of evidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-patient vs out-patient</td>
<td>No difference, out-patient cheaper</td>
<td>1b</td>
</tr>
<tr>
<td>Diet restrictions</td>
<td>No difference, earlier recovery with full diet</td>
<td>2b</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>No difference, without antibiotics shorter stay</td>
<td>1a</td>
</tr>
</tbody>
</table>

* Criteria according to UK National Health Service

**Colonoscopy**

For those without a recent colon evaluation, the ASCRS guidelines still recommend colonoscopy 6 – 8 weeks after symptom resolution.
Follow-up Colonoscopy

Classic Teaching:
6 weeks after treatment

Now:
CT (16 & 32 slice) scans
94% Sensitivity
99% Specificity

European Rad
2008; 18:2498-2501

Management of Diverticulitis

Hinchey 0/la
- Conservative management
- Bowel rest
- Antibiotics

Hinchey Ib/II
- Antibiotics +/-
- Percutaneous drainage +/-
- Surgical Resection, immediate vs. delayed
- Laparoscopic Lavage

Hinchey III/IV
- Surgical management
- Open or laparoscopic
- Primary anastomosis vs staged resection
- Laparoscopic Lavage
**HINCHEY 1b**

- Small abscesses can be treated with antibiotics (Level of Evidence 2b & Consensus)
- DIABOLO study: small abscesses might not need antibiotics

Vennix et al. CRD 2015
Brandt D et al. DCR 2006
Kumar RR et al. DCR 2006
Ambrosetti P et al. DCR 2005

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**Diverticulitis With Extraluminal Air Can Be Treated With Antibiotics and Drainage in Select Cases**

- Costi et al. Surg Endosc 2012
  - hemodynamically stable with free air with no diffuse extravasation (2001-2010)
  - CT with iv & rectal contrast
  - 36/39 (92% success)

- Sallinen et al. CRD 2014
  - Local peritonitis with free air n=132
  - Pericolic air (99% success), small amount distant air and no fluids, no peritonitis (86% success)
Acute Diverticulitis
HINCHLEY II

- **Large abscesses:** percutaneous drainage and antibiotics (Level of Evidence 2b & Consensus)

- **Pelvic abscesses:** more aggressive therapy compared to mesocolic abscesses with percutaneous drainage and elective surgery (Level of Evidence 2b & no consensus)

Ambrosetti P et al. DCR 1992
Ambrosetti P et al. DCR 2005
Vennix et al CRD 2014

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Percutaneous Drainage versus Antibiotics Depends on Abscess Size

<table>
<thead>
<tr>
<th>Study</th>
<th>Average abscess size amenable to antibiotic treatment alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brandt et al, DCR 2006</td>
<td>4cm</td>
</tr>
<tr>
<td>Siewart et al, Am J Roent 2006</td>
<td>3cm</td>
</tr>
<tr>
<td>Kumar et al, DCR 2006</td>
<td>4cm</td>
</tr>
</tbody>
</table>
Indications for Percutaneous Drainage in Sigmoid Diverticulitis

- Modified Hinchey Ib/II
  - Pericolic abscess
  - Pelvic abscess
- Amenable to drainage
- Greater than 4cm in size
  (average size of abscesses amenable to percutaneous drainage is >6cm)

Contraindications to Percutaneous Drainage

- Abscess inaccessible
- Inappropriate pathology (Hinchey Ia/phlegmon)
- Clinical status requiring emergent surgery
- Coagulopathy
- Relative:
  - Loculated abscess, lower drainage success rate
### Complications of Percutaneous Drainage

- 5% in most series
  - Bleeding
  - Perforation of viscus
  - Solid organ injury
  - Fistulization

### Perforated Sigmoid Diverticular Disease

**Percutaneous Drainage – Questions**

- How long should drain be left in place?
- Is a fistulagram necessary before removal?
- At what stage is a contrast study indicated?
- At what stage is endoscopy indicated?
- Is surgery mandatory after successful drainage?
Fistulagram

Demonstrates persistent fistula

Duration of Percutaneous Drainage

- Evidence of clinical improvement
- Minimal drainage
- Fistulagram demonstrates
  - Obliteration of abscess cavity
  - No evidence of persistent fistula to bowel lumen
Perforated Sigmoid Diverticular Disease

What should be done after successful percutaneous drainage of a diverticular abscess?
Indications for Surgery after Percutaneous Drainage

• **Definite Indications**
  – Lack of clinical improvement
  – Abscess rupture, conversion to diffuse peritonitis
  – Fistula formation
  – Stricture
  – Inability to exclude carcinoma
  – Immunocompromised status

• **Controversial Indication**
  – After successful remission following percutaneous drainage

Practice Parameters 2007
American Society of Colon & Rectal Surgeons

Indications for Surgery after Percutaneous Drainage

• ASCRS recommendation (2007) is to advise elective colon resection if an episode of complicated diverticulitis is settled conservatively
  – Rationale quoted is a reported 41% risk of recurrent severe sepsis
  – Kaiser et al, Am J Gastroenterol 2005
The decision to recommend elective sigmoid colectomy after recovery from uncomplicated acute diverticulitis should be individualized.

**Grade of Recommendation:**
Strong recommendation based on moderate-quality evidence

**Sigmoid Diverticulitis**

What is the appropriate treatment for the patient < 40 years old with symptomatic sigmoid diverticulitis?
Sigmoid Diverticulitis

Patient < 40 Years of Age

- More virulent disease
- Recurrent inflammatory episodes
- Propensity for serious complications

Ouriel & Schwartz: Surg Gynecol Obstet 1983;15

Diverticulitis in Young Patients

"Virulent Disease"
- "Next Time You Will Perforate"
- Recurrent episodes
- Doesn’t respond as well to antibiotics

"Aggressive Approach Needed"
- Operate routinely after first episode
Practice Parameters 2000
American Society of Colon & Rectal Surgeons

“Resection should be performed in young patients after a single attack of diverticulitis”
– Viewed as a specific entity
– “more virulent course”
  » ASCRS practice parameters 2000

Grade of Recommendation:
Strong recommendation based on moderate-quality evidence.

Sigmoid Diverticulitis

University of Vermont Experience

• 762 patients with Sigmoid Diverticulitis
• Mean follow-up 5.2 years
• Compare <50 years (Group 1) to >50 years (Group 2)

-Guzzo et al, DCR 2003
5/29/2017

**Sigmoid Diverticulitis**

Results: University of Vermont

762 Patients

259 Group 1 (34%)  503 Group 2 (66%)

238 (31%) underwent surgery

-Guzzo et al DCR 2003

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**Sigmoid Diverticulitis**

Results: University of Vermont

- Risk of Surgery on initial presentation ~ same
  
  (24% vs. 22%, p=0.8)

- Group 1 (<50) patients more likely to undergo elective resection
  
  (40% vs.26%, p=0.001)

-Guzzo et al DCR 2003
Sigmoid Diverticulitis

University of Vermont (<50)

- 259 Patients
  - 63 Immediate Surgery
  - 196 Patients Medically Managed
    - 155 no surgery
    - 41 later surgery

-Guzzo et al 2003

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Sigmoid Diverticulitis

University of Vermont (<50)

- Only 1/41 with perforation

** 1/196 patients <50 years medically managed return with perforation (0.5%)**

-Guzzo et al 2003
Sigmoid Diverticulitis

- Risk of Diverticular perforation in medically managed young patients is very low.

- ? Need for “routine” resection after a single attack in young patients.

- Guzzo et al 2003

Sigmoid Diverticulitis

Recommendation

- Do not necessarily treat young patients differently
- Advise surgery based on ongoing symptoms rather than risk of perforation

- Guzzo et al 2003
Routine elective resection based on young age (<50 years) is no longer recommended.

Grade of Recommendation:
Strong recommendation based on low-quality evidence

Management of Diverticulitis

- When to operate
- When to resect
- When to anastomose
Sigmoid Diverticulitis

Clinical Assessment
- WBC + Differential
- Abdominal X-rays
- CT Scan

Acute Diverticulitis

Major Symptoms
- Diffuse Peritonitis
- IV Resuscitation
- Antibiotics
- Emergency
- Laparotomy

Major Symptoms
- Localized Peritonitis
- NPO IV
- Fluids
- Antibiotics

Moderate Symptoms and Signs
- NPO IV Fluids
- Antibiotics
- No Improvement
- Improved
- Urgent
- Follow-up
- Confirmatory Colon Study
- Repeat CT Scan of Abd/Pelvis

Mild Symptoms and Signs
- Outpatient Oral Antibiotics
- Low Residue Diet
- No Improvement

Acute Diverticulitis

Urgent Surgery

- Indications
  - Acute deterioration
  - Non-resolving symptoms

- Options
  - Hartmann’s resection
  - Primary colorectal anastomosis with protecting stoma
  - Primary unprotected colorectal anastomosis
  - Laparoscopic peritoneal lavage and drainage
Urgent sigmoid colectomy is required for patients with diffuse peritonitis or for those in whom nonoperative management of acute diverticulitis fails.

**Grade of Recommendation:**
Strong recommendation based on moderate-quality evidence

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“Rather than await the inevitable perforation with septic complications, once the patient has had two or more bouts... he should be advised to have an elective colectomy...”

W. O. Griffen, Jr., 1976
Sigmoid Diverticulitis

Kaiser Permanente Los Angeles

3165 Patients (Mean follow-up: 8.9 yrs)
Hospitalized with acute diverticulitis

614 Patients (19%)
Emergency Colectomy

185 Patients (7.3%)
Elective Colectomy

2336 Patients (92.7%)
Managed Conservatively

Broderick-Villa et al. Archives of Surgery 2005

Sigmoid Diverticulitis

2366 Pts managed conservatively 1st attack

2052 Patients (86.7%) Did not have a recurrence

314 Patients (13.3%) Recurred

222 Patients Did not have a second recurrence

92 Patients had a re-recurrence
All treated non-operatively

Broderick-Villa et al. Archives of Surgery 2005
### Conclusion

- Need for percutaneous drain placement did not increase recurrence risk
- Operative rate for entire group: 25%
- Younger patients had greater tendency to recur but were still managed *non-operatively* for all recurrences
- Elective resection is not recommended even after two episodes of diverticulitis

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“After recovering from an episode of diverticulitis, the risk of an individual requiring an urgent Hartmann’s procedure is one in 2000 patient-years of follow-up.”

“There is no evidence ... that elective surgery should follow two attacks of diverticulitis.”

Janes et al, Br J Surg; 2005; 92: 133
Acute Diverticulitis
Lesson Learned

No specific number of “attacks” mandates resection in most patients. Exceptions are key.

Is There a Subset of Patients More Likely to Perforate After a Single Attack?

- Immunosuppressed patients
- Chronic renal failure
- Collagen vascular disease
- 5 Fold increase in perforation

*Klarenbeek et al Ann Surg 2010*
**Immuno Compromised Patients**

- High rate of complicated disease **40%**
- High mortality for emergency surgery **19-23%**

- Most experts recommend a lower threshold for operative intervention during acute attack

- Elective resection may be appropriate after a single documented attack

**Does Uncomplicated Disease Progress to Complicated Disease?**

- 502 patients, 337 uncomplicated
  - Recurrence 19%, 5% complicated recurrence
    - *Eglinton Br J Surg 2010*

- 672 patients
  - Recurrence 36%, 4% complicated recurrence
    - *Hall Dis Colon Rectum 2011*
### Current Recommendations

- Focused less on number of attacks and more on severity of attacks
- Decision to operate is based on:
  - Severity of attacks
  - Frequency of attacks
  - Associated patient disability
- Smoldering disease
  - Lingering symptoms that don’t respond to medical therapy

### Conclusions - Who needs an operation?

- Patients who present with uncomplicated diverticulitis rarely develop complicated diverticulitis or free perforation.
- Colectomy after the first or second attack does not decrease the risk of emergency surgery or the need for fecal diversion.
- Focus on uncomplicated diverticulitis with high risk of recurrence (long segment of disease, family history and severe disease especially in young patients).
### Management of Diverticulitis

- When to operate
- When to resect
- When to anastomose

### Chronic Diverticulitis

- Stricture
  - Sub-acute obstruction
- Fistula
  - Colocutaneous
  - Colovesicle
  - Colovaginal
- Recurrence
Perforated Diverticular Disease
Basic Surgical Options

1. Three stage resection
2. Primary resection without anastomosis
3. Primary resection with anastomosis
4. Primary resection with anastomosis and diverting ileostomy
5. Laparoscopic washout
Perforated Diverticular Disease

“In those cases in which an abscess or perforation has developed, immediate colostomy well above the affected area is the best treatment”

H.E. Lockhart-Mummery
1928

Perforated Diverticular Disease
Surgical Options
Perforated Diverticular Disease

Nouvea procede d’ablation des cancers de la partie terminale du colon pelvien.

Hartmann’s Procedure

- Widely perceived as the ‘safe’ option
- Performed on patients with adverse features
  - Co-morbidities
  - Hinchey III & IV
- ~40% never closed
- Closure > 40% morbidity

Aydin et al, Dis Colon Rectum, 2005

Perforated Diverticular Disease

Recommended Therapy

Stage IV

Resection or Exteriorization Mandatory
No Anastomosis

Hinchec, Adv Sura, 1976
Management of Diverticulitis

- When to operate
- When to resect
- When to anastomose

When to Anastomose

- *for anastomosis* single stage “low risk” patients
- *against anastomosis* leak rate proximal stoma
Perforated Diverticular Disease

What is the current status of primary resection and anastomosis with diverting stoma?
Hartmann Procedure vs Primary Anastomosis

<table>
<thead>
<tr>
<th></th>
<th>Hartmann +reversal</th>
<th>Primary Anastomosis (+/-stoma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mortality</td>
<td>19.6%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Wound infection</td>
<td>29.1%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>4.3%</td>
<td>13.9%</td>
</tr>
</tbody>
</table>

Salem & Flum, DCR 2004: systematic review

Hartmann Procedure versus Primary Anastomosis: Systematic Review

• No difference among any study in:
  – Wound complications
  – Anastomotic leak

• Significant difference in:
  – ICU stay and expense
  – Overall length of stay
  – Operative time

Abbas, Int J Colorect Dis 2007
Hartmann Procedure vs Primary Anastomosis

- Hartmann procedure: risk of reversal complications, e.g. re-operation, ileus
- Resection with primary anastomosis: one-stage, risk of leak
- Many comparison studies, most retrospective
  - Hartmann Procedure patients usually greater degree of contamination (Hinchey IV), more comorbidities
  - Studies do not elucidate surgeon decision-making

Sigmoid Diverticulitis

**Laparotomy Findings**

- **Fecal Peritonitis**
- **Purulent Peritonitis**
- **Pelvic Abdominal Abscess**
- **Localized Mesenteric Abscess**
- **Clean Peritoneum**

First, resect diseased colon to proximal rectum in almost all cases

Hartmann’s

- Primary anastomosis with diverting ileostomy
  - Compromised
  - Uncompromised

Closed suction drainage of remaining abscess cavity

Assess condition of ends of colon

Primary anastomosis without diversion
**Sigmoid Diverticulitis**

**SURGICAL HINTS FOR MOBILIZATION**

- Modified lithotomy
- Ureteral stents, early ureteral identification
- Early transection of sigmoid colon
- Scoring of mesentery in preparation for vessel ligation
- Electrocautery dissection

**Perforated Sigmoid Diverticular Disease**

**Proximal Extent of Resection**

- Resect to soft bowel
- Diverticula may be present
- May require mobilization of the splenic flexure
Perforated Sigmoid Diverticular Disease

Distal Extent of Resection

Resect entire sigmoid colon down to normal rectum

Extended Proximal Colectomy (descending colon)

- Blood Supply Critical
- Left transverse colon may be preferred to preserving proximal descending colon near flexure with marginal flow
- Mobilize flexure, ligate inferior mesenteric vein, and base anastomosis on left branch of middle colic artery

DO NOT OPT FOR DISTAL SIGMOID!
Sigmoid Diverticulitis

ANASTOMOSIS?

Consider primary anastomosis if circumstances ideal

Handsewn versus Stapled
Sigmoid Diverticulitis

“It is the condition of the end of the bowel rather than the condition of the peritoneal cavity that determines the outcome of the anastomosis.”

E.G. Balcos, M.D.
Clinical Professor of Surgery
University of Minnesota

Practice Parameters 2014
American Society of Colon & Rectal Surgeons

Following resection, the decision to restore bowel continuity must incorporate patient factors, intraoperative factors, and surgeon preference.

Grade of Recommendation:
Strong recommendation based on low-quality evidence
Perforated Diverticular Disease

What is the current status of laparoscopic colectomy for perforated diverticular disease?
Improvement in Short-term Outcomes – Lap Resection

- **NSQIP data**
  - 3468 open versus 3502 lap sigmoid resection
  - Lower incidence of surgical site infections and sepsis
  
  *Russ et al Gastroenterology 2010;138:2267-74*

- **Prospective randomized trial lap versus open**
  - 54 pts (open) v. 59 pts (lap)
  - Lap sigmoid had 30% reduction in postop ileus and hospital stay

  *Gervaz et al Ann Surg 2010;252:3-8*

Hand assisted technique
Sigmoid Resection

- Straight laparoscopic v. Hand assisted
  - 85 patients – straight laparoscopic
  - 66 patients – hand assisted
- No difference in patient demographics, diagnosis, length of stay, return of bowel function, complications
- Conversions 0% (hand) v. 13% straight laparoscopic, p<0.01

Chang et al. Surg Endosc 2005

### Multicenter Prospective Randomized Hand-Assisted Laparoscopic Sigmoid Resection Compared to Straight Laparoscopic Resection

<table>
<thead>
<tr>
<th></th>
<th>Hand-Assisted (N=33)</th>
<th>Lap (N=33)</th>
<th>PValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op Time (Minutes)</td>
<td>175</td>
<td>208</td>
<td>0.02</td>
</tr>
<tr>
<td>Blood Loss (ML)</td>
<td>211</td>
<td>198</td>
<td>0.07</td>
</tr>
<tr>
<td>Incision Size (CM)</td>
<td>8.2</td>
<td>6.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Length of Stay (Days)</td>
<td>5.7</td>
<td>5.2</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Marcello et al. DCR 2008
When expertise is available, the laparoscopic approach to elective colectomy for diverticulitis is preferred.

**Grade of Recommendation:**
Strong recommendation based on high-quality evidence

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**Perforated Diverticular Disease**
Perforated Sigmoid Diverticular Disease

Is laparoscopic colostomy takedown reasonable after a Hartmann procedure?

LAPAROSCOPIC MANAGEMENT

• No description of removal of residual diverticular disease at time of reversal
• No proven reduction in cost
Laparoscopic Versus Open Reversal of Hartmann’s Procedure

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopic (N=43)</th>
<th>Open (N=64)</th>
<th>PValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op Time (Minutes)</td>
<td>276</td>
<td>242</td>
<td>0.02</td>
</tr>
<tr>
<td>Conversion to Open</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Stay (Days)</td>
<td>6.7</td>
<td>10.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Post-Op Complication</td>
<td>14%</td>
<td>31%</td>
<td>0.04</td>
</tr>
<tr>
<td>Anastomotic Leak</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Yang et al Anj Surg 84 2014

Perforated Diverticular Disease

LAPAROSCOPIC MANAGEMENT OF GENERALIZED PERITONITIS

• 8 Patients with purulent peritonitis
• Laparoscopic peritoneal lavage
• No other surgical intervention
• Antibiotics
• Hospital stay – 10 days
• Follow-up 12-48 months.

O’Sullivan et al AM. J. Surgery, April 1996
**Laparoscopic peritoneal lavage for generalized peritonitis due to perforated diverticulitis**

E. Myers, M. Hurley, G. C. O'Sullivan, D. Kavanagh, I. Wilson, and D. C. Winter

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- **Morbidity** = 4%
- **Mortality** = 4%
- **Hospital stay** = 8 days (7 - 19)
- **8% Conversion**
- **2% re-operation**

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**Laparoscopic Lavage?**

1998 First report (n=10, lavage 15L)

2008 Prospective study (n=100)
- 92% laparoscopic procedure
- 8% conversion to Hartmann
- 3-4% morbidity and mortality

**Selection bias?**

Rizk et al. Chirurgie 1998
Myers et al. BJS 2008
## Laparoscopic Washout for Diverticulitis

<table>
<thead>
<tr>
<th>STUDY/COUNTRY</th>
<th># PATIENTS</th>
<th>HINCHEY</th>
<th>TREATMENT OF PERFORATION</th>
<th>LOS</th>
<th>RE-OPERATION</th>
<th>DEATH</th>
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</thead>
<tbody>
<tr>
<td>O’Sullivan 1996/Ireland</td>
<td>8</td>
<td>3</td>
<td>No</td>
<td>10</td>
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<tr>
<td>Faranada 2000/France</td>
<td>18</td>
<td>3-4</td>
<td>Biologic glue</td>
<td>8</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Mutter 2006/France</td>
<td>10</td>
<td>NA</td>
<td>Excludes pts with visible perforation</td>
<td>8.5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Taylor 2006/Australia</td>
<td>14</td>
<td>2-4</td>
<td>No</td>
<td>6.5</td>
<td>3</td>
<td>0</td>
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<tr>
<td>Franklin 2008/USA</td>
<td>40</td>
<td>2-4</td>
<td>Suture used if obvious perforation</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bretagnol 2008/France</td>
<td>24</td>
<td>2-4</td>
<td>No</td>
<td>12</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Myers 2008/Ireland</td>
<td>100</td>
<td>2-3-4</td>
<td>No</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
Are There Any Prospective Randomized Trials to Evaluate Laparoscopic Washout for Diverticulitis?

### Studies of Laparoscopic Washout

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladies Trial</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Lapland Trial</td>
<td>Ireland</td>
</tr>
<tr>
<td>Scandiv Trial</td>
<td>Norway</td>
</tr>
</tbody>
</table>
Future Directions….

- Multicenter randomized controlled trial
- Major endpoints: morbidity and mortality


Professor Bemelman
LOLA

purulent peritonitis for perforated diverticulitis
Laparoscopic LAvage or resection?

DIVA

faecal peritonitis for perforated DIVerticulitis
Hartmann’s procedure or primary Anastomosis?

Vennix et al. Lancet in press

“The Ladies Trial”

LOLA ARM

“The Ladies Trial”

• **Primary endpoint of LOLA-arm:**
  – Combined # of morbidity and mortality

• **Secondary endpoints of LOLA-arm:**
  – Numbers of day alive and outside hospital, QOL, Health care utilization + associated costs


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**DIVA ARM**

Figure 1: Study profile

Hypothesis:
Laparoscopic lavage results in a 25% reduction of mortality and severe morbidity at 1 year.

Hypothesis:
Sigmoidectomy with primary anastomosis results in a 25% higher stoma-free survival at 1 year.

Results LOLA
Third DSMB at 100 patients

March 2013, following the advice of the data and safety monitoring board (DSMB) because of:

- High rate of reinterventions
- Expected 25% reduction in severe morbidity/mortality (= primary outcome) not feasible
Classification Acute Diverticulitis

Modified Hinchey’s

Hinchey 0
Uncomplicated diverticulitis
(clinical diagnosis)

Hinchey I
Ia phlegmon
Ib pericolic abscess < 5 cm

Hinchey III
Purulente peritonitis

- True Hinchey III can be lavaged
- Exclude perforated tumors & Hinchey IV
  - CT + rectal contrast
  - Bubble test, perop endoscopy

Management of (perforated) Acute Diverticulitis

- No surgery
  - Hinchey 0-II
  - Select cases Hinchey III with free (localised) air

- Less invasive surgery
  - Lavage for true Hinchey III
  - Resection with anastomosis in Hinchey IV
  - Apply laparoscopy
Acute abdomen

Acute diverticulitis

Hinchey 1a, 1b

Hinchey II

Perforated diverticulitis

Localised < 5 cm fluids, only free air

Diffuse/distant/contrast extravasation

Laparoscopy (Bubble test, look for a hole)

Hinchey III

Lap. lavage

Hinchey IV

Primary anastomosis (or laparoscopic Hartmann)

Colonoscopy

Clinical decision rule CT scan iv + rectal contrast

 ➢ No antibiotics
 ➢ Pain medication
 ➢ No diet restrictions
 ➢ Outpatient management

 ➢ Antibiotics
 ➢ Percutaneous drainage

Practice Parameters 2014
American Society of Colon & Rectal Surgeons

In patients with purulent or feculent peritonitis, operative therapy without resection is generally not an appropriate alternative to colectomy.

Grade of Recommendation:
Strong recommendation based on low-quality evidence
Current Guidelines in Europe

• Colon resection remains the gold standard, but laparoscopic lavage and drainage may be considered in some selected patients
  • European Association for Endoscopic Surgery Consensus statement on Laparoscopy for Abdominal Emergencies
    Sauerland et al Surg Endosc 2006;20:14-29

• Laparoscopic lavage may play a role in some patients with acute diverticulitis. Whilst this is an alternative to resection in the acute setting for some patients, it is not certain whether it is an acute alternative to delayed resection.
  • ACPGBI 2011 Fozard et al Colorectal Dis 2011

Lavage

Take home message:

• Laparoscopic lavage for Hinchey III certainly allows some patients to be treated successfully without stoma (and perhaps never have a resection)

• Ultimately lavage will play a role in the treatment of perforated diverticulitis
Adieu to Henri Hartmann?

E. Myers and D. C. Winter
Department of Surgery, Saint Vincent’s University Hospital, Dublin, Elm Park, Dublin, Ireland.

No longer ‘gold standard’ in perforated diverticular disease

The laparoscopic non-resectional approach to perforated diverticulitis has been shown to be feasible ..but the indications are rare!

Surgery for Acute Diverticulitis Summary

• Convert to elective or urgent operation
• Mandatory colectomy after “attack” should be limited to specific indications
• If colectomy needed, resect to rectum
• If emergency surgery needed, consider
  - laparoscopic lavage on protocol
  - resect, anastomose, loop stoma better than Hartmann Procedure
RESULTS OF DIVERTICULAR SURGERY DEPENDS ON:

- Fecal /purulent peritonitis
- Immune status
- Nutritional status

RESULTS OF DIVERTICULAR SURGERY DEPENDS ON:

- Operative procedure
- Disease severity
- Associated co-morbid conditions
Conditions for Safe Anastomosis

The Patient

- No Shock
- Adequate oxygen delivery
  - Satisfactory cardiac output
  - Satisfactory hemoglobin
  - Satisfactory oxygenation

THE BOWEL

- Good blood supply
- Healthy bowel ends
- Adequate bowel prep ??
- Technically perfect anastomosis
- No tension on suture line

Experience!
Relative Contraindications to Primary Anastomosis

- Diffuse peritonitis
- Associated medical problems
- Immunosuppression
- Poor nutrition
- Steroids
- Radiation

Judgement!

“Good Judgement Comes From Experience And Experience Comes From Bad Judgement”
Diverticular Surgery
A Century of Evolution

1900 • 3 stage
• 2 stage (Hartmann)
• 2 stage (primary + loop ileostomy)

2016 • 1 stage or wash-out or No surgery

Thank You

Cruveilhier, in 1849, is credited with the first in-depth description of diverticulitis
Please join us at the 79th Annual Course in Colon & Rectal Surgery September 14 - 17, 2016

For more information, please visit our website: www.colonrectalcourse.org

Immonocompromised Patients

• Solid organ transplant patients

• Chronic corticosteriod users

• Aids patients

J. Gastrointestinal Surg 2014; 18:2038-2046
**Nomenclature/Grading**

- **Hinchey**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Mild clinical diverticulitis; diverticuli, colonic wall thickening</td>
</tr>
<tr>
<td>Ia</td>
<td>Confined pericolic inflammation or phlegmon</td>
</tr>
<tr>
<td></td>
<td>Colonic wall thickening with pericolic soft tissue changes</td>
</tr>
<tr>
<td>Ib</td>
<td>Pericolic or mesocolic abscess &lt; 5 cm;</td>
</tr>
<tr>
<td></td>
<td>Ia changes + pericolic or mesocolic abscess</td>
</tr>
<tr>
<td>II</td>
<td>Abscess ≥ 5 cm, pelvic, distant intra-abdominal or retroperitoneal abscess</td>
</tr>
<tr>
<td>IIa</td>
<td>II + distant abscess (generally deep in the pelvis or interloop regions)</td>
</tr>
<tr>
<td>III</td>
<td>Generalized purulent peritonitis; free air associated with localized or generalized ascites and possible peritoneal wall thickening</td>
</tr>
<tr>
<td>IV</td>
<td>Generalized faecal peritonitis</td>
</tr>
</tbody>
</table>

**Prognostic Value of Ambrosetti CT Classification of Diverticulitis**

- **Prospective evaluation of 423 patients**
- **Diagnostic sensitivity of CT scan was 97%**
- **Statistically predictive for failure of conservative management**
  - 74% of patients who failed conservative management had CT-severe diverticulitis
- **Statistically predictive for need of operative intervention**
  - CT-severe diverticulitis associated with 30% surgery
  - CT-moderate diverticulitis associated with 4% surgery
- **Statistically predictive for long-term complications of diverticulitis (fistula formation, stricture)**
  - 47% of patients who developed secondary complications had CT-severe diverticulitis
Complicated Diverticulitis: Laparoscopic Data

• A single training center's experience with 200 consecutive cases of diverticulitis: can all patients be approached laparoscopically?
  – *All complicated cases completed by straight laparoscopy.*

• Selective Conversion of Straight Laparoscopic Colectomy To Hand Assisted Colectomy: The Best of Both Worlds
  – *Complicated Diverticulitis (90% Completed Straight Laparoscopic)*

Clinical Diagnosis

**CT Scan**
- Hinchey III/IV
- Hinchey II
- Hinchey I A/B

**Pre-Operative Optimization**
- Yes: Septic Shock
- No: IR Drain

**Laparoscopy**
- Low Risk
- High Risk

**Damage Control**
- Yes: Lavage & Drain
- No: Definitive Resection

**Septic Shock**
- Yes: OR
- No: Successful

**Successful**
- Yes: Discharge
- No: Septic Shock

**Observe**
- Yes: Septic Shock
- No: IR Drain

5/29/2017
When to Anastomose

- *for anastomosis*
  - single stage
  - “low risk”
  - patients
- *against*
  - anastomosis
  - leak rate
  - proximal
  - stoma

A tailored approach to perforated diverticulitis

William Bemelman
Professor in Colorectal and Minimal Invasive Surgery
Academic Medical Center University of Amsterdam
Natural history over diverticulosis
lower rate of acute diverticulitis than previously thought

< 40 years

> 80 years

1-4% develop acute diverticulitis

Shahedi et al. Gastro 2012
Lavage failures

46 lavages

- Short term (n=11, 24%) 6 (13%) Hinchey IV 1 (2%) perforated cancer
- Long term (n=11, 24%) 6 (13%) ongoing complaints 4 (7%) cancers

Optimise identification of perforated colorectal cancer and Hinchey IV

Evolving Practice Patterns in the Management of Acute Colonic Diverticulitis: A Population-Based Analysis

- Population-based retrospective cohort study Ontario
- Emergency admission 2002-2012
In the absence of other risk factors, is colonoscopy not indicated in uncomplicated diverticulitis.
Primary endpoint

Severe morbidity and mortality

Primary endpoint

Severe morbidity and mortality

Short term  Long term  Primary endpoint

NS

Costs

LOLA arm Ladies trial

Lavage Resections
Acute laparoscopic and open sigmoidectomy for perforated diverticulitis: a propensity score-matched cohort

Shorter hospital stay 7 vs 9 days (scopy vs open)

Mortality 2% vs 4%

Morbidity 44% vs 66%

Costs laparoscopy 8000 € cheaper (due to ICU days)

Vennix et al. submitted

SCANDIV
SCANDINAVIAN DIVERTICULITIS TRIAL

90 days results

Oresland

Schultz et al. JAMA 2015
Acute laparoscopic and open sigmoidectomy for perforated diverticulitis: a propensity score-matched cohort

**Patients**
Observational cohort parallel to LADIES trial (n = 307 pts)

**Methods**
1:1 propensity matched cohort (age, gender, previous laparotomy, CRP level, gastrointestinal surgeon and Hinchey classification)

- 39 laparoscopic, 78 open
- 1/3rd primary anastomoses, 2/3rd Hartmann

Vennix et al. submitted

Conclusions valid?
- Study powered for different endpoint!
- Selection bias?:
  - Eligible non included patients the same? Enveloppes
- No intention to treat (perforated cancer excluded)

Acute laparoscopic and open sigmoidectomy for perforated diverticulitis: a propensity score-matched cohort

**Stoma closure**

- Anastomosis + ileostomy
- Lap. Hartmann’s
- Open Hartmann’s

More Lap Hartmann’s closed
80 vs 60%

Sources: Vennix et al. Submitted
**Diagnosis of acute diverticulitis**

**Imaging (CT vs US)**

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients without diverticulitis</th>
<th>Patients with diverticulitis</th>
<th>Specificity</th>
<th>Positive likelihood ratio</th>
<th>Negative likelihood ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lammers et al. [6]</td>
<td>44 9 17 14</td>
<td>0.45 (0.45-0.70)</td>
<td>0.69 (0.69-0.77)</td>
<td>4.3 (0.65-0.70)</td>
<td>0.10 (0.05-0.20)</td>
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<tr>
<td>Schutte, 2008 [7]</td>
<td>28 5 23 2</td>
<td>0.38 (0.38-0.64)</td>
<td>0.70 (0.70-0.77)</td>
<td>3.3 (0.65-0.70)</td>
<td>0.19 (0.05-0.07)</td>
</tr>
<tr>
<td>Cotsis, 2007 [8]</td>
<td>62 12 64 3</td>
<td>0.44 (0.44-0.64)</td>
<td>0.70 (0.70-0.77)</td>
<td>3.3 (0.65-0.70)</td>
<td>0.17 (0.05-0.03)</td>
</tr>
<tr>
<td>Perao, 2007 [9]</td>
<td>24 5 26 7</td>
<td>0.49 (0.49-0.70)</td>
<td>0.72 (0.72-0.79)</td>
<td>3.5 (0.65-0.70)</td>
<td>0.19 (0.05-0.04)</td>
</tr>
<tr>
<td>Serrano-Gonzalez, 2011 [10]</td>
<td>42 6 29 7</td>
<td>0.45 (0.45-0.70)</td>
<td>0.72 (0.72-0.79)</td>
<td>3.5 (0.65-0.70)</td>
<td>0.18 (0.05-0.04)</td>
</tr>
</tbody>
</table>

Summary estimate (95% CI)

CT better for additional diagnoses

**Other outcomes ......

No further surgeries

- Initial abscess: 76%
- Perforation: 52%
- Overall: 31%

No stoma rates

- 78%
- 74%
- 71%
- 19%

Vennix et al. Lancet in press
Uncomplicated diverticulitis dietary restrictions?

Comparison study n=256

1 Correction for age, fever, antibiotics, Hinchey classification and complications

2 Early feeding reduces hospital stay and costs (25 pts)

Descriptive systematic review emergency resection

Laparoscopic better

Publication Bias
classification acute diverticulitis
modified Hinchey’s

Hinchey I
Ia phlegmon
Ib pericolic abscess < 5 cm

Hinchey II
II pelvic, intra-abdominal or retroperitoneal abscess

Hinchey III
Purulent peritonitis

Hinchey IV
Faecal peritonitis

Acute Perforated Diverticulitis
What Are the Options?

Purulent peritonitis (Hinchey III)
  "Microscopic perforation"

Faecal peritonitis (Hinchey IV)
  "Macroscopic perforation"

- Antibiotics + drainage
- Laparoscopic lavage
- Resectional surgery

- Hartman's
- Resection and anastomosis
- Laparoscopic approach
Classification Acute Diverticulitis
Modified Hinchey's

Hinchey 0
Uncomplicated diverticulitis (clinical diagnosis)

Hinchey I
Ia phlegmon
Ib pericolic abscess < 5 cm

Hinchey III
Purulent peritonitis

Hinchey II
II pelvic, intra-abdominal or retroperitoneal abscess

Hinchey IV
Fecale peritonitis

Principles of Safe Resection in Acute Diverticulitis

- Experienced team
- Adequate assistance
- Headlight
- Modified lithotomy position
- Ureteral catheters
Increase in Colectomy and Hospitalization Due to Young Patients

Staged Procedures

Disadvantages

At Best: Restoration of continuity at second or third operation

At Worst: Significant morbidity or mortality from unresected pathology (3 stage) or at time of colostomy closure

Frequently: “Temporary” stoma becomes permanent
Peritonitis from Diverticulitis

Laparoscopic Lavage

- Multi-center Irish trial: 1257 admitted
- 100 patients with free air on CXR, CT
- 8 patients converted to open Hartmann because of fecal peritonitis
- 92 patients had lavage (> 4 liters NS) for Hinchey II (25) or III (67)
- IV antibiotics for 72 hrs; po for 1 wk


Perforated Diverticulitis with Peritonitis

Laparoscopic assessment $n=100$

Hinchey grade ≤ 3, Perforation $n=92$

Hinchey grade 4, Perforation $n=8$

Post-op death ← Laparoscopic Lavage → Non-resolution → Laparotomy and Hartmann’s

Resolution $n=87$

Radiological Drainage $n=1$

Interval colonoscopy or barium enema $n=88$

BJS 2008
Management of (perforated) Acute Diverticulitis

• No surgery
  - Hinchey 0-II
  - Select cases Hinchey III with free (localised) air

• Less invasive surgery
  - Lavage for *true* Hinchey III
  - Resection with anastomosis in Hinchey IV
  - Apply laparoscopy

Conclusions

• Diverticulitis appears to be increasing in incidence

• The majority of patients with acute diverticulitis can be managed non-operatively with a low risk of complications and recurrence

• Patients requiring urgent surgery have a number of viable operative options
Presentation and Evaluation

- **History**
  - Typical symptoms of acute diverticulitis, Recurrent pattern
  - History of diverticulosis

- **Physical exam, Labs**
  - Ranges from mild left lower quadrant tenderness to acute abdomen
  - CBC, urine analysis

- **Imaging**
  - Abdominal plain x-ray films
  - Ultra Sound
  - Contrast enema
  - CT SCAN
  - Colonoscopy, not acutely
Patient Prep for CT scan

• Oral contrast
  – would need 60-90mins to highlight sigmoid colon and rectum, therefore optional
• Rectal contrast
  – most helpful, allows immediate scanning
• IV contrast
  – also given to highlight abscesses

Percutaneous Drainage

Pericolic abscess

Drain insertion

Post drainage
### Approaches for Percutaneous Drainage

- **Transabdominal**  
  - Prefer lateral to avoid inferior epigastric
- **Other approaches**  
  - Transgluteal, beware of sciatic nerve  
  - Transperineal  
  - Transvaginal  
  - Transrectal
- **Successful drainage for simple abscess: 80%**

Golfieri et al, Tech Coloproctol 2007

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### Sigmoid Diverticulitis

**Endoscopy in Sigmoid Diverticulitis**  
**When should it be performed?**

- In the operating room in acute situation
  - 2-3 weeks after hospitalization
### Perforated Sigmoid Diverticular Disease

When is a contrast enema indicated?

4-6 weeks after resolution of an attack to rule out a neoplastic lesion and to evaluate the extent of disease.

---

### Elective Diverticulitis

- Recurring episodes
- “Smoldering” symptoms
- Fixed anatomical problems (stricture, fistula)
### Perforated Sigmoid Diverticular Disease

**Who should have surgery?**

- Unable to rule out cancer
- “Multiple” episodes
- Persistent fistula
- Symptomatic stricture
- Continued symptoms

### Elective Diverticulitis

- **“Smoldering” symptoms**
  - **Definition:**
    - Chronic left lower quadrant pain
    - No documented history of diverticulitis
    - Diverticulosis
    - No evidence of stricture, abscess, perforation, obstruction
  - **Outcomes:**
    - 76% had evidence of chronic inflammation in the specimen
    - 88% had resolution of symptoms

---

*Horgan et al, DCR 2001 - 47 patients*
Elective Diverticulitis

• “Smoldering” symptoms
  – Chronic symptoms
  – After an episode of diverticulitis
  – No distinct radiographic evidence

• To operate, or not to operate…

“Smoldering” Symptoms

• DIRECT trial results 2010-2014
  – 109 enrolled
  – All aspects of QoL better with surgery
  – Full results pending

Stam et al, DDW 2015

Van De Wall, BMC Surgery 2010
Laparoscopic Lavage:

- Help to avoid emergent exploratory laparotomy, resection, stoma
- Decreased post-op pain, convalescence
- May avoid resection all together


Perforated Sigmoid Diverticular Disease

When is CT Scan Indicated?

- Uncertain diagnosis
- Failure to improve
- Clinical Deterioration
- Suspected abscess
CT scan of the abdomen and pelvis is the most appropriate initial imaging modality in the assessment of suspected diverticulitis.

**Grade of Recommendation:**
Strong recommendation based on moderate-quality evidence.
**Functional Outcomes After Sigmoidectomy For Diverticulitis**

- Question survey of 325 patients
  - Open v. laparoscopic sigmoid resection
  - 76.% response rate
  - Fecal incontinence quality of life scale and the memorial bowel function instrument
- 20% have fecal urgency, incontinence and incomplete emptying (no pre-op arm)

*Levack et al Dis Colon Rectum 2012;55:10-17*

**Sigmoid Diverticulitis**

**EFFECTIVE ANTIBIOTICS FOR ACUTE DIVERTICULITIS**

**Oral antibiotics:**
- Ampicillin
- Trimethoprim-Sulfamethoxazole (Bactrim)
- Ciprofloxacin (Cipro)
- Metronidazole (Flagyl)
- Tetracycline
Conclusion

Laparoscopic Peritoneal lavage is safe for treatment of perforated sigmoid diverticulitis
• Only purulent peritonitis has been studied, no evidence for fecal peritonitis
• Viable alternative to Hartmann’s
• Avoids morbidity associated with laparotomy
• Avoids stoma which may affect QOL

Acute Diverticulitis
Immune Suppressed

• “Immunosuppressed patients...have a significantly greater risk of recurrent, complicated diverticulitis requiring emergency surgery. Surgeons should maintain a low threshold to recommend operative intervention…”

Hwang et al, DCR 2010 – Systematic Review
25 studies, 143 patients
25% overall mortality
Higher mortality with non-surgical treatment
**Prophylactic Surgery**

**ASCRS Practice Parameters:**

“Estimate risk of needing emergency surgery with stoma formation is in 2000 patient years of follow-up”

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**Use of Antibiotics in Uncomplicated Diverticulitis**

- Mainstay of treatment – bowel rest, IV fluids and antibiotics
- Wide variation in choice and route of administration
  - Oral v. IV Duration of treatment
- Review of 549 studies only four met inclusion criteria-systematic review

Ridgeway et al Colorectal Disease 2009
*De Korte Br J Surg 2011;98:761-7*
Sigmoid Diverticulitis

IS IT APPROPRIATE TO TREAT WITH ANTIBIOTICS AND BOWEL REST IN A STABLE PATIENT?

• 70% of patients treated for first episode will recover with no further problem

Management of Diverticulitis

- Hinchey 0/la
  - Conservative management
  - Bowel rest
  - Antibiotics

- Hinchey III/IV
  - Surgical management
  - Open or Laparoscopic
  - Primary anastomosis vs staged resection
**Outcome Differences Between Mesocolic and Pelvic Abscesses**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mesocolic abscess</th>
<th>Pelvic abscess</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of patients</td>
<td>45</td>
<td>28</td>
</tr>
<tr>
<td>PCD</td>
<td>24%</td>
<td>29%</td>
</tr>
<tr>
<td>Avg size of abscess drained</td>
<td>6.8cm</td>
<td>6.6cm</td>
</tr>
<tr>
<td>Avg size of abscess not drained</td>
<td>3.8cm</td>
<td>5cm</td>
</tr>
<tr>
<td>Surgery during 1st hospitalization</td>
<td>15%</td>
<td>39%</td>
</tr>
<tr>
<td>Subsequent surgery</td>
<td>36%</td>
<td>32%</td>
</tr>
<tr>
<td>Successfully avoided surgery</td>
<td>49%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Prospective study of 73 cases, 43 months follow-up
Ambrosetti et al, DCR 2005

**Indications for Percutaneous Drainage in Perforated Sigmoid Diverticulitis**

<table>
<thead>
<tr>
<th>Name</th>
<th>Total</th>
<th>Drained</th>
<th>Mean age yr (range)</th>
<th>Site of abscess</th>
<th>Size for PCD (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuman et al</td>
<td>30</td>
<td>12</td>
<td>59</td>
<td>Paracolic</td>
<td>6.5</td>
</tr>
<tr>
<td>Stable et al</td>
<td>20</td>
<td>19</td>
<td>63.8</td>
<td>Paracolic</td>
<td>8.7</td>
</tr>
<tr>
<td>Kaiser et al</td>
<td>99</td>
<td>16</td>
<td>74</td>
<td>Pelvic</td>
<td>25</td>
</tr>
<tr>
<td>Ambrosetti et al</td>
<td>73</td>
<td>19</td>
<td>66.9</td>
<td>Others</td>
<td>45</td>
</tr>
<tr>
<td>Brandt et al</td>
<td>66</td>
<td>34</td>
<td>73</td>
<td>Paracolic</td>
<td>25</td>
</tr>
<tr>
<td>Babadi증 et al</td>
<td>28</td>
<td>10</td>
<td>65</td>
<td>Pelvic</td>
<td>25</td>
</tr>
<tr>
<td>Stierwalt et al</td>
<td>30</td>
<td>4</td>
<td>54.2</td>
<td>Others</td>
<td>9.9</td>
</tr>
<tr>
<td>Net et al</td>
<td>16</td>
<td>16</td>
<td>62.86</td>
<td>Others</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Alvine et al</td>
<td>59</td>
<td>–</td>
<td>64</td>
<td>Others</td>
<td>32</td>
</tr>
</tbody>
</table>

Soumian et al, World J Gastroenterol 2008
Diverticular Disease

Miscellaneous Observations:

• Youthfull patients (under 50)
  – More aggressive course, frequently needing surgery
  – Commonly with family members

• Right sided Diverticulosis/itis:
  – More commonly seen in Asia/Africa
  – Infrequently needs surgery

Diagnosis of Diverticulitis

• Clinical diagnosis
  – Often sufficient in cases of uncomplicated diverticulitis

• CT diagnosis
  – Grade A recommendation by ASCRS in suspected diverticulitis
  – Guides management by providing staging information for the classification of diverticulitis

• Laparoscopic diagnosis
  – Favored by some groups in cases of diffuse peritonitis for diagnosis and washout
Antibiotics + Percutaneous Drainage versus Antibiotics Only for Hinchey II

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Antibiotics + PCD</th>
<th>Antibiotics only</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of patients</td>
<td>34</td>
<td>32</td>
</tr>
<tr>
<td>Successful conservative management during initial hospitalization</td>
<td>23 (68%)</td>
<td>26 (81%)</td>
</tr>
<tr>
<td>Avg size of abscess drained</td>
<td>6cm</td>
<td>4cm</td>
</tr>
<tr>
<td>Successfully avoided surgery</td>
<td>11 (32%)</td>
<td>10 (31%)</td>
</tr>
</tbody>
</table>

Case control study for Hinchey II diverticulitis: 66 cases
Median time to elective surgery was 113 days (40-600)
Brandt et al, DCR 2006

Conclusions

1. Percutaneous management of localized complicated diverticulitis has allowed the conversion of emergent surgery into elective one-stage operations

2. In the absence of definite surgical indications, successful percutaneous drainage for localized complicated diverticulitis could be considered definitive management
<table>
<thead>
<tr>
<th>Exceptions to Non-Op Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Immunosuppressed</td>
</tr>
<tr>
<td>• Obstruction</td>
</tr>
<tr>
<td>• Fistulas</td>
</tr>
<tr>
<td>• Inability to exclude cancer</td>
</tr>
<tr>
<td>• Ongoing “grumbling” symptoms</td>
</tr>
<tr>
<td>• Increasingly frequent hospitalizations</td>
</tr>
<tr>
<td>• “Stiff colon” at colonoscopy</td>
</tr>
<tr>
<td>• Life style (live in remote areas etc)</td>
</tr>
</tbody>
</table>
Perforated Sigmoid Diverticular Disease

What percentage of patients who present with perforated Sigmoid Diverticular Disease have had a previous attack?

- 108 Patients
- 91% Admitted as emergency
- 98 patients had a Hartmann operation
- 31% patients died post-operatively
- 26% had known diverticulosis
- 2.7% (3 patients) had previous episode of acute Diverticulitis

-Somasekar K. et al.,Jr Royal College Surg. Edinb., April 2002
Perforated Sigmoid Diverticular Disease

Complications of diverticular disease occur de novo in the majority of patients who have no previous history of diverticulitis

Is Interval Colectomy Protective?

Perforated Diverticular Disease Resectional Procedures

Advantages:
1. Remove septic focus and/or continued source of contamination
2. Decrease morbidity & hospital stay
3. Decrease number of operations
4. Earlier return to normal activity
Why Bother?

- Mortality in modern series remains high 5%, 15%, 20%, 24%

- Morbidity is still common, especially for emergency surgery in obese patients

- Stoma complications in up to 10% after Hartmann

- Leaks in up to 14% after primary anastomosis

*Constantinides et al Dis Colon Rectum 2006;49: 966
** Salem et al Dis Colon Rectum 2004; 47: 1953
WHAT ARE THE LONG TERM RESULTS OF DIVERTICULAR SURGERY?

“The single most important predictor of recurrence after sigmoid resection for uncomplicated diverticulitis is an anastomosis to the distal sigmoid rather than the rectum.”

William Halstead

‘Conceptions from the past have blinded us to facts which almost slap us in the face’

Halstead WS
Johns Hopkins Hosp Rep 1894

Natural History of Diverticulitis in Young Patients ( < 40 years)

40 Patients

10 Immediate Surgery 30 medically managed

10 Surgery 20 No Surgery

**No Perforations

-Vignati et al. Dis Colon Rectum 1995
Diverticulitis

Patients < 50 Years of Age

- 10/40 Required surgery with first hospitalization
- 7 years mean follow-up
  - 9/28 Required elective sigmoid resection
  - 17/28 Symptom free
- Summary
  - 50% Required surgery (urgent/elective)
  - 50% only one attack

Vignati et al. Dis Colon Rectum 1995

Percutaneous Drainage of Sigmoid Diverticular Abscess

- 24 patients undergoing CT guided percutaneous drainage of pelvic fluid associated with acute diverticulitis
- 14 patients Single-stage operation within 10 days of initial drainage
- 5 patients Two-stage operation
- 4 patients Surgery deferred or never done
- 1 patient Died after attempted surgical drainage of recurrent abscess

Mueller et al, Radiology 1987
Percutaneous Drainage of Sigmoid Diverticular Abscess

- Prior to the advent of percutaneous drainage, 10-15% of operations for diverticulitis were for drainage of abscess
  - Rodkey et al, Ann Surg 1984

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### Sigmoid Diverticulitis

**Who does not require surgery?**

- Young patients with uncomplicated diverticulitis successfully treated medically
- Patients with abscess successfully treated with percutaneous drainage

### 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
### Cologenital Fistula

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of patients</th>
<th>Tube</th>
<th>Uterus</th>
<th>Vagina</th>
<th>Prior hysterectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wychulis and Pratt (1966)</td>
<td>11</td>
<td></td>
<td></td>
<td>11</td>
<td>6/11</td>
</tr>
<tr>
<td>Grissom and Snyder (1991)</td>
<td>9</td>
<td></td>
<td></td>
<td>9</td>
<td>7/9</td>
</tr>
<tr>
<td>Tancer et al (1996)</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>10/10</td>
</tr>
<tr>
<td>Hjern et al (present study)</td>
<td>60</td>
<td>1</td>
<td>2</td>
<td>57</td>
<td>44/57</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
<td><strong>3</strong></td>
<td><strong>6</strong></td>
<td><strong>131</strong></td>
<td><strong>106 (81%)</strong></td>
</tr>
</tbody>
</table>

Hjern, Goldberg DCR 2006
Closure Rectal Stump

Leaks in IBD

- 3 of 16 stapled
- 1 in 42 sutured

McKee et al 1995
Diverticulitis

The Hartmann Procedure

- 40-60% of “temporary” stomas are permanent
- Morbidity of closure is 40-60%
- Mortality of closure is 0-5%

Traditional Options

Treatment Options: Perforated Diverticulitis

Radical: Sigmoidectomy

- Hartmann's Procedure
- Primary Anastomosis

Conservative Treatment

- Nothing by mouth
- Intravenous fluids
- Intravenous antibiotics
Treatment Options: Perforated Diverticulitis

LAP Pertoneal Lavage??

Radical: Sigmoidectomy

Conservative Treatment

Hartmann’s Procedure

Primary Anastomosis

Nothing by mouth
Intravenous fluids
Intravenous antibiotics

Nothing by mouth
Intravenous fluids
Intravenous antibiotics
Sigmoid Diverticulitis

"THE BOLD SURGEON’S PATIENTS TAKE ALL THE RISKS"

WARD O. GRIFFEN, JR., MD., PH.D
PROFESSOR OF SURGERY
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At reoperation, 2/5 patients had feculent diverticulitis