Current Management of Diverticulitis
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Controversies in Surgery
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Overview
• Background
• Pathophysiology
• Clinical Classification
• Presentation
• Management: Controversies
• Outcomes
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


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 Diverticular Disease

- Increased intraluminal pressure
- Modern disease of industrialized society
- Sigmoid colon most commonly involved (95%)
  - Smallest diameter
  - Laplace’s law: $P=T$
  - Generates highest pressure
- Incidence of diverticulosis increases with age:
  - 30% at age 60
  - 60-80% at age 80
Role of Fiber

- That portion of dietary intake which is not absorbed - cellulose
- Decreases whole-gut transit time
- Increases stool weight
- Lower colonic intraluminal pressure

History of Fiber

- Late 1800’s
- Grist Mill replaced by Roller Mill
- Leading to highly refined/crushed flour
- Move to cities and Refrigeration and Canning
- Increased consumption of refined sugar and protein
- Diverticulosis became epidemic
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

Clinical Classification

Acute Diverticulitis

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

**Hinchey Stage**

<table>
<thead>
<tr>
<th>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
- **Uncomplicated Diverticulitis:**
  - Fever, Leukocytosis, LLQ tenderness
  - Mass may be palpated
- **Complicated Diverticulitis:**
  - Tender mass palpable on abdominal, pelvic, rectal exam
  - Diffuse tenderness and peritonitis
Evaluation- CT Scan

- Most appropriate imaging modality
- Sensitivity and Specificity as high as 98% and 99%
- Confirms diagnosis and stages process
- Pitfalls
  - Cancers masquerading as diverticulitis
  - Immunocompromised patients - less inflammation

Imaging: CT Scan

- Fascial infiltration of the mesentery
- Thickened bowel wall
- Diverticula
Management: Acute Uncomplicated Diverticulitis

- Conservative Management
  - Nonoperative: Bowel rest, Antibiotics
    - PO or IV depending on severity
    - Anaerobic/GN coverage
  - Successful in 70-100% pts


Outpatient vs Inpatient

- DIVER Trial: Multicenter RCT, (Biondo et al 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
  - Concluded: Outpatient treatment safe and effective selected patients with uncomplicated acute diverticulitis
Are Antibiotics Necessary?

- 10 surgical departments in Sweden & 1 Iceland
- Cochrane Review- (Shabanzedeh et al 2012)
- Both Concluded- No difference in outcomes for treatment of uncomplicated diverticulitis with or without abx

Colonoscopy Following Recovery

- Avoid with acute diverticulitis
  - Risk of perforation-???
- Perform 6 to 8 weeks after when inflammation subsides
- Diagnose IBD, ischemia, exclude neoplasia
- 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
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?

What is the role of Surgery following recovery from an episode of Complicated or Uncomplicated Diverticulitis
Natural History

- Following recovery of uncomplicated attack recurrence is about 25%
- Following recovery from second episode recurrence is higher
- Evidence is lacking that recurrent episodes will be more serious or more complicated

Natural History of Disease

- Most perforations and complications happen at first attack not after recurrences
- Conservative management of recurrent nonperforated diverticulitis is associated with low rates of Morbidity & Mortality
- Therefore, elective procedures may not decrease morbidity
Predicting Recurrence After Initial Attack

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

Jason F. Hall, M.D., M.P.H.; Patricia L. Roberts, M.D.; Rocco Riccardi, M.D., M.P.H.; Thomas Rand, M.D.; Christopher Schieber, M.D.; Christoph Wald, M.D.; Peter W. Marcello, M.D.; David J. Schottz, M.D.

1 Department of Colorectal Surgery, Lakeview, Buffalo, Massachusetts
2 Department of Radiology, Lakeview, Buffalo, Massachusetts

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

<table>
<thead>
<tr>
<th>Predictors</th>
<th>HR (95% CI)</th>
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<tbody>
<tr>
<td>Retropertioneal abscess</td>
<td>4.5 (1.1–19.4)</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>
</tr>
<tr>
<td>Right colonic disease</td>
<td>0.27 (0.09–0.86)</td>
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</table>

ASCRS-Recommendation

- “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, immunosuppression
• 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

Management of Acute Diverticulitis with Abscess After Drainage

• Elective resection should typically be considered 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- however studies have been small, retrospective, single-institution data sets with limited follow-up and lack of time-to-event analysis, and selection bias
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.


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
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

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

Randomized Controlled Trials

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 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).
- HP: high M&M, reanastomosis often not performed, Long LOS.
- 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 the 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


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**Laparoscopic Lavage for Perforated Diverticulitis: A Population Analysis**

- 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**

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

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Resection</th>
<th>Lavage</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>(n = 427)</td>
<td>(n = 2028)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>89(44.3)</td>
<td>199(46.6)</td>
<td>0.59</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>64.8</td>
<td>63.7</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>Outcomes</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>133(6.0)</td>
<td>0.000</td>
</tr>
<tr>
<td>Mortality</td>
<td>210(10.4)</td>
<td>174(0.0)</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 evd 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 taenia coli splay out onto upper rectum

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 wont 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
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 Anastomosis + Diverting Loop Ileostomy better outcomes than Hartmann Procedure
- Laparoscopic Lavage is a promising new technique
- Prospective RCT data needed
- To avoid recurrences, ensure use the rectum for

Thank You