

## Changing Concepts in the Surgical Management of Perforated Sigmoid Diverticular Disease

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Medical Center

مرحبا بكم

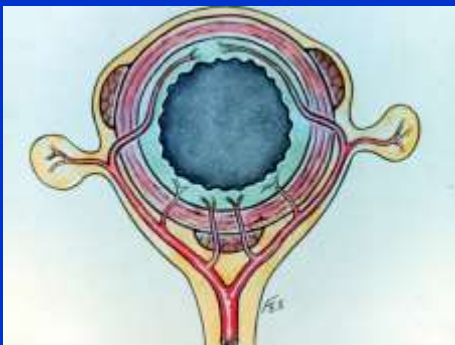


# Disclosures

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



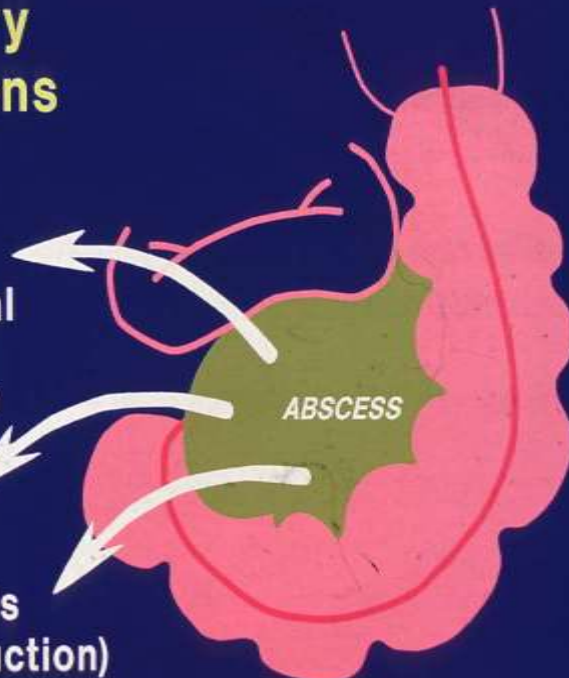
## Inflammatory Complications

Peritonitis  
local, general

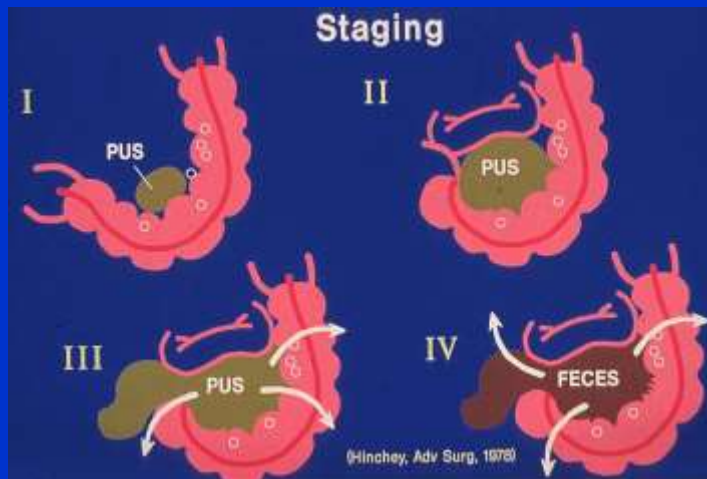
Free perforation

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



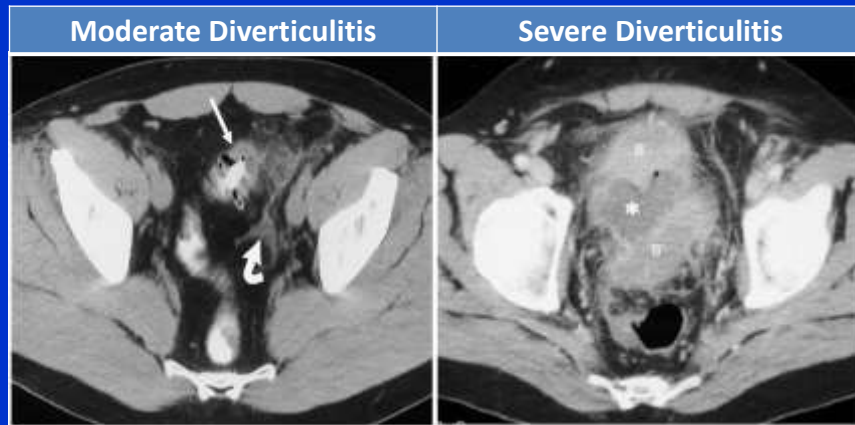
## Ambrosetti CT Classification of Diverticulitis

Moderate Diverticulitis	Severe Diverticulitis
Localized thickening of colonic wall $\geq 5\text{mm}$	Moderate findings PLUS
Signs of inflammation in pericolonic fat	Abscess +/- extraluminal air +/- contrast extravasation

Ambrosetti et al, Br J Surg 1997



## Ambrosetti CT Classification of Diverticulitis



Horton et al, RSNA 2000



## Phlegmon versus Abscess on CT

Phlegmon



Kircher et al, Am J Roentgenol 2002

Pelvic Abscess



Soumian et al, World J Gastroenterol 2008



## Classification Acute Diverticulitis Modified Hinchey

### Hinchey 0

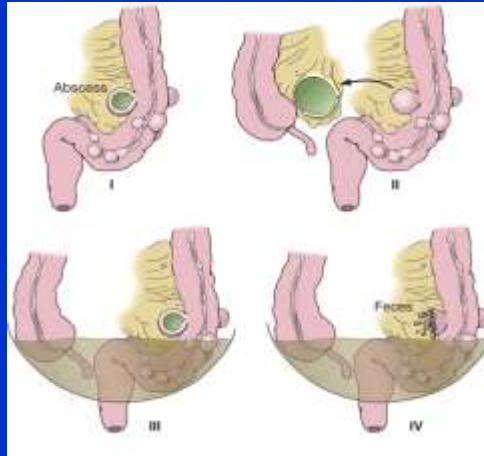
Uncomplicated  
diverticulitis  
(clinical diagnosis)

### 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



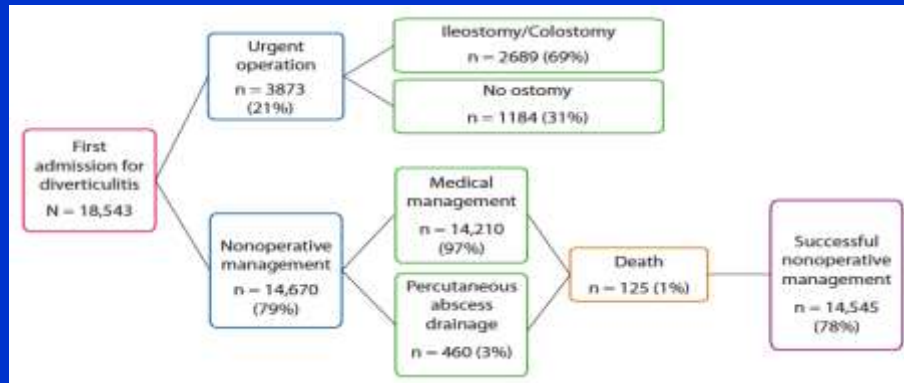
## Modified Hinchey Classification of Diverticulitis

- 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



DCR 2014



## 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

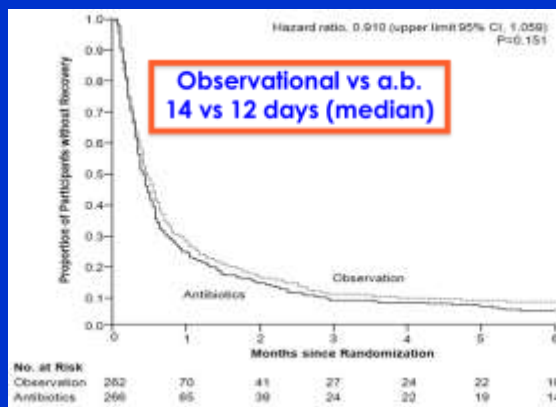
ChaBok A, Pahlman L, Hjern F, et al  
Br J Surg 2012



## 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

No differences  
in outcome



- **DIABOLO (570 patients, 1a-b):** a.b. can be omitted without short and long term repercussions

No differences  
in outcome



## 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

Intravenous:	Oral:
Piperacillin – Tazabactam Carbapenems 3 <sup>rd</sup> Generation Cephalosporins	Ciprofloxacin/Levofloxacin Metronidazole

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



## Outpatient Versus Hospitalization Management for Uncomplicated Diverticulitis

*A Prospective, Multicenter Randomized Clinical Trial (DIVER Trial)*

- 132 pts randomized *after CT diagnosis*
- One shot iv ab

TABLE 4. Costs of Treatment for Each Patient (All Number Are Values in Euros)

	Hospitalization Group 1		Outpatient Treatment Group 2		Costs Saving	
	Cost	Total	Cost	Total	Cost	Total
Physician	75.87	141.89*	95.25	164.77*	21.38	22.88*
Nurse	58.74		58.74		0.00	
Personal variable	0.28		18.78		1.50	
Medical supplies	3.20	5.51	3.20	5.51	0.00	0.00
Variable	0.51		8.31		0.00	
Drugs	27.74	28.40	0.31	8.81	19.43	28.59
Variable	1.66		0.99		1.27	
Diagnostic tests	118.53	337.60	318.53	337.00	0.00	0.00
Variable	18.47		18.47		0.00	
Bed cost	285.831	1063.331	0.00	0.00	285.83	1063.33
Nonmedical personnel, administrative work	94.63	64.63	38.98	30.98	63.65	63.65
Total cost		1671.79		947.05		1124.70

\*Costs in emergency department.  
 †Total cost for 1 day.  
 ‡Total cost calculated according to the mean hospital stay of the group 1.

Biondo et al. Ann Surg  
2013



COLOPROCTOLOGÍA  
BARCELONA



## Acute Management

- The acute management of uncomplicated diverticulitis is non-operative  
 > 95% Success Rate
- No reasonable argument for primary surgical intervention in the 21<sup>st</sup> 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

Treatment		Effect on disease outcome	Level of evidence*
In-patient vs out-patient		No difference, out-patient cheaper	1b
Diet restrictions		No difference, earlier recovery with full diet	2b
Antibiotics		No difference, without antibiotics shorter stay	1a

\* 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/Ia

- 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



## 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)

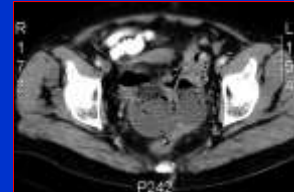




## Acute Diverticulitis HINCHEY II



- *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. Eur Radiol 2002  
Ambrosetti P et al. DCR 2005  
Vennix et al CRD 2014



## Percutaneous Drainage versus Antibiotics Depends on Abscess Size

Study	Average abscess size amenable to antibiotic treatment alone
Brandt et al, DCR 2006	4cm
Siewart et al, Am J Roent 2006	3cm
Kumar et al, DCR 2006	4cm



## 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



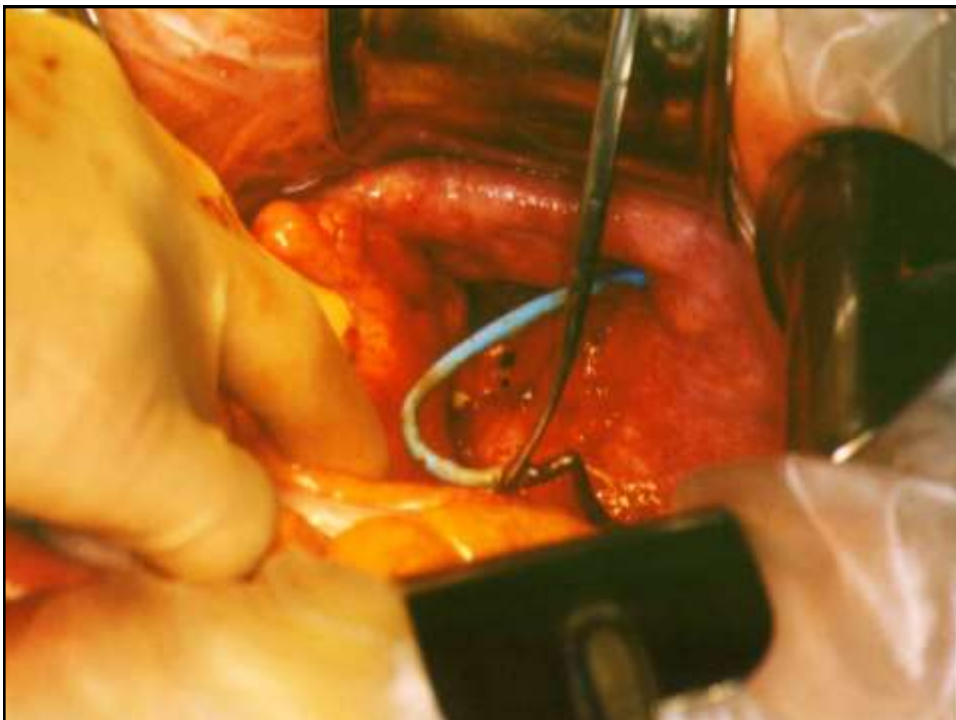
## Duration of Percutaneous Drainage

- 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



## **Practice Parameters 2014 American Society of Colon & Rectal Surgeons**

**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”**

- a) “Next Time You Will Perforate”
- b) Recurrent episodes
- c) Doesn't respond as well to antibiotics

**“Aggressive Approach Needed”**

- a) 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

# 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



# 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



# 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



## Practice Parameters 2014 American Society of Colon & Rectal Surgeons

Routine elective resection based on young age (<50 years) is no longer recommended.

### Grade of Recommendation:

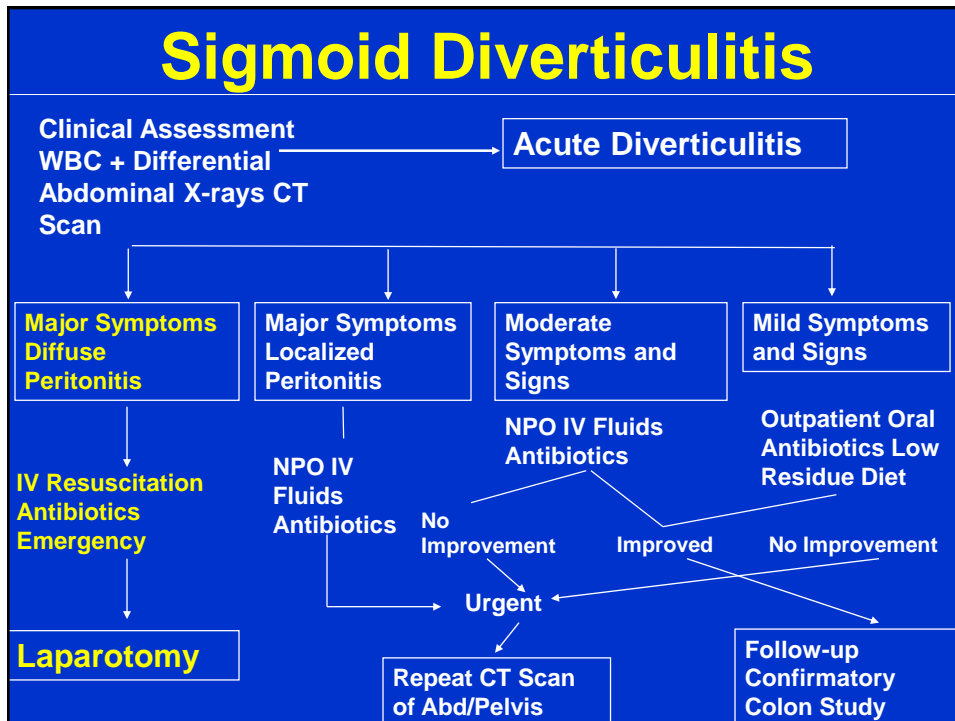
Strong recommendation based  
on low-quality evidence



## Management of Diverticulitis


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





## 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



## Practice Parameters 2014 American Society of Colon & Rectal Surgeons

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



## How Many Episodes Before Surgery?

“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

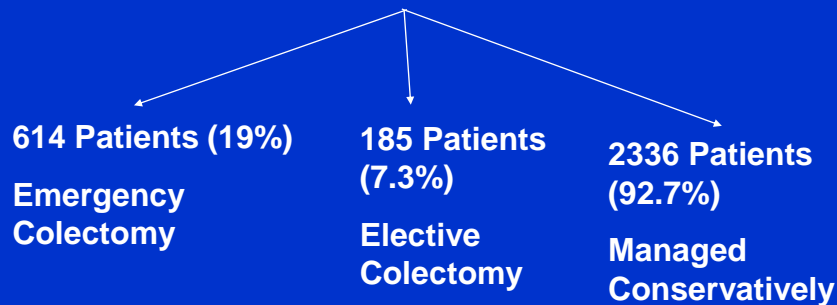


# Sigmoid Diverticulitis

## Kaiser Permanente Los Angeles

3165 Patients (Mean follow-up: 8.9 yrs)

Hospitalized with acute diverticulitis

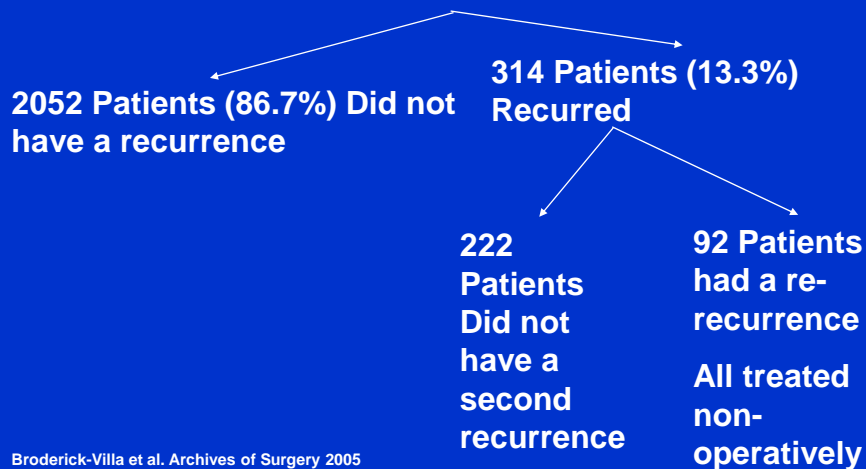


Broderick-Villa et al. Archives of Surgery 2005



# Sigmoid Diverticulitis

2366 Pts managed conservatively 1<sup>st</sup> attack



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



**“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).



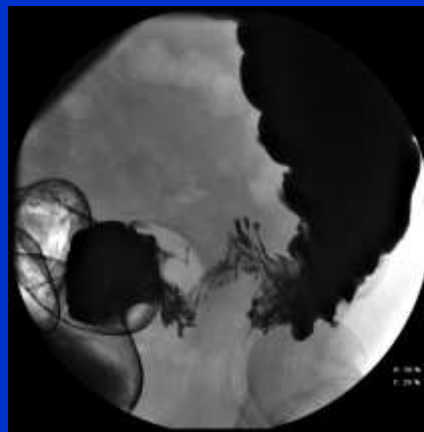
## Management of Diverticulitis

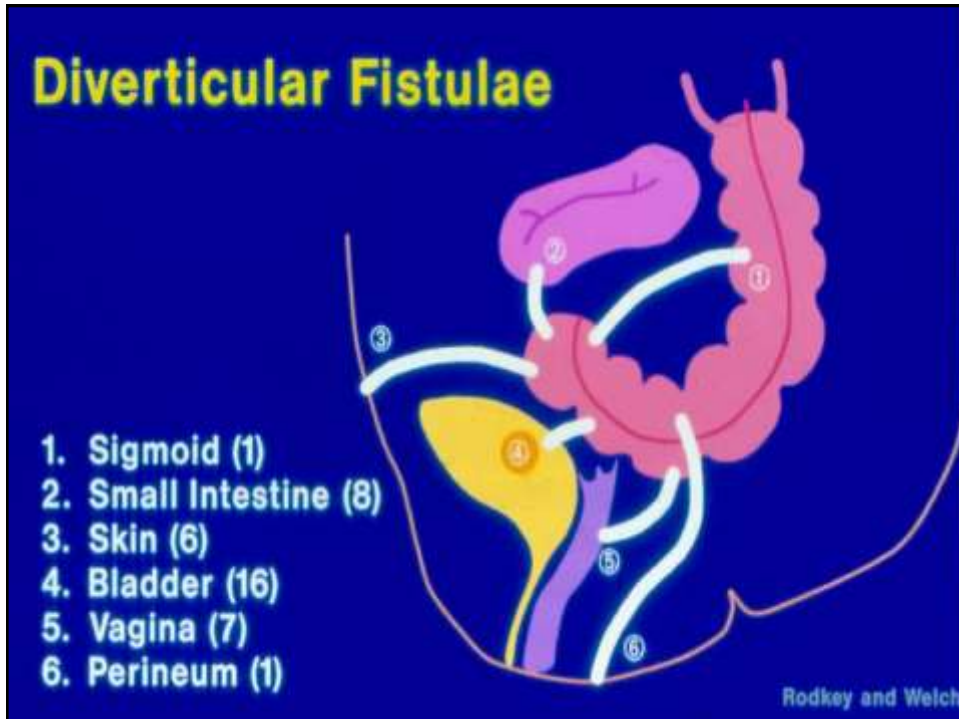
- When to operate
- **When to resect**
- When to anastomose



## 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

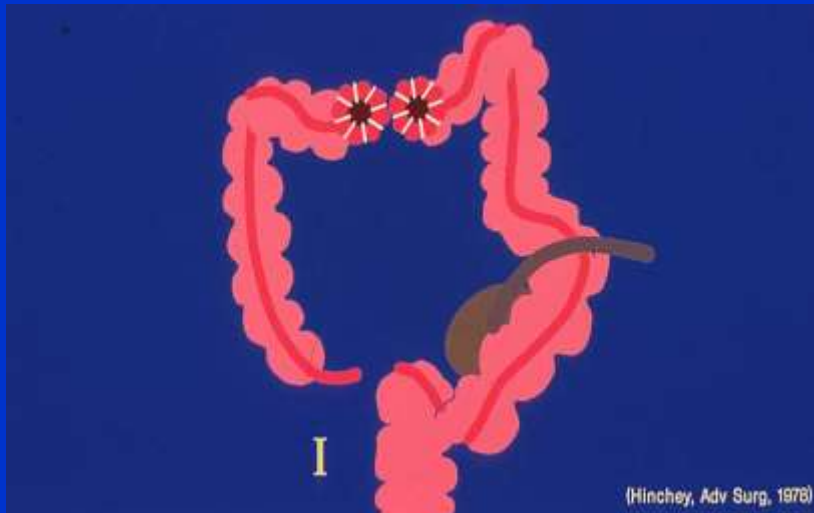


**“ In those cases in which an abscess or perforation has developed, immediate colostomy well above the affected area is the best treatment”**

**H.E. Lockhart-Mummery  
1928**



## Perforated Diverticular Disease Surgical Options



(Hinchey, Adv Surg, 1978)





## **Perforated Diverticular Disease**

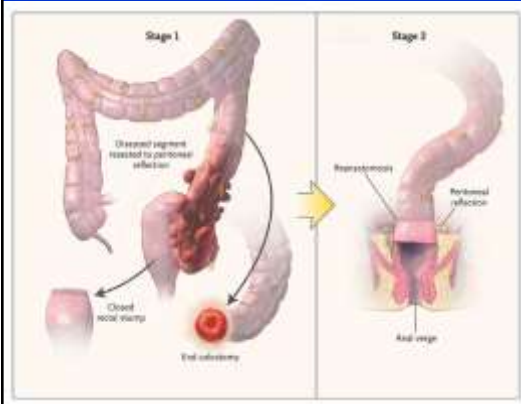
**Nouveau procede d'ablation des cancers de la  
partie terminale du colon pelvien.**

**Tritium congres Franscais de Chirurgie,  
Strasbourg, Association Fracaise de Chirurgie,  
Proces Verbaux, Momoires et Discussions,  
Felix Alcan, Parils,  
1921:411**





# 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

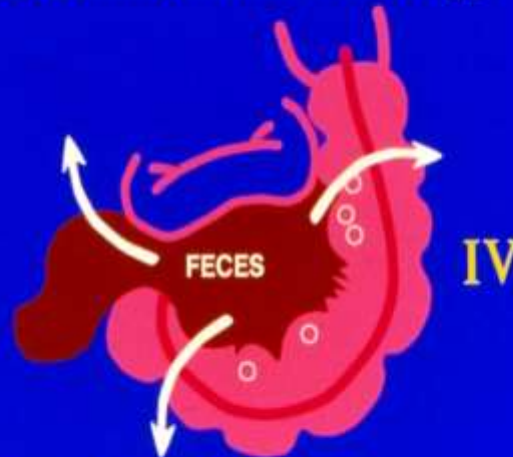
with permission; Jacobs D. N Engl J Med 2007;357:2057-2066, Copyright© 2007 Massachusetts Medical Society, all rights preserved

*Aydin et al, Dis Colon Rectum, 2005*



## PERFORATED DIVERTICULAR DISEASE Recommended Therapy

Stage IV

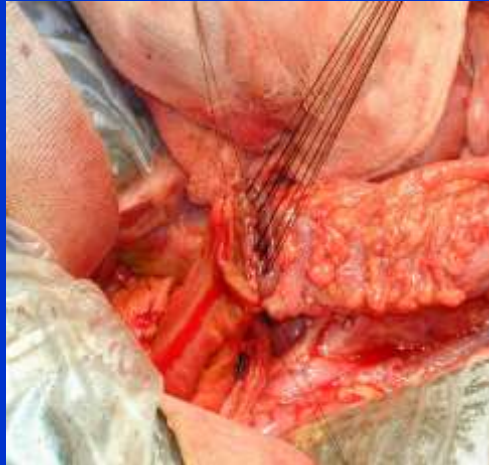


**Resection or Exteriorization Mandatory**  
**No Anastomosis**

(Hinchey, Adv Surg. 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

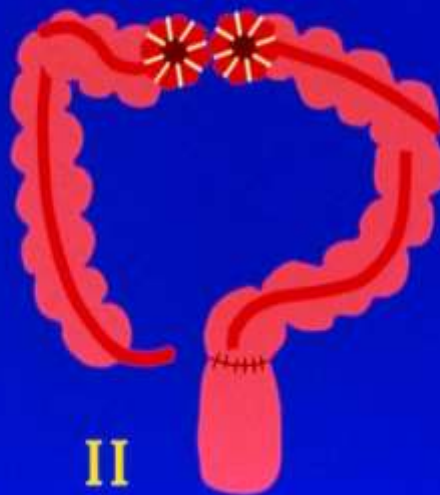


## Perforated Diverticular Disease

What is the current status of primary resection and anastomosis with diverting stoma?



### PERFORATED DIVERTICULAR DISEASE Surgical Options



(Hinchey, Adv Surg, 1978)

## Hartmann Procedure vs Primary Anastomosis

	Hartmann +reversal	Primary Anastomosis (+/-stoma)
Overall mortality	19.6%	9.9%
Wound infection	29.1%	9.6%
Anastomotic leak	4.3%	13.9%

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

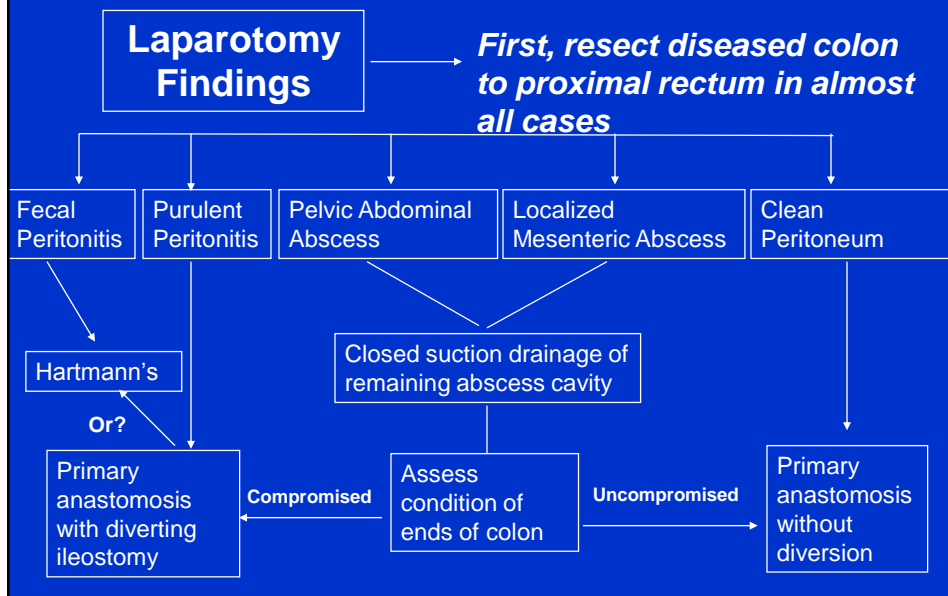


## Hartmann Procedure vs Primary Anastomosis

- 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



## **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!**

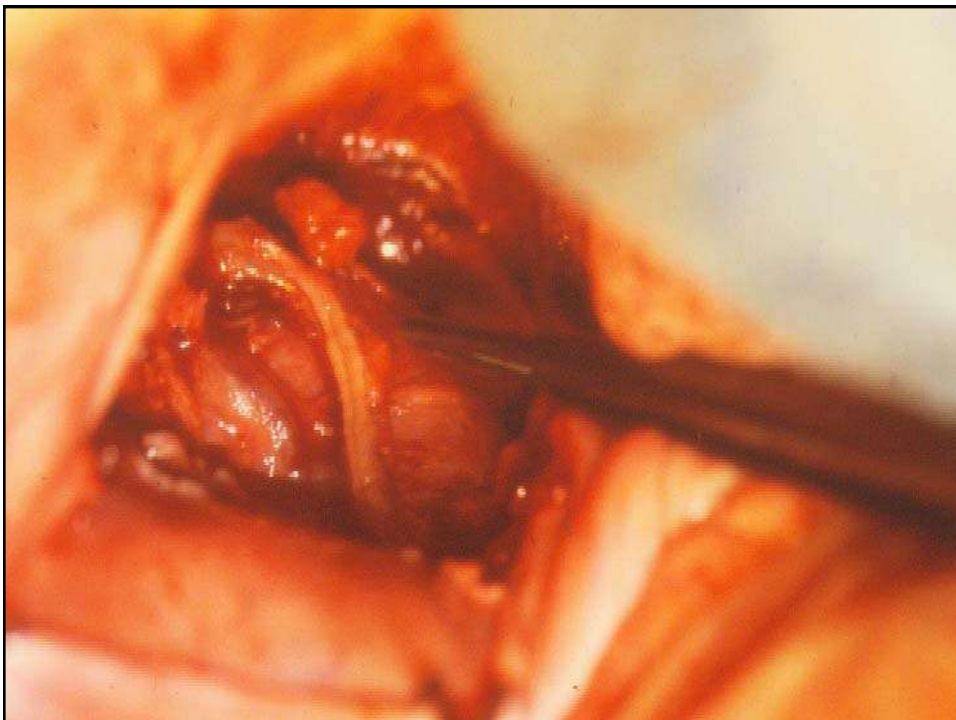


# Sigmoid Diverticulitis

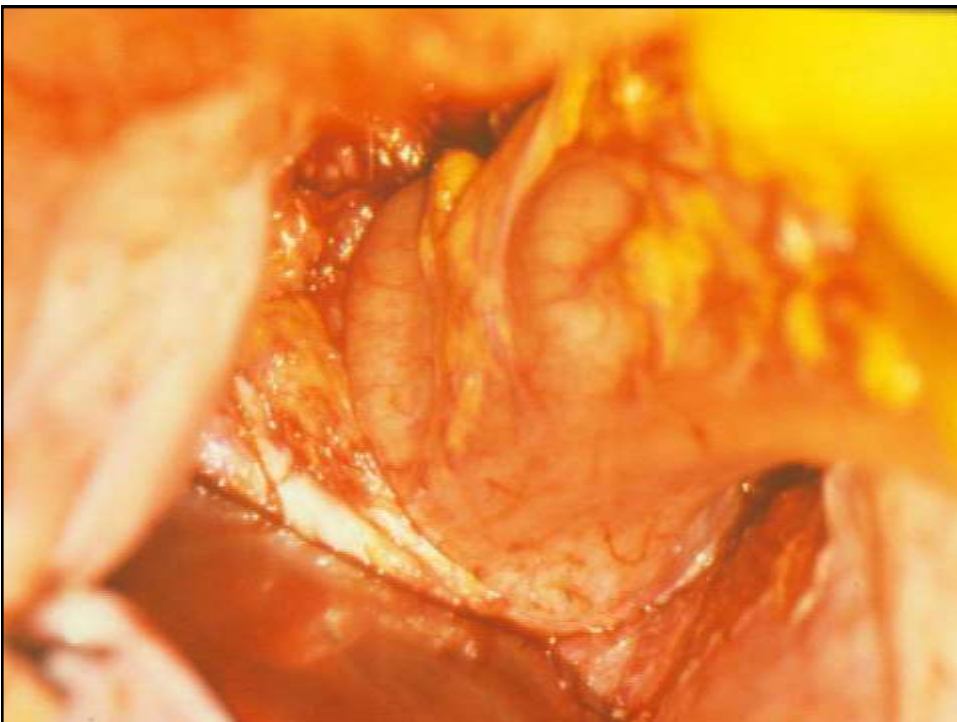
## ANASTOMOSIS?

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

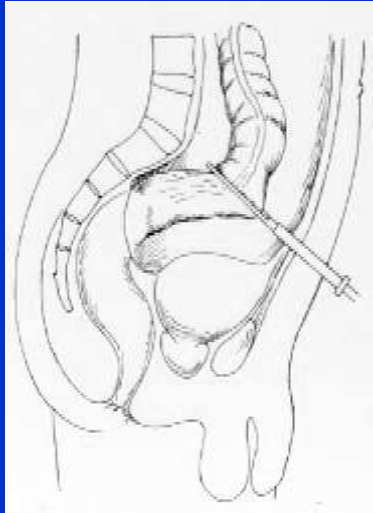
**Following resection, the decision to restore bowel continuity must incorporate patient factors, intraoperative factors, and surgeon preference.**

**Grade of Recommendation:**

**Strong recommendation based on low-quality evidence**



## Perforated Diverticular Disease



## 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

	Hand-Assisted (N=33)	Lap (N=33)	PValue
Op Time (Minutes)	175	208	0.02
Blood Loss (ML)	211	198	0.07
Incision Size (CM)	8.2	6.1	<0.01
Length of Stay (Days)	5.7	5.2	0.55

Marcello et.al  
DCR 2008



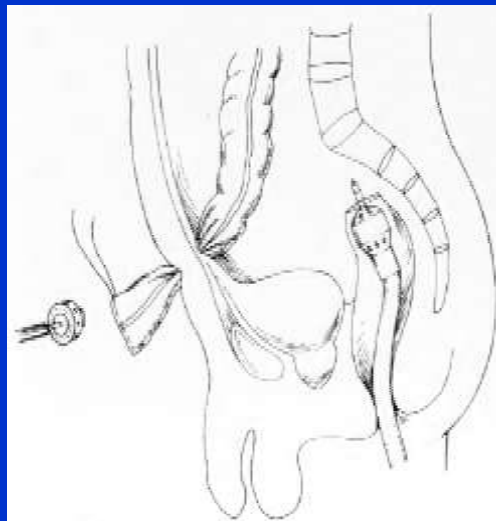
## Practice Parameters 2014 American Society of Colon & Rectal Surgeons

When expertise is available, the laparoscopic approach to elective colectomy for diverticulitis is preferred.

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



## Perforated Diverticular Disease



## **Perforated Sigmoid Diverticular Disease**

**Is laparoscopic colostomy  
takedown reasonable after a  
Hartmann procedure?**



## **Perforated Diverticular Disease**

### **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

	Laparoscopic (N=43)	Open (N=64)	PValue
Op Time (Minutes)	276	242	0.02
Conversion to Open	3		
Hospital Stay (Days)	6.7	10.8	0.001
Post-Op Complication	14%	31%	0.04
Anastomotic Leak	0		0

Yang et. al Anj Surg 84 2014



## Perforated Diverticular Disease

### LAPAROSCOPIC MANAGEMENT OF GENERALIZED PERITONITIS

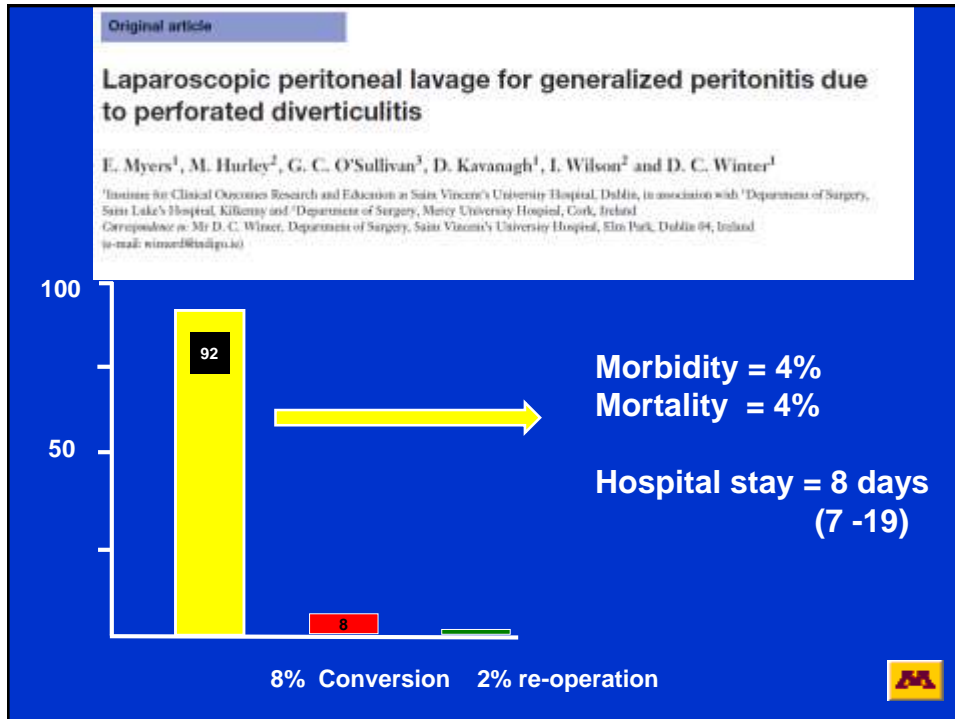

- 8 Patients with purulent peritonitis
- Laparoscopic peritoneal lavage
- No other surgical intervention
- Antibiotics
- Hospital stay – 10 days
- Follow-up 12- 48 months.



O'Sullivan et al AM. J. Surgery , April 1996





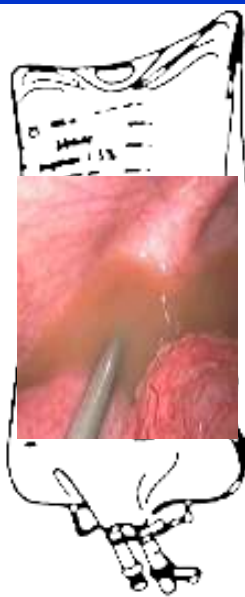
## Laparoscopic Lavage?

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

STUDY/ COUNTRY	# PATIENTS	HINCHEY	TREATMENT OF PERFORATION	LOS	RE- OPERATION	DEATH
O'Sullivan 1996/Ireland	8	3	No	10	0	0
Faranada 2000/France	18	3-4	Biologic glue	8	0	0
Mutter 2006/ France	10	NA	Excludes pts with visible perforation	8.5	1	0
Taylor 2006/ Australia	14	2-4	No	6.5	3	0
Franklin 2008/ USA	40	2-4	Suture used if obvious perforation	8	0	0
Bretagnol 2008/France	24	2-4	No	12	0	0
Myers 2008/ Ireland	100	2-3-4	No	8	1	3



# **Are There Any Prospective Randomized Trials to Evaluate Laparoscopic Washout for Diverticulitis?**



## **Studies of Laparoscopic Washout**

**Ladies Trial**

**Netherlands**

**Lapland Trial**

**Ireland**

**Scandiv Trial**

**Norway**



# Future Directions....

Swank et al. *BMC Surgery* 2010, **10**:29  
<http://www.biomedcentral.com/1471-2482/10/29>



## STUDY PROTOCOL

## Open Access

The ladies trial: laparoscopic peritoneal lavage or resection for purulent peritonitis<sup>A</sup> and Hartmann's procedure or resection with primary anastomosis for purulent or faecal peritonitis<sup>B</sup> in perforated diverticulitis (NTR2037)

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

Swank et al. The Ladies Trial.  
*BMC Surgery* 2010.



## Professor Bemelman







**LOLA**

*purulent peritonitis for perforated diverticulitis*  
Laparoscopic LAvage or resection?

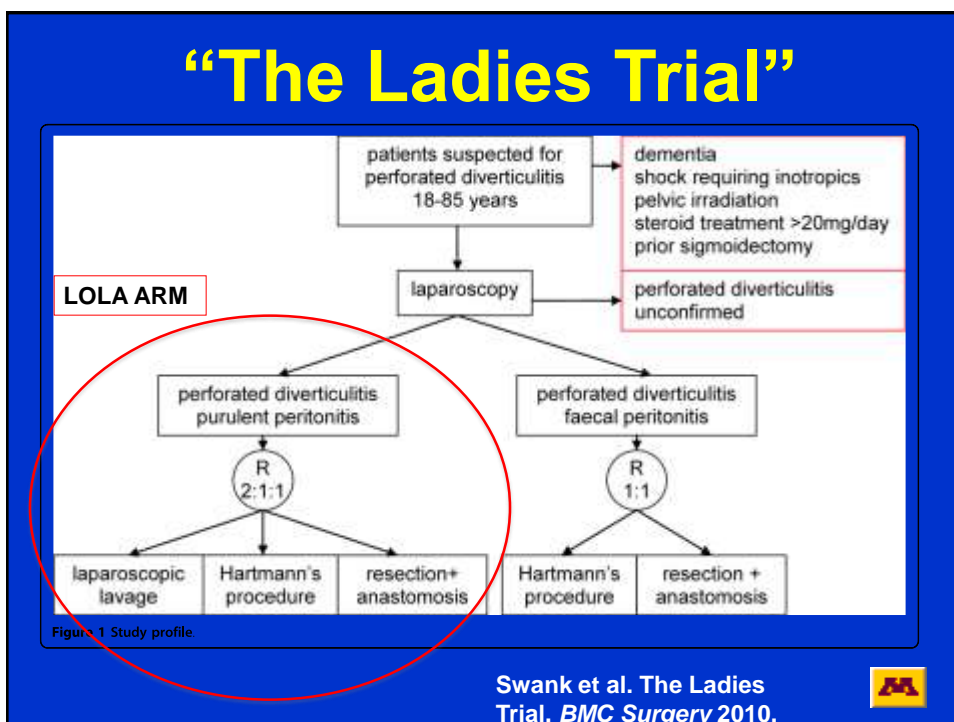


**DIVA**

*faecal peritonitis for perforated **DI**verticulitis*  
Hartmann's procedure or primary Anastomosis?

Vennix et al. Lancet *in press*



## “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

Swank et al. The Ladies Trial. *BMC Surgery* 2010.



## “The Ladies Trial”

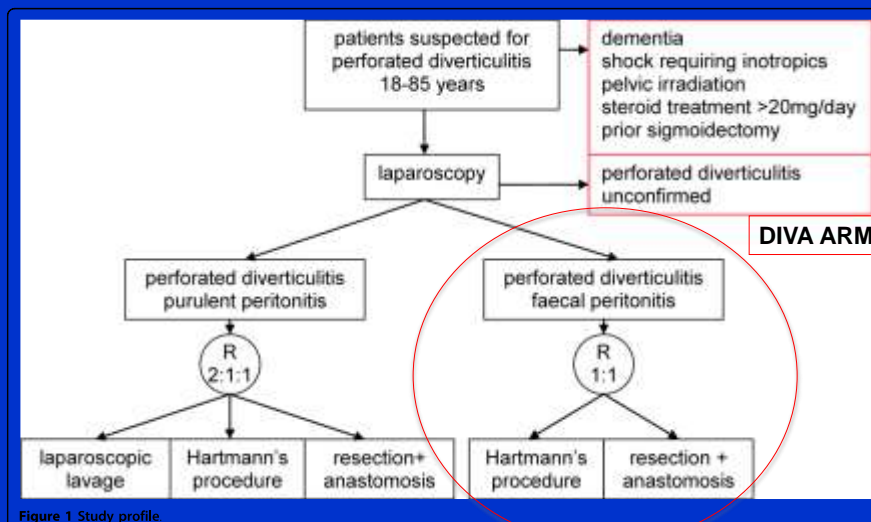
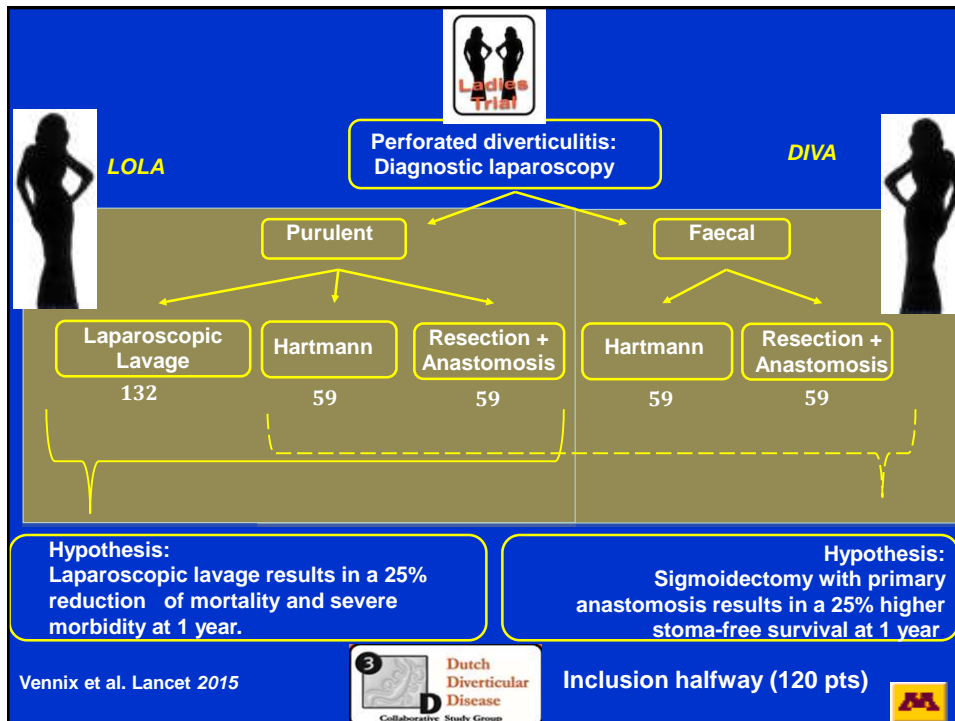


Figure 1 Study profile.

Swank et al. The Ladies Trial. *BMC Surgery* 2010.





## Results LOLA

### Third DSMB at 100 patients

**LOLA STOP**

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

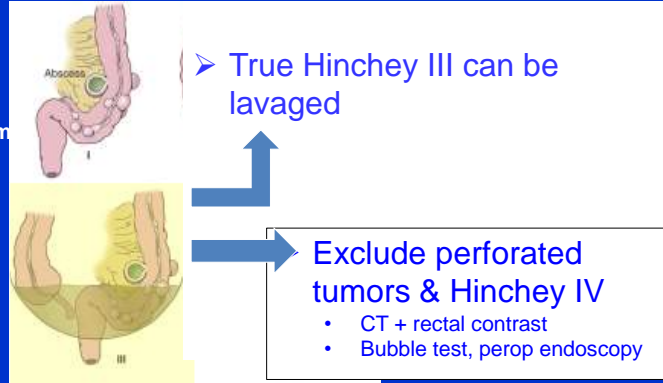
Vennix et al. Lancet *in press*

## 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

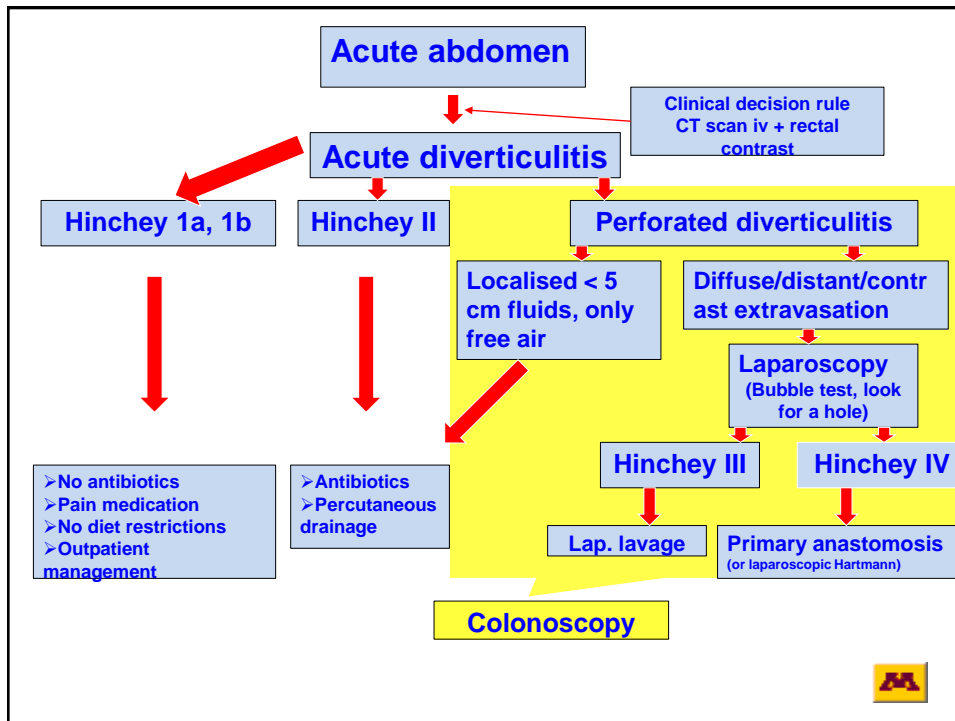


## Management of (perforated) Acute Diverticulitis

- 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







## 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



Leading article doi:10.1111/j.1463-1318.2009.01909.x

## 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!**

**EDITORIAL**

**Complicated Diverticulitis: Are There Indications for Laparoscopic Lavage and Drainage?**

## 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



## **Sigmoid Diverticulitis**

### **RESULTS OF DIVERTICULAR SURGERY DEPENDS ON :**

- Fecal /purulent peritonitis
- Immune status
- Nutritional status



## **Sigmoid Diverticulitis**

### **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



## **Conditions for Safe Anastomosis**

### **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**

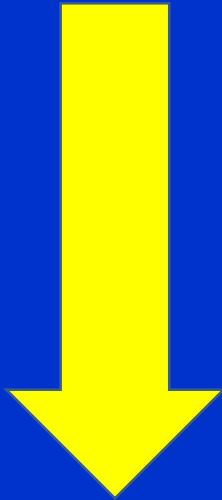
**Judgement !**



**“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  
79<sup>th</sup> Annual Course in  
Colon & Rectal Surgery  
September 14 - 17, 2016**

**For more information, please visit our  
website: [www.colonrectalcourse.org](http://www.colonrectalcourse.org)**



**Immunocompromised  
Patients**

- Solid organ transplant patients
- Chronic corticosteroid users
- Aids patients

J. Gastrointestinal Surg  
2014; 18:2038-2046





# Nomenclature/Grading

## • Hinchey

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



## Prognostic Value of Ambrosetti CT Classification of Diverticulitis

- **Prospective evaluation of 423 patients**
  - Ambrosetti et al, Br J Surg 1997
- **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

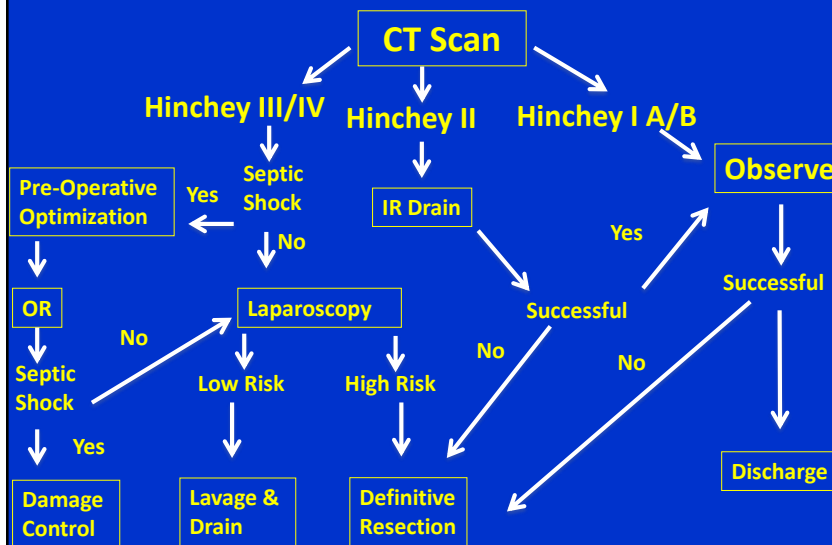


## Complicated Diverticulitis: Laparoscopic Data

- 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)*

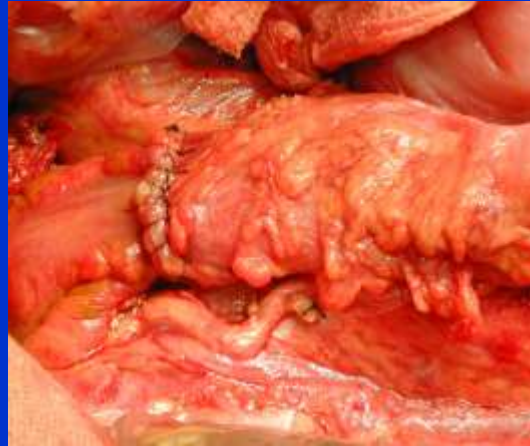


## Clinical Diagnosis



# When to Anastomose

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



## A tailored approach to perforated diverticulitis

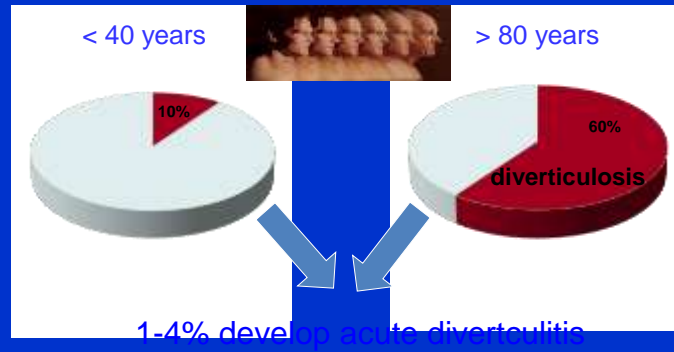


Willem Bemelman

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



Shahedi et al. Gastro 2012  
Shahedi et al. Clin Gastro Hep 2013





## Lavage failures



**LOLA**

### 46 lavages

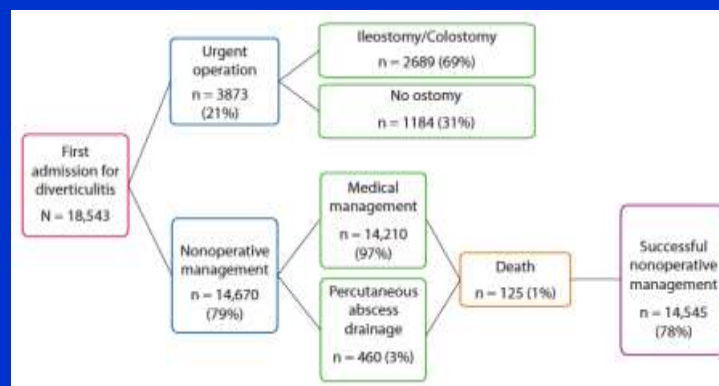
- Short term (n=11, 24%) 6 (13%) Hinchey IV  
1 (2%) perforated cancer
- Long term (n=11, 24%) 6 (13%) ongoing complaints  
4 (7%) cancers

Optimise identification of  
perforated colorectal cancer and Hinchey IV



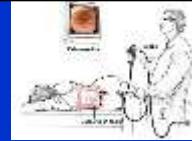
## Evolving Practice Patterns in the Management of Acute Colonic Diverticulitis: A Population-Based Analysis

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

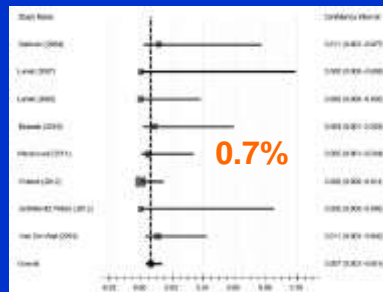


Li D et al. CDR 2014

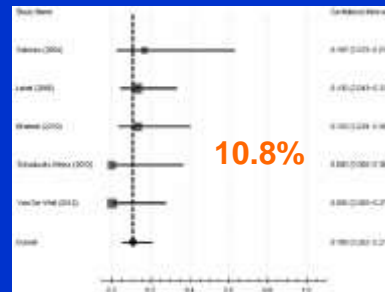
# Systematic Review and Meta-analysis of the Role of Routine Colonic Evaluation After Radiologically Confirmed Acute Diverticulitis



## uncomplicated



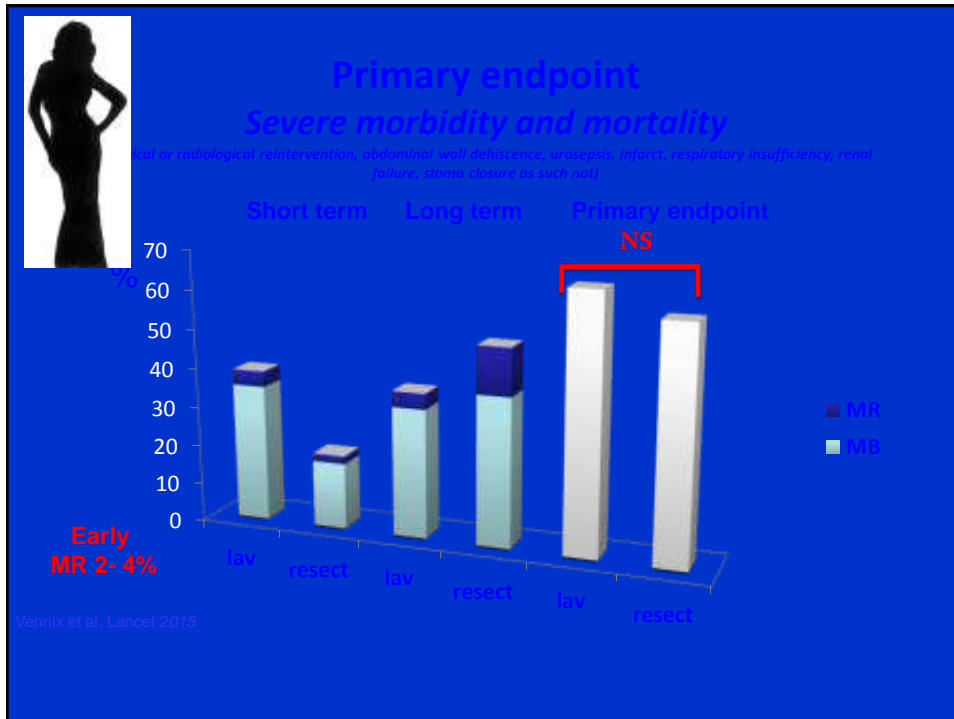
## complicated



In the absence of other risk factors is colonoscopy not indicated in uncomplicated diverticulitis

Sharma P. Ann Surg 2014





### Costs

#### LOLA arm Ladies trial

	Mean Costs gb (£)	Mean Costs gb (£)	Mean difference gb (£)
<b>Index admission</b>			
Index surgery	2 074	3 110	-1 036
Stomach wound	7 870	7 517	-137
Intensive care unit	5 505	6 185	-680
Additional imaging	253	214	40
Transfusion	35	88	-51
Subtotal index admission	<b>18 276</b>	<b>17 131</b>	<b>-1 145</b>
<b>Readmission and interventions</b>			
Acute reinterventions	1 170	628	542
Elective reinterventions	874	190	784
Readmission ward	4 343	3 898	445
Readmission ICU	285	150	129
Transfusion	14	0	14
Subtotal readmission and interventions	<b>6 786</b>	<b>4 876</b>	<b>1 910</b>
<b>Stoma related costs</b>			
Stoma care	1 019	1 635	-1 636
Reversal surgery	396	1 806	-1 411
Reversal ward admission	269	2 025	-1 670
Reversal ICU admission	9	104	-104
Subtotal stoma related costs	<b>1 793</b>	<b>5 570</b>	<b>-3 777</b>
<b>Other</b>			
Imaging	89	108	-19
Consultations	827	886	-59
Travel expenses	25	27	-2
Home care	614	409	205
Indirect costs	843	541	302
Production losses	1 733	4 520	-2 787
<b>TOTAL costs (£2 months)</b>	<b>27 077</b>	<b>33 359</b>	<b>-6 282</b>

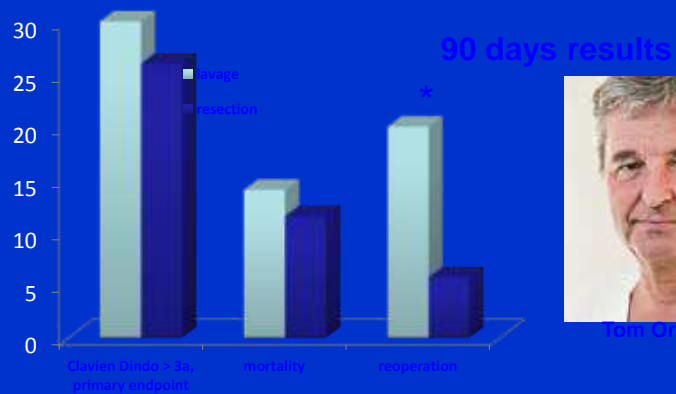
Vennix et al. Submitted

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

Shorter hospital stay	7 vs 9 days (scopy vs open)
Mortality	3% vs 4%
Morbidity	44% vs 66%
Costs	laparoscopy 8000 € cheaper (due to ICU days)

Varma et al. submitted

Registration  
cohort Ladies



Schultz et al JAMA 2015



Tom Oresland



## 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 : 2 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

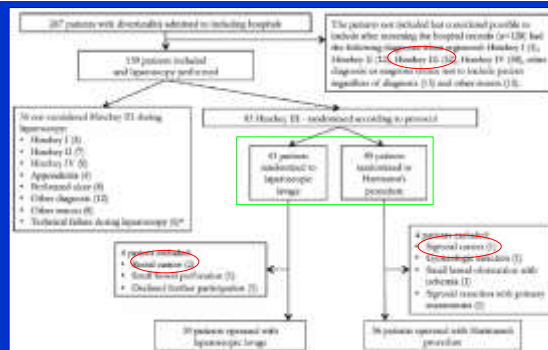
Registration  
cohort LADIES



Vermeir et al. submitted



## Laparoscopic Lavage Is Feasible and Safe for the Treatment of Perforated Diverticulitis With Purulent Peritonitis The First Results From the Randomized Controlled Trial DILALA



**DILALA**

Failure 13%

↓  
17%

Conclusions valid?

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

Angenete et al. Ann Surg 2015

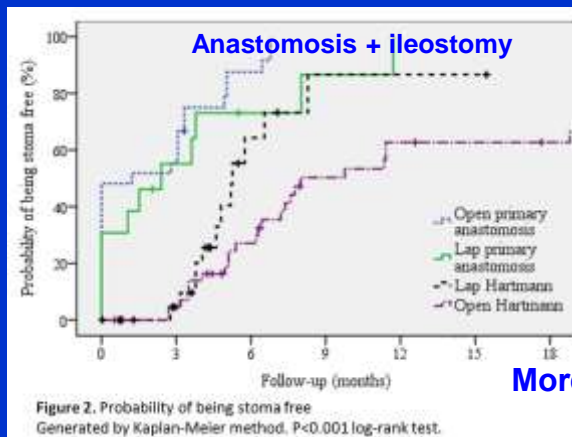


Acute laparoscopic and open sigmoidectomy for perforated diverticulitis; a propensity score-matched cohort

### Stoma closure



Registration  
cohort Ladies



Lap. Hartmann's

Open Hartmann's

More lap Hartmann's closed  
80 vs 60%

Herms et al. submitted

## Diagnosis of acute diverticulitis imaging (CT vs US)

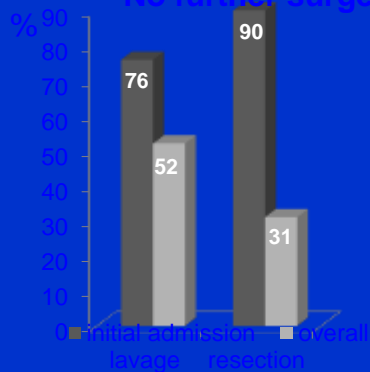
Study/year	Patients with diverticulitis		Patients without diverticulitis		Sensitivity <sup>2</sup>	Specificity <sup>2</sup>	Positive likelihood ratio <sup>3</sup>	Negative likelihood ratio <sup>3</sup>
	TP	FN	TN	FP				
<b>Ultrasound</b>								
Nofzueck, 1989 [20]	44	8	87	14	0.85 (0.44-1.0)	0.98 (0.77-1)	4.3 (0.85-20)	0.19 (0.15-0.90)
Schrock, 1991 [29]	73	1	84	3	0.99 (0.74-1)	0.97 (0.48-1)	28.6 (1.94-0.0)	0.01 (0.01-0.97)
Zetke, 1997 [31]	62	32	64	5	0.64 (0.24-1)	0.93 (0.48-1)	11.6 (0.84-0.0)	0.17 (0.16-0.97)
Pradl, 1997 [32]	28	3	26	3	0.95 (0.28-1)	0.94 (0.37-1)	5.3 (0.80-0.36)	0.19 (0.19-0.84)
Garcia-Aguayo, 2002 [34]	42	0	35	1	0.95 (0.25-1)	0.79 (0.25-1)	3.9 (0.80-0.20)	0.24 (0.19-0.79)
Faring Schmidt, 2004 [33]	43	0	29	0	1.00 (0.43-1)	1.00 (0.43-1)	N/A	N/A
Summary estimate (95% CI) <sup>2</sup>					0.92 (0.89-0.97)	0.98 (0.92-0.99)	8.6 (5.0-19.6)	0.09 (0.04-0.23)
<b>Computed tomography</b>								
Cho, 1990 [35]	28	2	29	0	0.93 (0.25-1)	1.00 (0.29-1)	N/A	0.07 (0.07-1.00)
Domingo, 1990 [30]	28	1	8	3	0.99 (0.21-1)	0.73 (0.12-1)	3.8 (0.99-0.25)	0.06 (0.05-0.73)
Pradl, 1997 [33]	18	1	24	3	0.91 (0.33-1)	0.77 (0.24-1)	4.0 (0.99-0.23)	0.12 (0.09-0.77)
Sofman, 1997 [37]	36	0	36	0	0.99 (0.36-1)	1.00 (0.36-1)	N/A	0.31 (0.31-1.00)
Itai, 1998 [36]	62	2	86	0	0.97 (0.24-1)	1.00 (0.36-1)	N/A	0.03 (0.03-1.00)
Warner, 2003 [34]	65	2	52	1	0.95 (0.85-1)	0.99 (0.25-1)	51.4 (1.97-0.02)	0.03 (0.03-0.90)
Faring Schmidt, 2004 [33]	42	0	29	0	0.98 (0.43-1)	1.00 (0.29-1)	N/A	0.02 (0.02-1.00)
Tack, 2005 [40]	36	1	16	1	0.92 (0.36-1)	0.99 (0.71-1)	45.5 (1.42-0.01)	0.08 (0.08-0.99)
Summary estimate (95% CI) <sup>2</sup>					0.94 (0.93-0.97)	0.99 (0.98-1.00)	76.4 (8.7-766.6)	0.06 (0.03-0.13)
Summary likelihood ratio (95% CI) <sup>3</sup>								

CT better for additional diagnoses

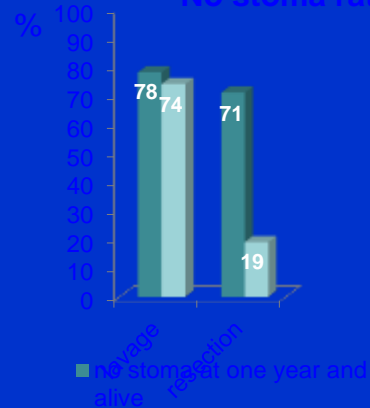
Lamont W et al. Eur Radiol 2008

## Other outcomes .....

No further surgeries



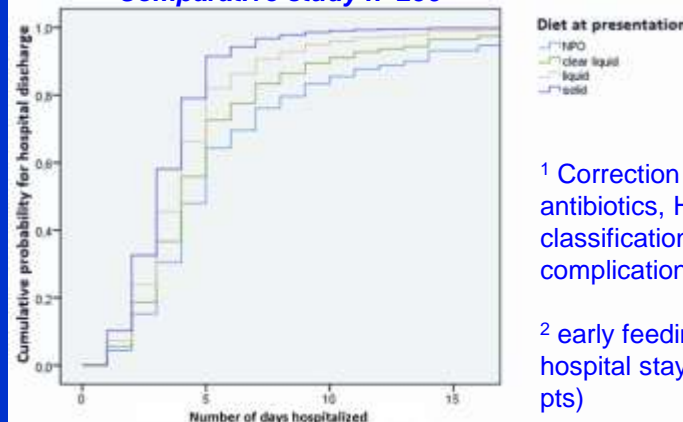
No stoma rates



Vennix et al. Lancet in press

## Uncomplicated diverticulitis dietary restrictions?

Comparative study n=256

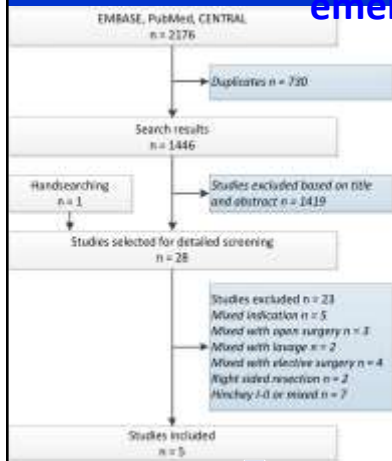


<sup>1</sup> Correction for age, fever, antibiotics, Hinchey classification and complications

<sup>2</sup> early feeding reduces hospital stay and costs (25 pts)

vd Vliet et al. J Clin Med 2015  
v Goleghem et al. Ann Gastro Belg 2013

## descriptive systematic review emergency resection



Laparoscopic better

Publication Bias

Author	Patients (n)	Duration of surgery (min, range)	Conversion rate (n (%))	Length of stay (days, range)	Mortality rate (n (%))	Reoperation rate (n (%))	Length reoperation time (min, n (%))	Rate (n (%))	Median reoperation rate (n (%))
Agarwal (2009)	7	110 (1.36-141)	0 (0-0)	0 (0-20)	2 (28.6)	NA	2 (0)	0 (0)	7.7 (0.00)
Silgert (2007)	13	115 (80-170)	0 (0-0)	0 (0-28)	1 (7.7)	0 (0)	0 (0)	1 (7.7)	Unknown
Choudhary (2007)	30	125 (15-250)	0 (0-0)	12 (5-25)	0 (0-0)	NA	0 (0-0)	0 (0-0)	2.0 (0.00)
Lim et al (2011)	86	101.8 (64.9-147)	0 (0-0)	10.0 (8.0-12.0)	7 (8.1)	NA	0 (0)	0 (0-0)	26.0 (0.00)
Wagman (2009)	12	100 (50-150)	2 (16.7)	10 (5-14)	0 (0-0)	0 (0-0)	0 (0)	0 (0)	NA
TOTAL	104	94 (15-141)	0 (0-0)	10.0 (8.0-12.0)	10 (9.6)	0 (0-0)	0 (0-0)	0 (0-0)	16.7 (0.00)

Wagman et al

## classification acute diverticulitis modified Hinchey's

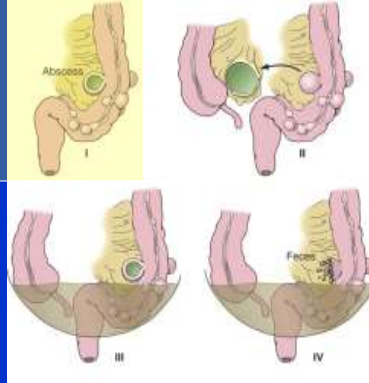
**Hinchey 0**  
Uncomplicated diverticulitis  
(clinical diagnosis)

**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



## Acute Perforated Diverticulitis What Are the Options ?



Purulent peritonitis (Hinchey III)  
"Microscopic perforation"



Faecal peritonitis (Hinchey IV)  
"Macroscopische perforation"



- Antibiotics + drainage
- Laparoscopic lavage
- Resectional surgery



- Hartman's
- Resection and anastomosis
- Laparoscopic approach

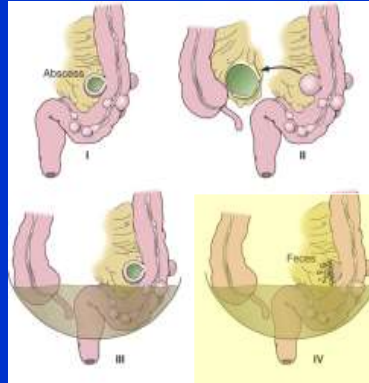


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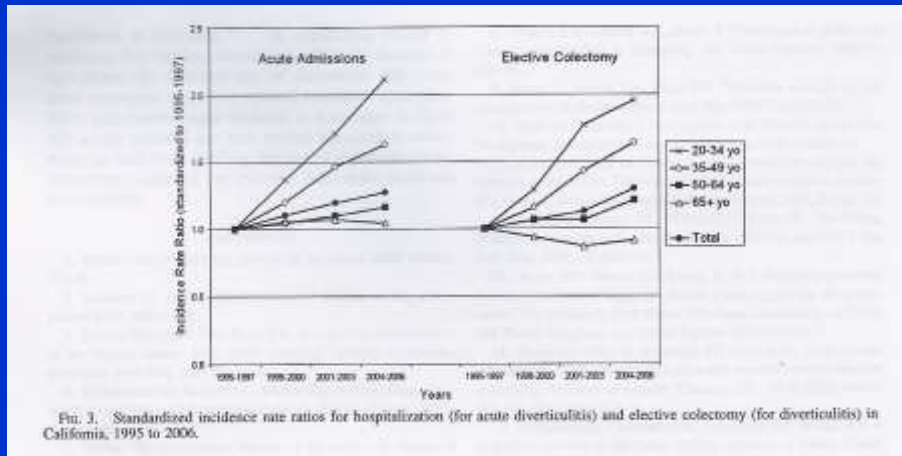


## Principles of Safe Resection in Acute Diverticulitis

Experienced team  
Adequate assistance  
Headlight  
Modified lithotomy position  
Ureteral catheters



## Increase in Colectomy and Hospitalization Due to Young Patients



*Etzioni et al Am Surg 2009;75:981-985.*



## 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

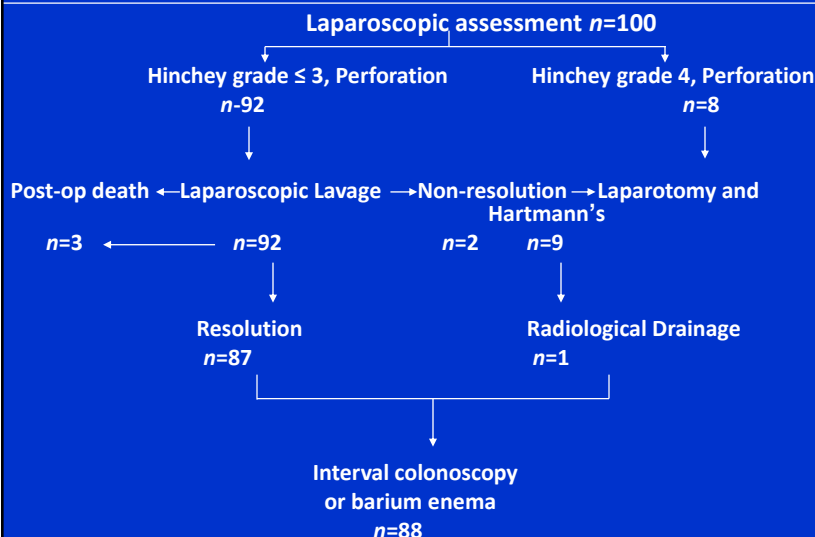
### Laparoscopic Lavage

- 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

Myers et al, Br J Surg 2008; 95: 97



## Perforated Diverticulitis with Peritonitis



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



# Evolving Practice Patterns

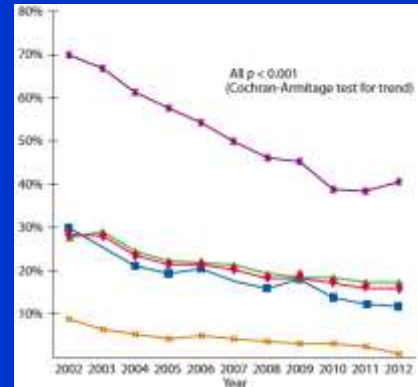
## Admissions



DCR 2014



## % undergoing urgent surgery

All  $p < 0.001$   
(Cochran-Armitage test for trend)

◆ All patients  
 ◆ Young patients <50 yr  
 ◆ Older patients ≥50 yr  
 ◆ Patients with uncomplicated diverticulitis  
 ◆ Patients with complicated diverticulitis (abscess, perforation)

# 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

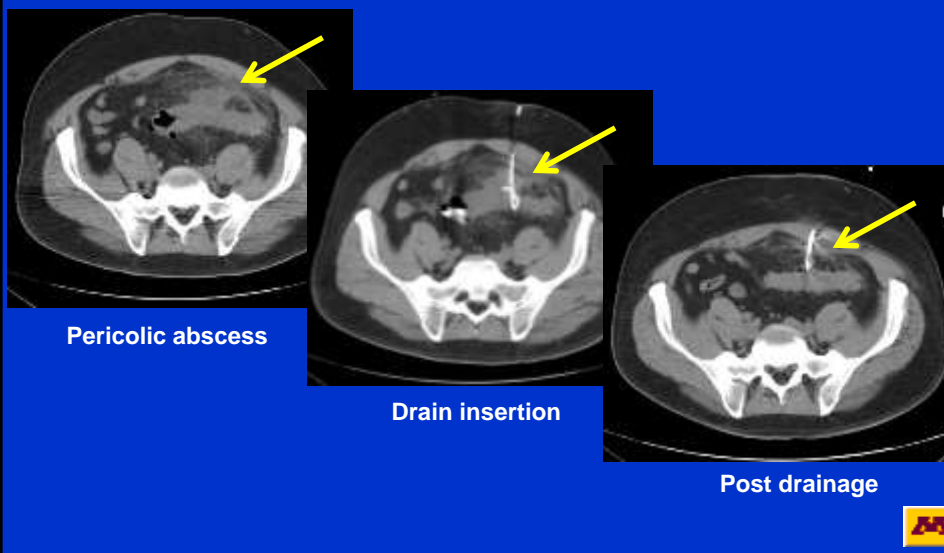


## Patient Prep for CT scan

- 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



## 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



## 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

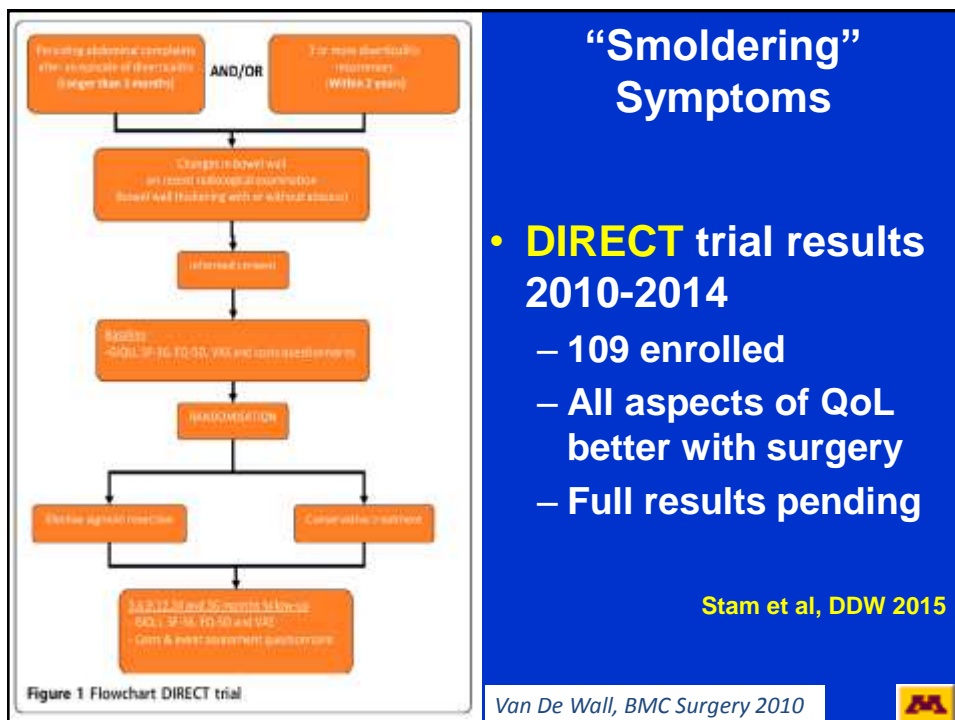
- “Smoldering” symptoms
  - Definition:
    - Chronic left lower quadrant pain
    - No documented history of diverticulitis
    - Diverticulosis
    - No evidence of stricture, abscess, perforation, obstruction
  - Outcomes:
    - 76% had evidence of chronic inflammation in the specimen
    - 88% had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



## Laparoscopic Lavage:

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

Myers E, et al British J Surg 2008; 95:97-101



## Perforated Sigmoid Diverticular Disease

### When is CT Scan Indicated?

- Uncertain diagnosis
- Failure to improve
- Clinical Deterioration
- Suspected abscess





## Practice Parameters 2014 American Society of Colon & Rectal Surgeons

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”**



## 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/Ia

- 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

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

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



## Indications for Percutaneous Drainage in Perforated Sigmoid Diverticulitis

Table 5: Results showing the total number, numbers drained, age, site and size (average for PCD) of abscesses from studies in literature

Name	Total	Drained	Mean age yr (/range)	Site of abscess			Size for PCD (cm)
				Paracolic	Pelvic	Others	
Kumar et al <sup>(20)</sup>	30	12	39	15	5	10	6.5
Stabile et al <sup>(26)</sup>	19	19	63.8	8	9	2	8.7
Kaiser et al <sup>(11)</sup>	99	16	-	74	25	-	7.1
Ambrosetti et al <sup>(4)</sup>	73	19	66.9	45	28	-	6.7
Brandt et al <sup>(16)</sup>	66	34	71	-	-	-	6
Bahadursingh et al <sup>(32)</sup>	25	10	61	9	9	7	-
Siewert et al <sup>(33)</sup>	30	4	54.2	-	-	-	5.9
Neff et al <sup>(26)</sup>	18	16	42-86	2	13	1	> 5
Alvarez et al <sup>(36)</sup>	59	-	64	37	22	-	-

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

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

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





## Exceptions to Non-Op Approach

- Immunosuppressed
- Obstruction
- Fistulas
- Inability to exclude cancer
- Ongoing “grumbling” symptoms
- Increasingly frequent hospitalizations
- “Stiff colon” at colonoscopy
- Life style (live in remote areas etc)



## Exceptions to Non-Op Approach

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- Life style (live in remote areas etc)



## **Perforated Sigmoid Diverticular Disease**

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



## **Perforated Sigmoid Diverticular Disease**

- **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

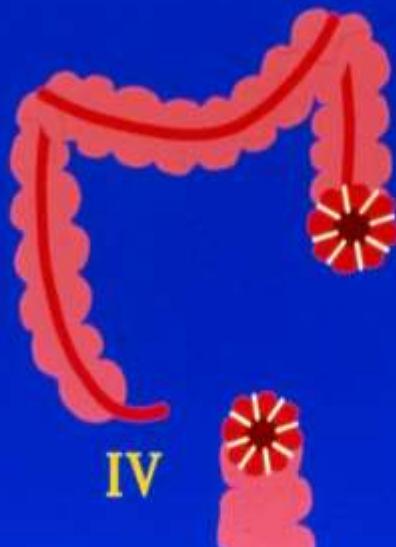
\*\* Salem et al Dis Colon Rectum 2004; 47: 1953

\*\*\* Morris et al, Br J Surg 2008; 95: 876

\*\*\*\* Myers et al, Br J Surg 2008; 95: 97



## PERFORATED DIVERTICULAR DISEASE Surgical Options



(Hinchey, Adv Surg, 1978)

# 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.”**

Thaler, Baig, Berho, et al Determinants of recurrence after sigmoid resection for uncomplicated diverticulitis. Dis Colon Rectum. 2003 March 46(3): 385-388.



# William Halstead

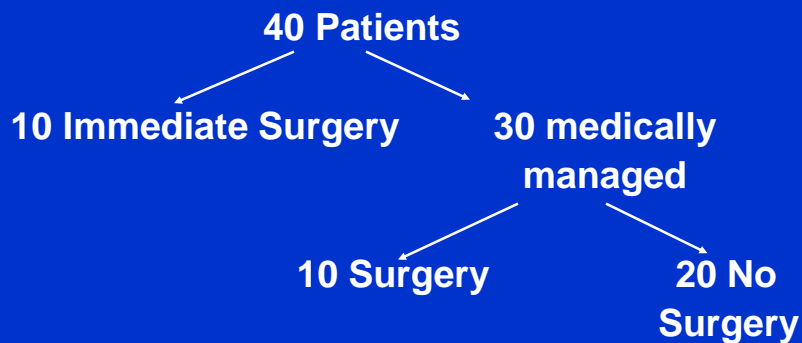


**'Conceptions from  
the past have  
blinded us to facts  
which almost slap  
us in the face'**

Halstead WS  
Johns Hopkins Hosp  
Rep 1894



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



**\*\*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



**WARD O. GRIFFEN, JR.,  
M.D., PH.D**

PROFESSOR OF SURGERY  
UNIVERSITY OF KENTUCKY





# Sigmoid Diverticulitis

## Who does not require surgery?

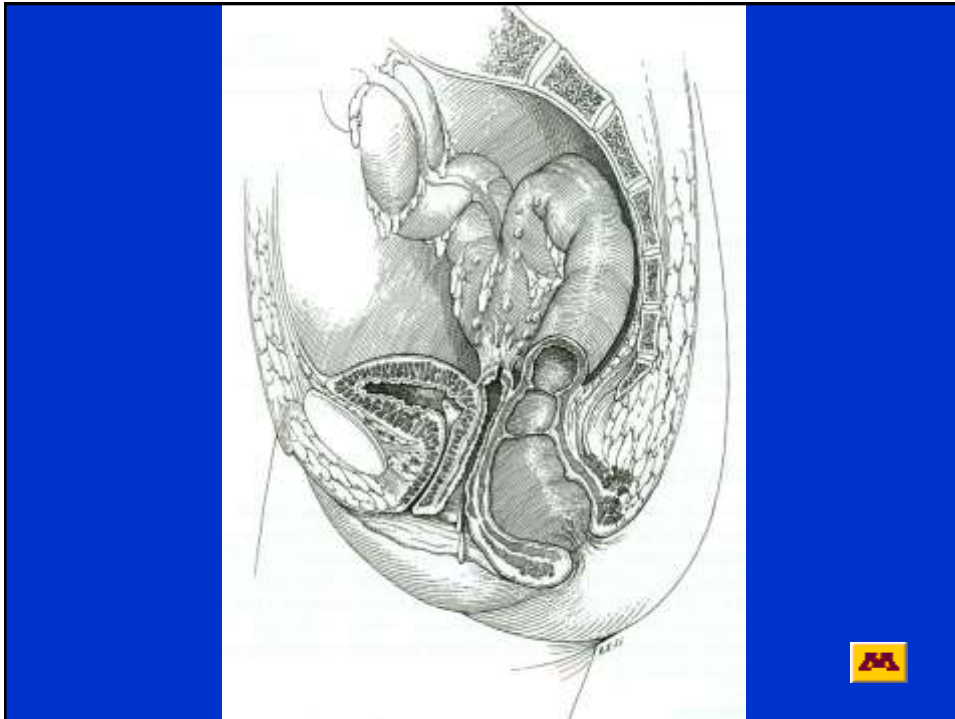
- Young patients with uncomplicated diverticulitis successfully treated medically
- Patients with abscess successfully treated with percutaneous drainage



## 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





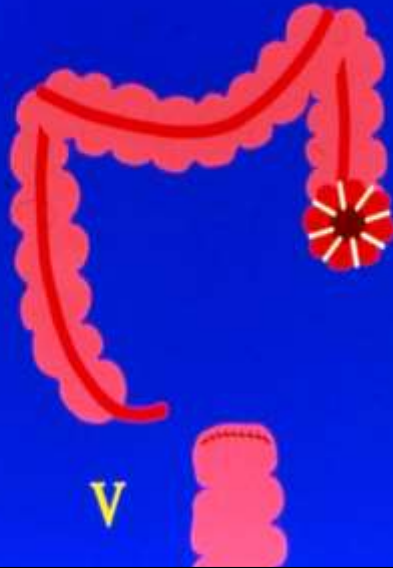
## Cologenital Fistula

Study	Number of patients	Tube	Uterus	Vagina	Prior hysterectomy
Wychulis and Pratt (1966)	11			11	6/11
Woods et al (1988)	26		3	23	19/23
Grissom and Snyder (1991)	9			9	7/9
Tancer et al (1996)	12	1	1	10	10/10
Vasilevsky et al (1998)	21	1		20	20/20
Hjern et al (present study)	60	1	2	57	44/57
<b>Total</b>	<b>140</b>	<b>3</b>	<b>6</b>	<b>131</b>	<b>106 (81%)</b>

Hjern, Goldberg DCR 2006

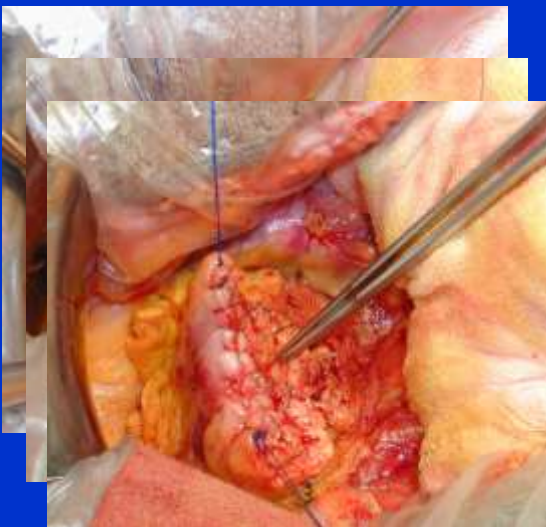


## PERFORATED DIVERTICULAR DISEASE Surgical Options



(Hinchey, Adv Surg, 1978)

## 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%



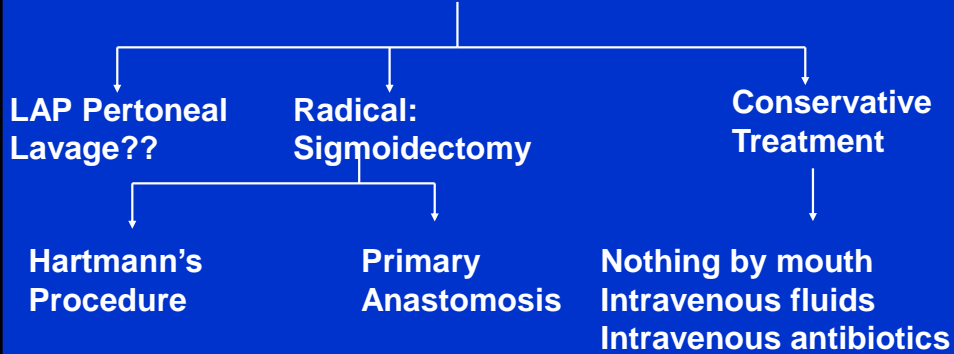
## Traditional Options

### Treatment Options: Perforated Diverticulitis



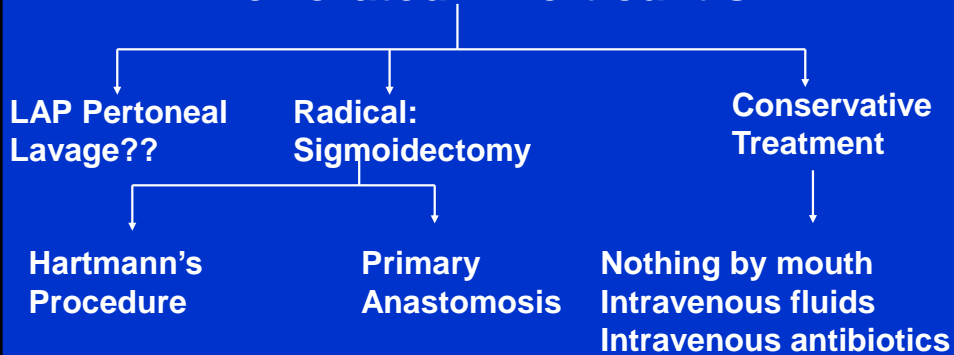
## A New Paradigm?

### Treatment Options: Perforated Diverticulitis



## A New Paradigm?

### Treatment Options: Perforated Diverticulitis



# Sigmoid Diverticulitis

**“THE BOLD SURGEON’S PATIENTS  
TAKE ALL THE RISKS”**

**WARD O. GRIFFEN, JR., MD., PH.D**

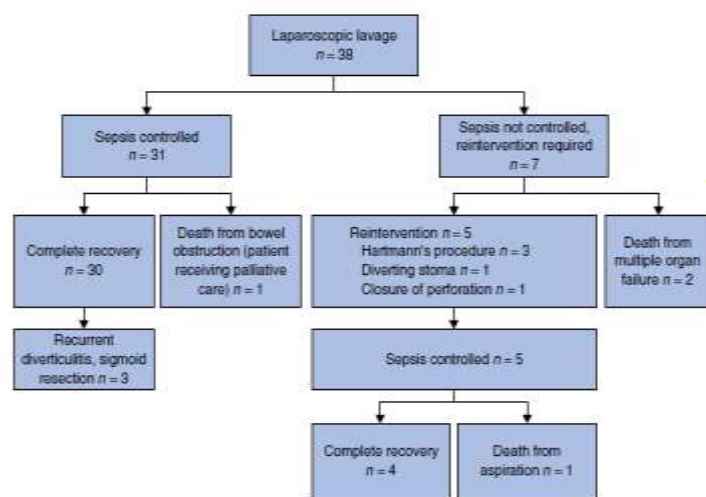
PROFESSOR OF SURGERY  
UNIVERSITY OF KENTUCKY



## Early experience with laparoscopic lavage for perforated diverticulitis

*British Journal of Surgery* 2013; 100: 704–710

H. A. Swank<sup>1</sup>, I. M. Mulder<sup>2</sup>, A. G. M. Hoofwijk<sup>3</sup>, S. W. Nienhuijs<sup>4</sup>, J. F. Lange<sup>2</sup> and W. A. Bemelman<sup>1</sup>, on behalf of the Dutch Diverticular Disease Collaborative Study Group



At  
reoperation,  
2/5 patients  
had feculent  
diverticulitis

