Current Management of Diverticulitis

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Controversies in Surgery
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Overview

• Background
• Pathophysiology
• Clinical Classification
• Presentation
• Management: Controversies
• Outcomes
Diverticula

- Small (0.5 - 1.0 cm) pouches protruding from bowel wall
- Most pseudodiverticula: mucosa and submucosa only- muscle layer not present
- True diverticula: all layers of the bowel wall involved
- Up to 60% of people living in industrialized countries will develop colonic diverticula

Pathophysiology of Diverticular Disease

- Increased intraluminal pressure
- Caused by low fiber, constipation
- Sigmoid colon most commonly involved (95%)
  - Smallest diameter
  - Laplace’s law: generates highest pressure
- Right sided disease tend to be younger
  - RLQ pain, fever, leukocytosis, suspect acute appendicitis
- Incidence of diverticular disease increases with age:
  - 30% at age 60
  - 60-80% at age 80
Risk Factors

- Low fiber Diet
- Smoking
- Constipation
- Obesity
- NSAIDS
Diverticulitis

- Diverticulum inflamed due to obstruction
- Microperforation and inflammation of surrounding tissue results in phlegmon
- Incidence 10% to 25% in patients with diverticula
  - 75% Uncomplicated
  - 25% complicated
- Risk of diverticulitis increases as pts. w/ diverticulosis age
  - 10% after 5 years
  - 35% after 20 years
Significance of Diverticulitis

- Significant problem in Western Countries
- One of the most common causes of acute surgical admission
- 152,000 yearly hospitalizations
- 1.5 million days of inpatient care per year
- Annual costs of diverticular disease estimated at $2.7 billion per year

Clinical Classification

• Uncomplicated vs. Complicated
  • Uncomplicated
    • Pericolic soft-tissue stranding, colonic wall thickening, phlegmon
  • Complicated: Acute diverticulitis +
    • Abscess
    • Obstruction
    • Perforation
    • Fistula
## Complicated Diverticulitis: Hinchey Classification

<table>
<thead>
<tr>
<th>Hinchey Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Pericolic or Mesenteric abscess</td>
</tr>
<tr>
<td>II</td>
<td>Retroperitoneal or Pelvic abscess</td>
</tr>
<tr>
<td>III</td>
<td>Purulent peritonitis</td>
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<tr>
<td>IV</td>
<td>Fecal peritonitis</td>
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Presentation

• Symptoms
  • LLQ Pain, Fever, Diarrhea or constipation
  • Urinary symptoms if inflammation adjacent to the bladder

• Classic Triad
  • Fever, Leukocytosis, LLQ tenderness
  • Mass is occasionally felt

• Complicated Diverticulitis:
  • Abscess: tender, +/- palpable mass on abdominal, rectal, or pelvic examination.
  • Obstruction: distention, tenderness
  • Free perforation: peritonitis, sepsis
Imaging: CT Scan

FASCIAL INFILTRATION OF THE MESENTERY

THICKENED BOWEL WALL

DIVERTICULA
Imaging

- Barium Enema
  - Avoid in acute setting
  - If scope not possible can aid in distinguishing CA vs. diverticulitis after acute attack
  - Consider CT Colonography
- Sensitivity: CT 98% vs. BE 92%
Colonoscopy

- Avoid with acute diverticulitis
  - Risk of perforation
- Perform 6 to 8 weeks after when inflammation subsides
- Confirms diagnosis and excludes malignancy
- Current Accepted society and international guidelines recommend routine colonoscopic evaluation after 1 episode of acute diverticulitis
Is Colonoscopy Mandatory After Radiologically Confirmed Acute Diverticulitis?

- N=319 had colonoscopy after episode
- 23 (2.1%) had cancer
- Odds of Dx CRC
  - 6.7 time in pts w abscess
  - 4 times in local perforation
  - 18 times in pts with fistula
- Concluded: Recommend routine colonoscopy in all cases
Proportion Estimated Risk of Malignancy:
- Uncomplicated 0.7% vs. Complicated 10.8%

Conclusion: Risk of malignancy after radiographically proven episode of acute uncomplicated diverticulitis low

Routine colonoscopy may not be necessary in uncomplicated cases

Pts with complicated diverticulitis have significant risk & should have colonoscopy
Management: Acute Uncomplicated Diverticulitis

- Conservative Management
  - Nonoperative: Bowel rest, Antibiotics
    - PO or IV depending on severity
    - Anaerobic/GN coverage
  - Outpatient or Inpatient
- Successful in 70-100% pts
- Etzioni et al. 94% successful outpt mgmt of uncomplicated diverticulitis
- 6-8 weeks later
  - Scope to rule out cancer
- Elective Resection??

DIVER Trial: Multicenter RCT, Ann Surg, Jan 2014
132 Patients, 5 Hospitals in Spain
Outpatient vs. Hospital Treatment of Uncomplicated Diverticulitis (CT Confirmed) + Abx
Same rate of treatment failure
Overall health care cost per episode was 3 times lower in outpatient group
No difference in QOL
Concluded: Outpatient treatment safe and effective selected patients with uncomplicated acute diverticulitis
Important costs saving without negative influence on QOL
• AVOD Trial: Multicenter RCT, *BJS 2012*
• 10 surgical departments in Sweden & 1 Iceland
• 623 patients
• Abx vs. No Abx in Uncomplicated Diverticulitis
• Complication Rates same (1.9% vs. 1.0%)
• LOS same (3 d)
• Concluded: Antibiotics for acute uncomplicated diverticulitis neither accelerates recovery nor prevents complications or recurrence
• Should be reserved for the treatment of complicated diverticulitis
Elective Sigmoid Resection

- Open, Lap, Robotic
- Sigmoid Resection
  - Proximal Margin: compliant bowel
    - Include thickened, woody or grossly diseased bowel
    - Not all diverticula bearing colon must be removed
  - Distal: upper rectum
- Ureteral stenting available
Elective Sigmoid Resection: Bowel Prep?

- Concluded: bowel prep has no influence on anastomotic leak rates or other septic complications
Management of Acute Uncomplicated Diverticulitis: Elective Surgery

- >20% will require surgical treatment
- Management of acute diverticulitis has evolved over the past 2 decades
- Shift toward higher threshold for elective resection in recurrent disease and in favor of primary anastomosis for patients with acute disease
Management of Acute Diverticulitis: Natural History of Disease

- Most perforations and complications do not occur after recurrences, happen at first attack.
- Thus, a policy of elective resection after recovery from uncomplicated acute diverticulitis may not decrease likelihood of later emergent surgery or overall mortality.
- Conservative management of recurrent nonperforated diverticulitis associated with low rates of Morbidity & Mortality with mild course.

“The decision to recommend elective sigmoid colectomy after recovery from acute diverticulitis should be made on a case-by-case basis”

– Level of Evidence III; Grade B
– Consider Age, comorbidities, frequency & severity of attacks, and if sx persistent after acute episode
– Consider travel outside US and QOL
Concluded elective sigmoid rsxn should be restricted and only considered in complicated cases and for high risk patients (IS/CRF/CVD) following a conservatively treated episode.
Predicting Recurrence After Initial Attack

- 5-year Recurrence 36%
- Complicated Recurrence 3.9%
- Concluded: although recurrence is common following an initial attack managed medically, complicated recurrence is uncommon.

**TABLE 3. Multivariate model**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>HR (95% CI)</th>
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<tbody>
<tr>
<td>Retroperitoneal abscess</td>
<td>4.5 (1.1–18.4)</td>
</tr>
<tr>
<td>Family history of diverticulitis</td>
<td>2.2 (1.4–3.2)</td>
</tr>
<tr>
<td>Segment &gt;5 cm</td>
<td>1.7 (1.3–2.3)</td>
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<tr>
<td>Right colonic disease</td>
<td>0.27 (0.09–0.86)</td>
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*Original Contribution*

Long-Term Follow-up After an Initial Episode of Diverticulitis: What Are the Predictors of Recurrence?

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Diverticulitis in Young Patients

• < Age 50
• No clear consensus
• More virulent course of disease untrue
• Not at increased risk of complications or recurrent attacks
• Longer lifespan – higher cumulative risk for recurrent attacks
• Resection is no longer indicated at the time of the first attack in young pts.

Laparoscopic Resections

- Sigma Trial: Multicenter double blind RCT 2002-2006
- Lap vs. Open Elective Resection
- Lap and Lap-assisted elective colon resections can be performed safely with low conversion and complication rates
- Faster Recovery, Decreased LOS
- Less postoperative pain, more cosmetic
- Factors to Consider: body habitus, local tissue inflammation, complicated diverticulitis
- More complicated disease may require conversion

**Randomized Controlled Trials**

Laparoscopic Sigmoid Resection for Diverticulitis Decreases Major Morbidity Rates: A Randomized Control Trial

*Short-term Results of the Sigma Trial*

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Donald L. van der Peet, MD, PhD,* Wim T. van den Broek, MD, PhD,* Elly S. de Lange, PhD,*
Willem A. Bemelman, MD, PhD,‡ Piet Heres, MD,§ Antonio M. Lacy, MD, PhD,¶
Alexander F. Engel, MD, PhD,|| and Miguel A. Cuesta, MD, PhD*
Lap vs. Open

- 2002-2006 prospective, multicenter, double-blind, parallel-arm, RCT in 5 centers
- Significantly more major complications in Open group 9.6% vs. 25.0% (P = 0.038)
- Less pain, improved quality of life, and shorter LOS at the cost of a longer operating time
- Minor complication rates were similar

Complicated Diverticulitis: Abscess

- Hinchey Stages I (pericolic abscess) and II (retroperitoneal or pelvic abscess)
- Approx 15% of patients with acute diverticulitis
- Admission + IV Antibiotics
- Abscesses <2 cm should resolve
- Larger abscess amenable percutaneous drainage
- Elective Resection?

Management of Acute Diverticulitis with Abscess After Drainage

- Elective resection typically advised after episode of complicated diverticulitis (ASCRS)
  - Association of Coloproctology of Great Britain and Ireland statement does not specifically address
- After percutaneous drainage of abscess elective resection has been recommended as 41% will develop recurrence
- This has been challenged

- All small, retrospective, single-institution data sets with limited follow-up and lack of time-to-event analysis, and selection bias
Complicated Diverticulitis: Obstruction

- Can be partial or complete
- Colonic obstruction from edema and/or inflammation.
- Recurrent attacks can cause inflammation and fibrosis resulting in stricture
- Must evaluate for cancer
Complicated Diverticulitis: Fistula

• Abscess rupture
• Incidence 5-33% reported
• Types:
  • Colovesical fistula:
    • Most common fistula from diverticulitis
    • Diverticulitis most common cause of CVF
    • Less common in females due to uterus protection
  – Colovaginal fistula: Females after hysterectomy
  • Colocutaneous fistula
  • Less Common: Coloenteric, colouterine, Colosalpingeal
Complicated Diverticulitis: Fistula

- Diagnosis is Clinical
- Many won't be identified on imaging
- Excess efforts should not be taken to demonstrate fistula
- Primary aim is determine etiology (Ca, IBD, Diverticulitis) and manage appropriately
- Treatment:
  - Treat acute attack
  - Elective resection, primary anastomosis
Complicated Diverticulitis: Free perforation

- 1% to 2% of cases
- Mortality between 20% - 30%
- Hinchey Stage III - Purulent peritonitis
- Hinchey Stage IV - free perforation with fecal peritonitis

Emergent Operative Intervention
- Management Options
Emergent Surgical Intervention

- Controversial Management of Hinchey III & IV disease
- According to current ASCRS guidelines, HP recommended
  - Sigmoid resection, end colostomy, closure of distal stump
  - Overall Morbidity up to 29%
  - Mortality 10-20%
  - Long LOS (20+ days)
  - Colostomy closure technically difficult
  - “Temporary” colostomies often never closed (30%-75%)
- This has been challenged by European Association for Endoscopic Surgery recommendations + several studies
- Alternative to HP include: PA +/- Diversion & Lap Lavage
Emergent Surgical Intervention

- RCT: HP vs. PA + DLI
  - N=62 Hinchey III/IV

- Complication Rate (M&M) for resection and Stoma reversal comparable in each group

- Primary Anastomosis Favored:
  - Stoma reversal rate significantly higher (90% vs. 57%)
  - Significantly reduced major complications, OR time, LOS, and cost
Emergent Surgical Intervention

- Salem and Flum et al. Meta-analysis
  - PA (569 cases 50 studies) v. HP
  - M&M greater in HP group
  - Concluded PA safe

- Therefore PA + DLI in Left sided perforation
  - Higher Stoma reversal rate
  - Shown to be safe, with less complications, shorter LOS, and less cost

- Future Question: Is diverting ileostomy is necessary?
Laparoscopic Lavage

- Lap lavage for perforated diverticulitis is a newer modality of treatment.
- First described by O’Sullivan et al. *Ireland, 1996*:
  - 2009 published 100 consecutive cases with 93% success.
  - 2012 published 427 cases with 14% morbidity.
- Nonfeculent Perforated Diverticulitis (Hinchey 3):
- Not actually a new concept, now more realistic option:
  - Increase in adoption of laparoscopy & advances in technical skill + Improvement in CT imaging.
  - Treatment option now within skills set of most general surgeons.

Laparoscopic Lavage

- In institutions who use commonly: report refinements in technique and improvement in case selection have resulted in increased use

- Generally Antibiotics +
  - Hinchey I-II Percutaneous Drainage
  - Hinchey III Lap Lavage
  - Hinchey IV Hartmann’s

- Failures:
  - Fistula formation
  - Perforated cancer
  - Ongoing sepsis/inadequate washout/missed collection

Laparoscopic Lavage

- Systematic Review Publications 1990 - 2008
- 8 studies met inclusion criteria
- 213 patients with acute complicated diverticulitis managed by laparoscopic lavage & Abx
- Hinchey Grade 3 disease
- Conversion to laparotomy in 6 (3%) patients
- Mean LOS 9 days
- 10% had complications
- Mean f/u 38 mos, 38% underwent elective sigmoid resection with primary anastomosis
- Alternative to more radical surgery in selected patients

Laparoscopic Lavage for Perforated Diverticulitis: A Population Analysis

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- Overall intervention rate same
- Proportion of pts undergoing lap lavage increased 8% to 17%
  - Lap Lavage more likely in pts at extremes of age
- Lap Lavage:
- Lower mortality
- Less complications 14.1% vs. 25% (P<0.001)
- Shorter LOS
- ICU admission rates significantly lower

Concluded: Promising Therapeutic Option

**TABLE 2.** Demographics and outcomes of patients with acute diverticulitis undergoing emergency procedures 1995 to 2008

<table>
<thead>
<tr>
<th></th>
<th>Resection (n = 427)</th>
<th>Lavage (n = 2028)</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>899 (44.3)</td>
<td>199 (46.6)</td>
<td>0.501</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>64.8</td>
<td>60.7</td>
<td>0.000</td>
</tr>
<tr>
<td>Charlson score</td>
<td>0.9</td>
<td>0.8</td>
<td>0.041</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median length of stay, d</td>
<td>20</td>
<td>10</td>
<td>0.000</td>
</tr>
<tr>
<td>Intensive care admissions</td>
<td>235 (11.6)</td>
<td>13 (3.0)</td>
<td>0.000</td>
</tr>
<tr>
<td>Mortality</td>
<td>210 (10.4)</td>
<td>17 (4.0)</td>
<td>0.010</td>
</tr>
</tbody>
</table>
Laparoscopic Lavage

- Issues that have precluded this from being standard of care to replace HP
  1. Patient selection (Hinchey 3)
  2. Accuracy of Preop Determination
  3. Lack Prospective RCT

Critiques:
- Selection Bias
- Inclusion Criteria Variable
- Lack of Prospective Data
- No Randomized Studies

Laparoscopic Lavage

• RCT in Progress
  – DILA-LA *Scandinavia, Thornell et al.*
  – The Ladies Trial *Dutch Diverticular Disease (3D) Collaborative*
  – LapLAND *Hogan et al.*
  – SCANDIV *Scandinavia, Schultz et al.*

• Questions for future:
  – If we manage pts. successfully, what percent remain symptomatic?
  – Compare to HP and PA +/- DLI
  – Should elective resection be performed?
• Nationwide inpatient sample
• N=267,000 acute diverticulitis
• 33,500 operations
• Admissions increased by 26%
• Rates of admission increased more rapidly for young pts (82% vs. 36%)
• Elective operations rose 29%
• No evid that PA becoming more widely used
• Mortality decreased
Outcomes

- 1991 - 2005

- Despite a significant decline in surgical treatment for diverticulitis, there has been no change in the proportion of patients discharged for free diverticular perforation.

- Rationale for offering prophylactic surgery to prevent future free perforation is unsubstantiated.
Recurrence After Resection

• Recurrent diverticulitis is rare after a colectomy for diverticulitis (3% to 13%)

• As many as 3% will require repeat resection

• Thaler et al. found level of anastomosis was the only predictor of recurrence

• Important predictor is colosigmoid rather than colorectal anastomosis
  – Recurrence 4 times greater

• To avoid recurrences, the rectum should be used for anastomosis
  – Where taeina coli splay out onto upper rectum

Take Home Message

• Patients are often sent to a surgeon’s office to consider an elective colectomy to avoid urgent surgery and the possibility of a stoma.

• As few patients will actually require urgent surgery, should limit discussion regarding this uncommon complication.

• Instead should focus on discussion of risks and benefits of surgery, QOL implications, and the higher likelihood of similar episodes as the reason to, or not to, consider surgery.

Conclusions

• Colonoscopy in at least complicated if not all cases after an acute attack
• Uncomplicated Diverticulitis: Admission and Antibiotics may not be necessary
• Bowel Prep unnecessary
• Elective sigmoid colectomy after recovery from acute diverticulitis should be made on a case-by-case basis
• Guidelines should be revised
• Recommendations continually evolving as we learn more about the Natural course of the disease
Conclusions

- Emergent Resection: Primary Anastomosis + Diverting Loop Ileostomy better outcomes than Hartmann Procedure
- Laparoscopic Lavage is a promising new technique
- Prospective RCT data needed
- To avoid recurrence, ensure rectum
Thank You