

Future Trends in Diverticular Disease: What is Role of Surgery

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Do not use this man as
reference!!!
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Diverticular Disease

- 65 to 80 percent of population by age 80 years have simple form in US
- 1 to 4 percent develop AD
- 1 in 200 receive operation
- Hinchey 3 or 4 usually undergo resection
- Resection has high morbidity and mortality as high as 27 percent

Historical Diverticulitis

- Colonic diverticulosis acquired disease with age dependent prevalence- 5% at 30 to 60% at 80
- AD occurs in 4 to 25 % of which 8-35% present with perforated disease
- Generalized peritonitis in past surgical emergency
- Hartmann's procedure work horse of disease

Historical Diverticulitis

- 10 percent require surgery
- Hartmann's gold standard for generalized peritonitis secondary to AD
- Hartmann's procedure is morbid – stoma, need reoperation, incidence of incisional hernia, parastomal hernia and failure to close stoma

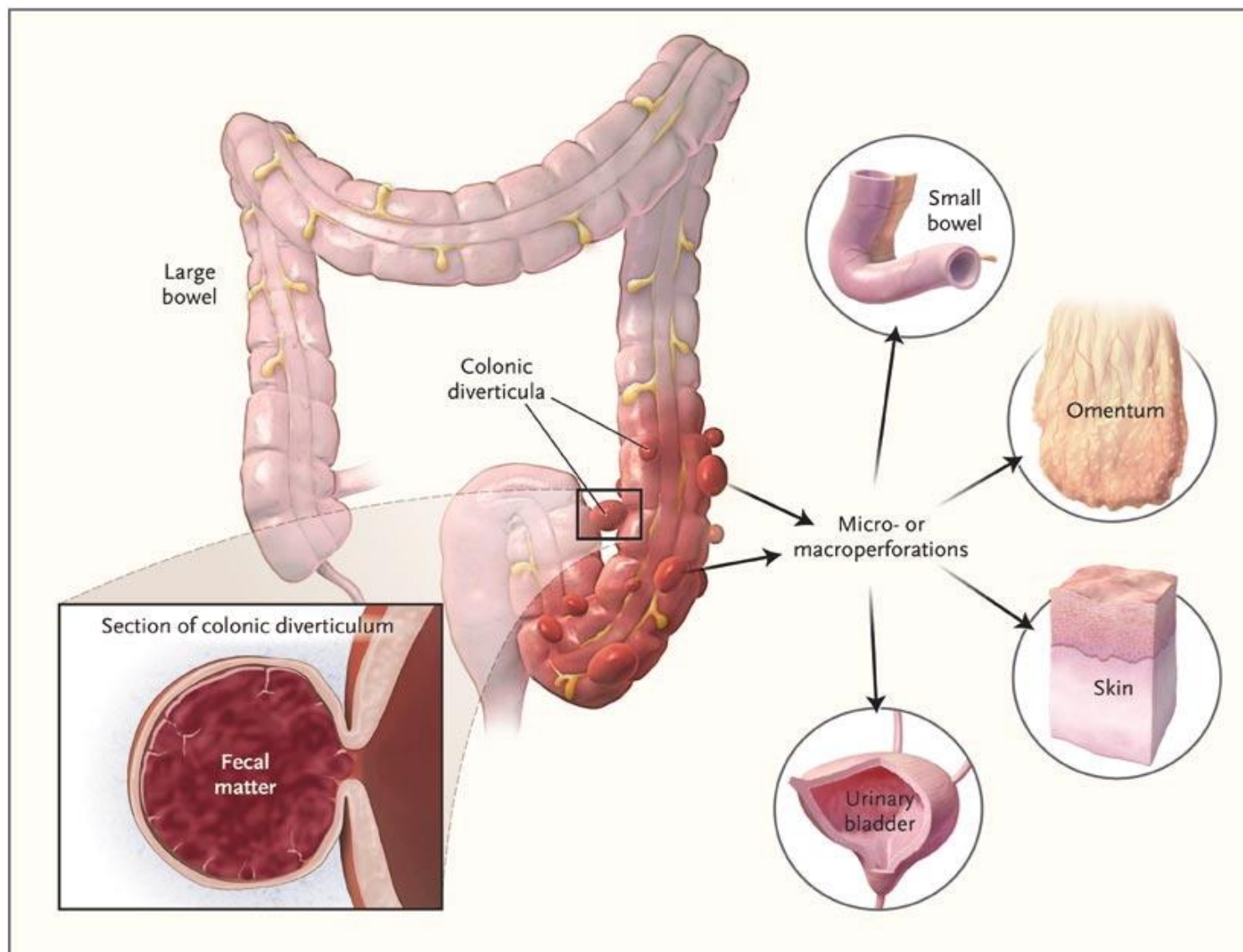
Historical Diverticulitis

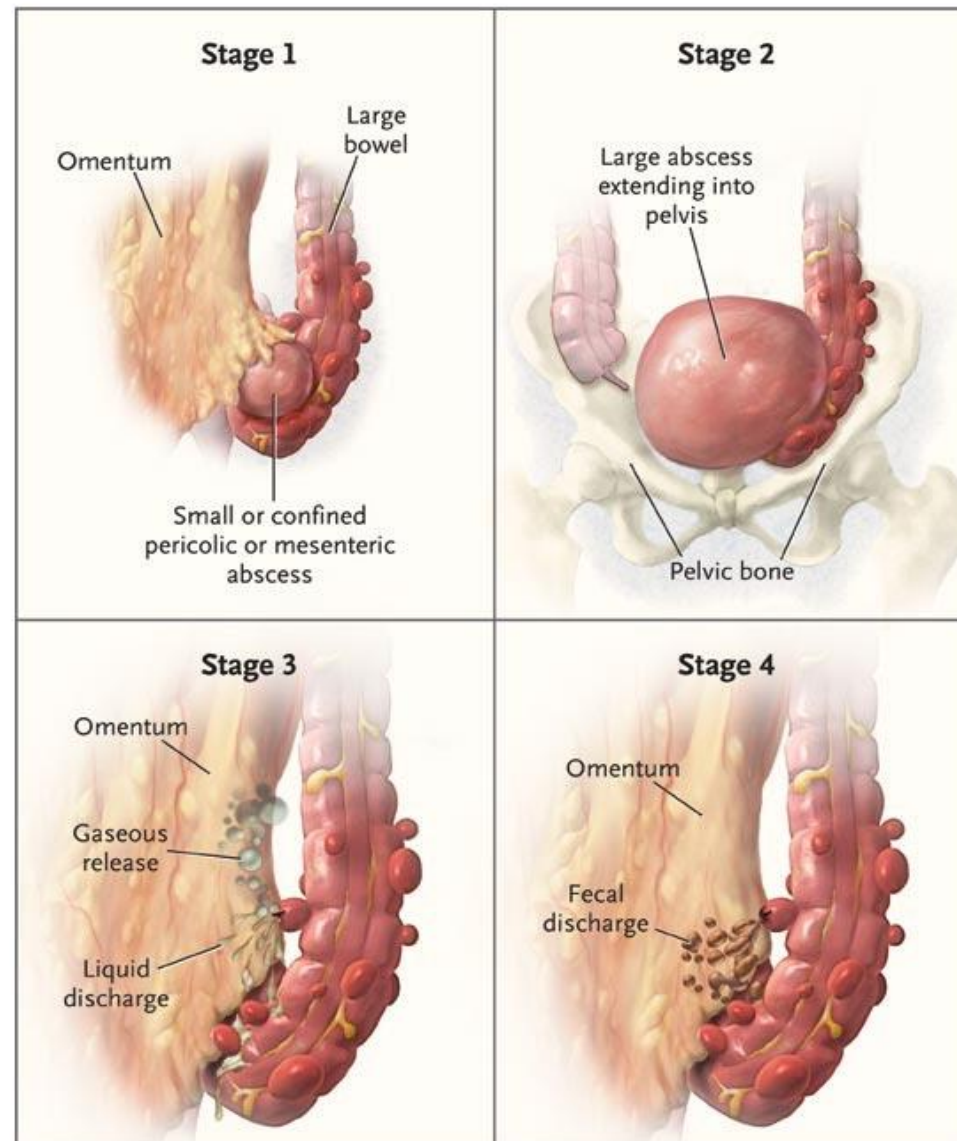
Hartmann's procedure:

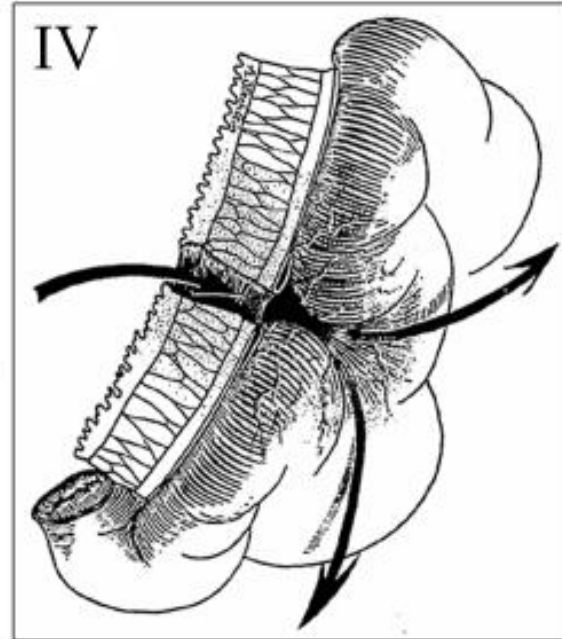
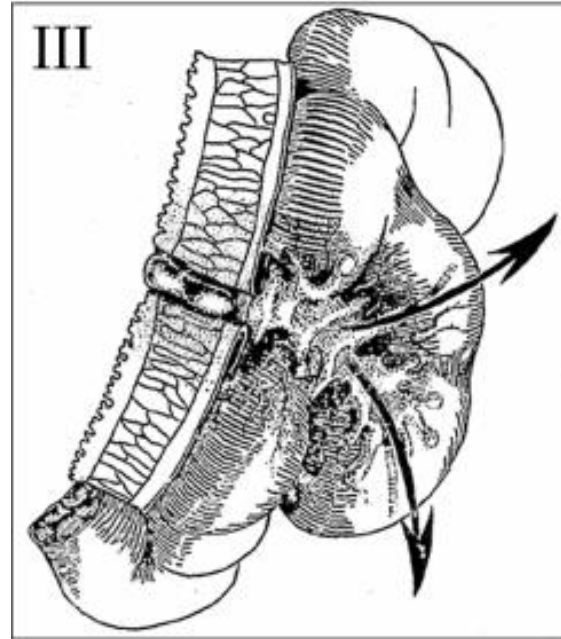
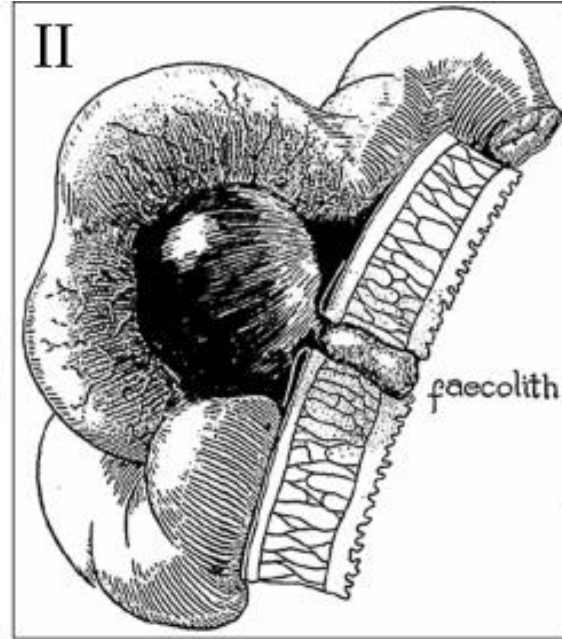
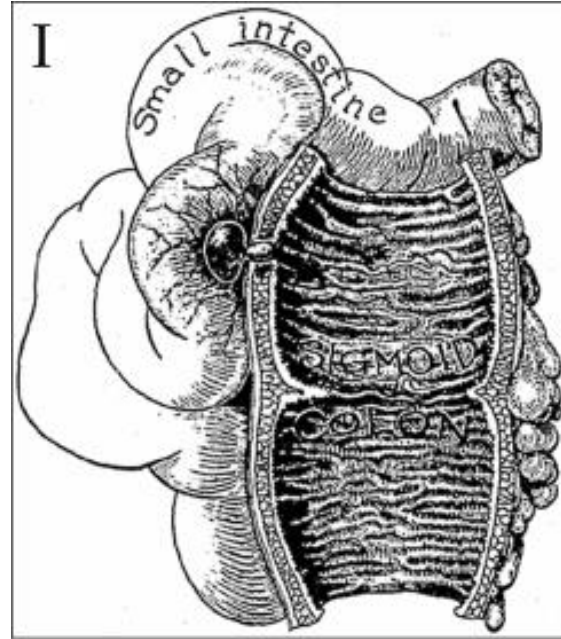
- Resection of affected diverticular colon segment
- Closure of rectal stump
- Formation of end colostomy
- Morbidity and mortality rates as high as 24 % and 19% with high risk of permanent stoma

Classical Teaching: Natural History of Acute Diverticulitis (AD)

- Following initial attack of AD, recurrent attacks lead to 20 to 40 % readmission
- Complication rates following AD, exceed 50 %
- Two hospitalized attacks- elective resection



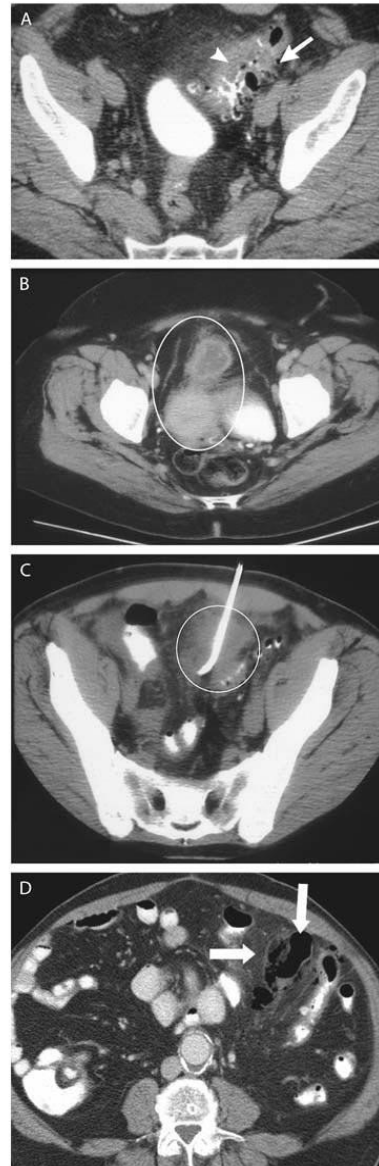




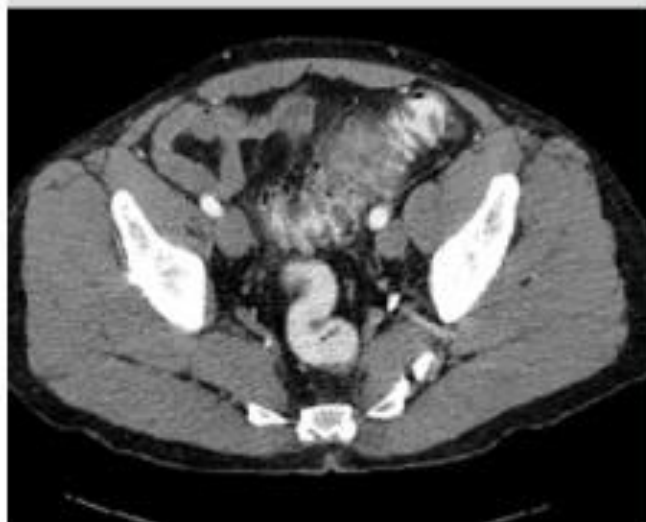
Classical Teaching: Natural History of Acute Diverticulitis (AD)

Hinchey Classification 1978

- 1- localized pericolic abscess
- 2- larger mesenteric abscess
- 3- free perforation causing purulent peritonitis
- 4- fecal peritonitis caused by free perforation



$n = 285$



Recurrent diverticulitis

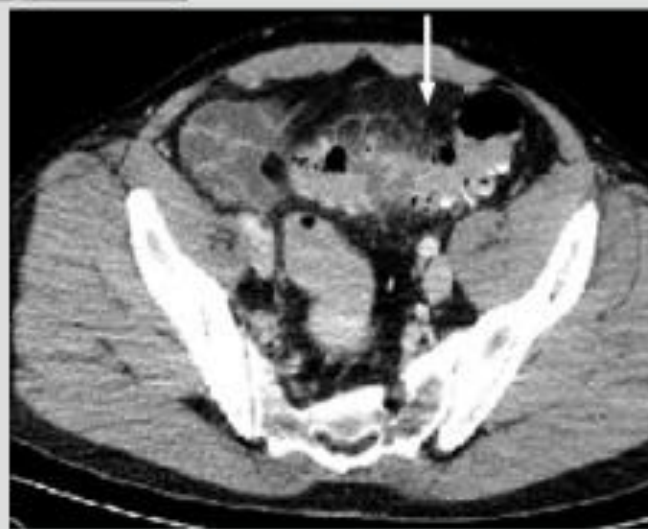
$n = 40$

$n = 6$

$n = 239$



No recurrence = 84%



Simple = 14%



Complicated = 2%

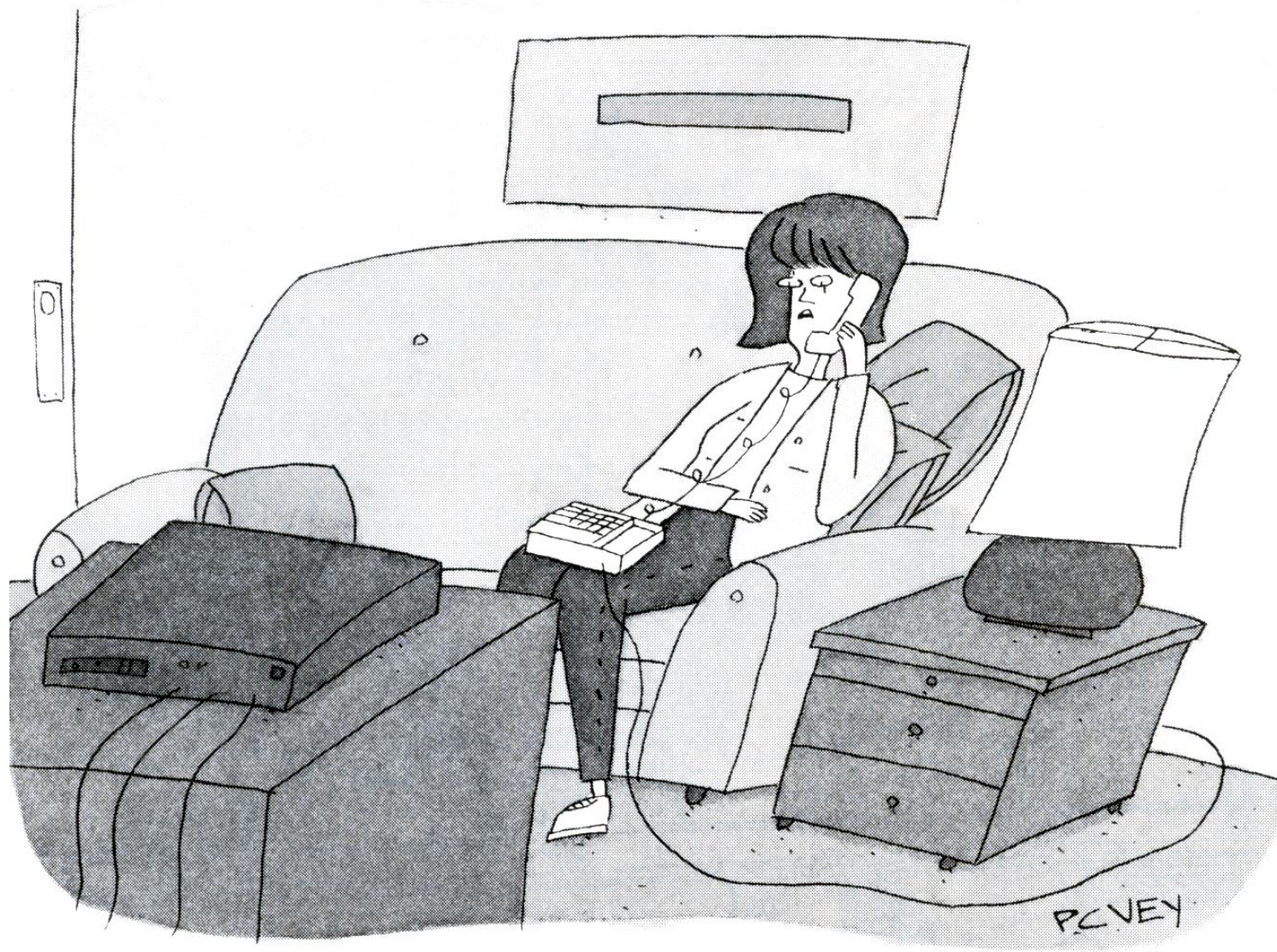






Hypothesis: Diverticulitis

- Operations for Inflammatory bowel disease are to treat complications of the disease process in Crohn's and for complications and cancer risk in CUC
- Could this be the case for diverticulitis???



"I was hoping to settle this without avoiding some sort of argument."

When should we operate?

- *Should we operate at all?*
 - *under what circumstances?*
- *What is the optimal timing for surgery?*

Diverticulitis

Who needs surgery?

- uncomplicated
- complicated– ongoing
- complicated– resolved



Diverticular disease

Indications for immediate surgery

- peritonitis
- patient status deterioration on medical therapy
- unrelenting obstructive symptoms

“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...”

WO Griffen, Jr., 1976

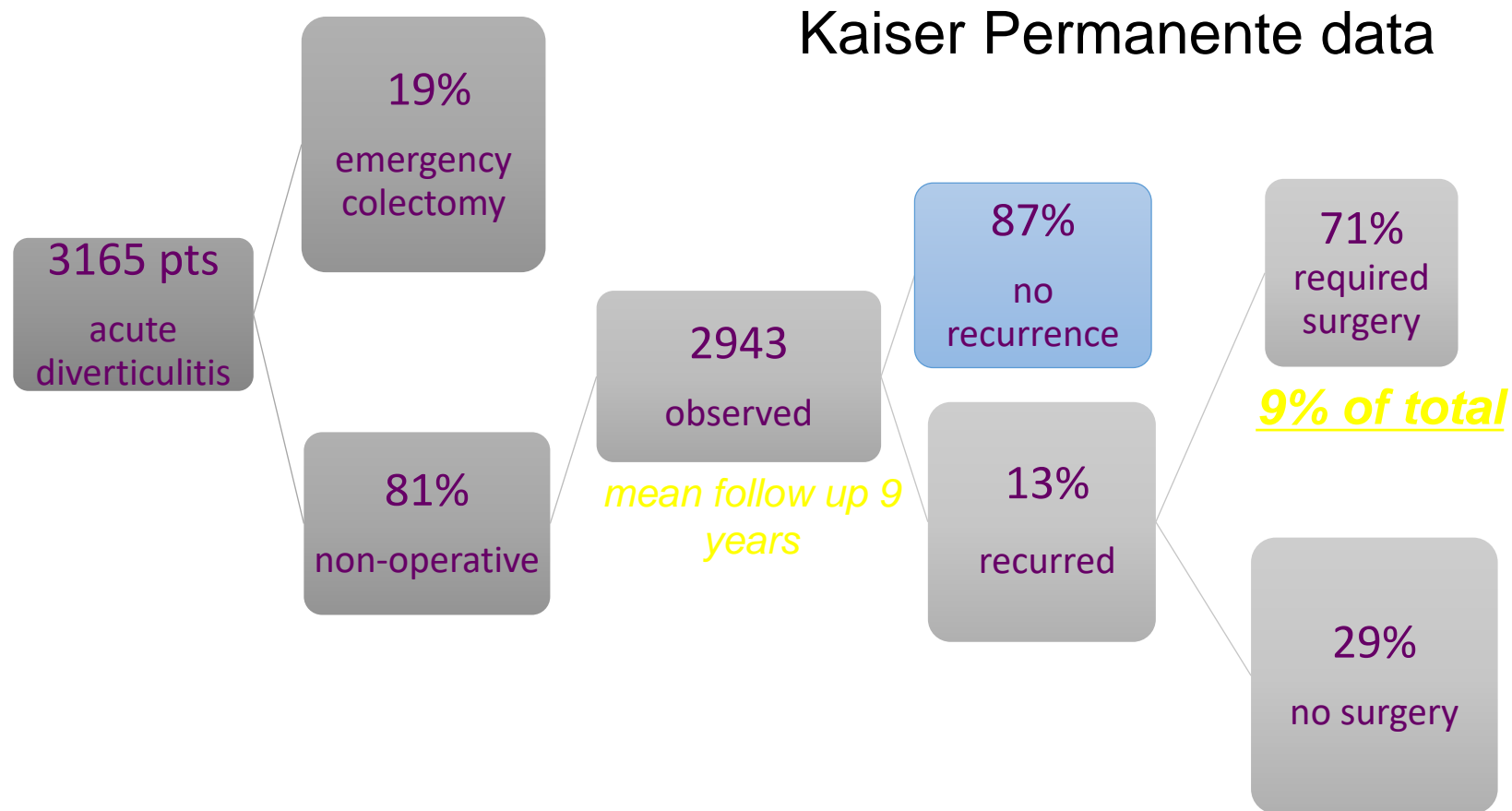


What constitutes a previous diverticular attack?

- LLQ pain?
- response to antibiotics
- MD or hospital visit?
- fever/ leukocytosis?
- CT scan?
- hospitalization?



Does hospitalization for acute diverticulitis mandate colectomy?



Broderick-Villa 2005

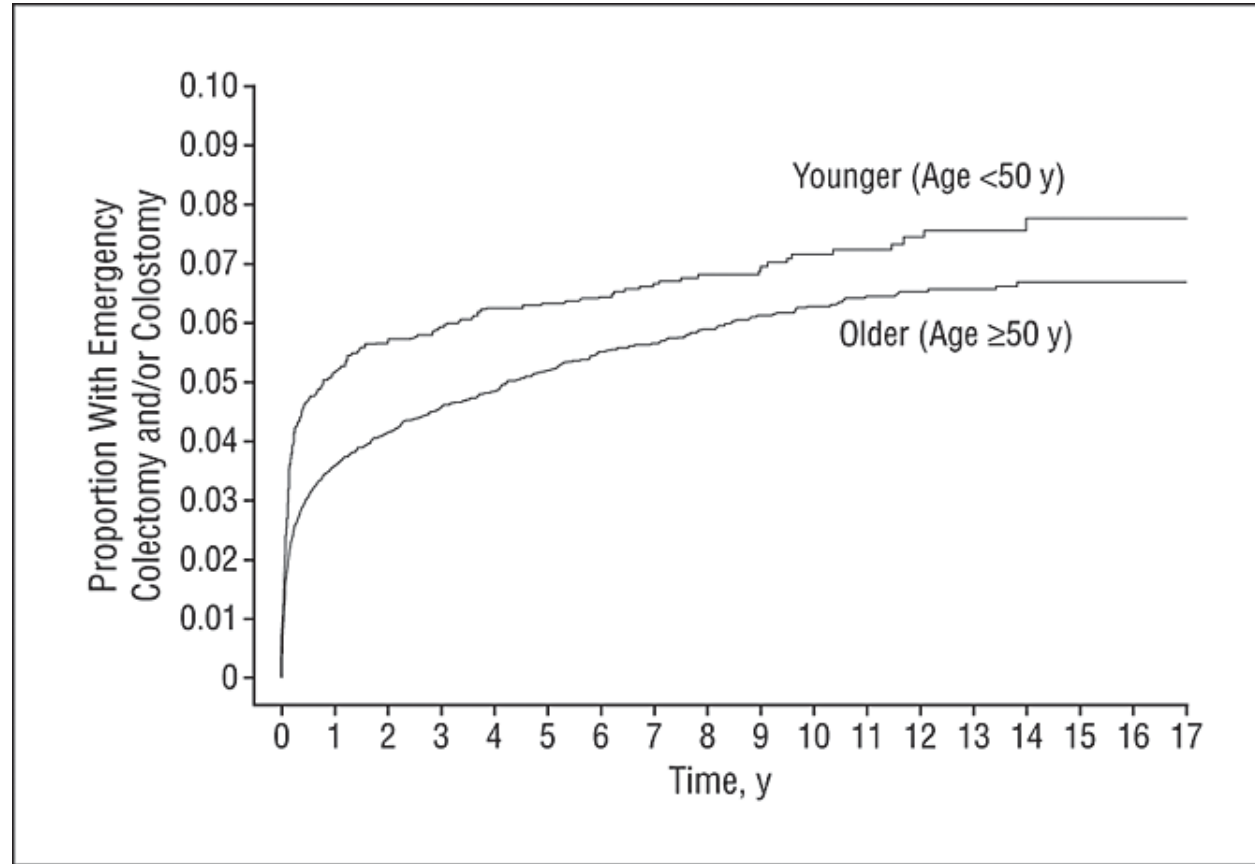
caveat lector!

*“required colectomy” is not
an objective endpoint*

Risk of emergency colectomy/colostomy following hospitalization for diverticulitis

- Washington state hospital discharge database
- 20,136 patients initially treated without operation 1987-2001
- 19% recurrence rate
- 5.5% required emergency colectomy and/or colostomy

Emergency colectomy and/or colostomy after non-operative management



Diverticular disease in the younger patient

- Multiple papers suggest a more virulent form of the disease
- Many authorities suggest operative intervention after one attack

“Virulent” Diverticular disease in the young *problems with data!!!!*

- selection bias
 - atypical presentation
 - high rate of misdiagnosis (7-88%)
 - high rate of delayed diagnosis
 - patients managed as outpatients excluded
- high rates of surgery for uncomplicated disease



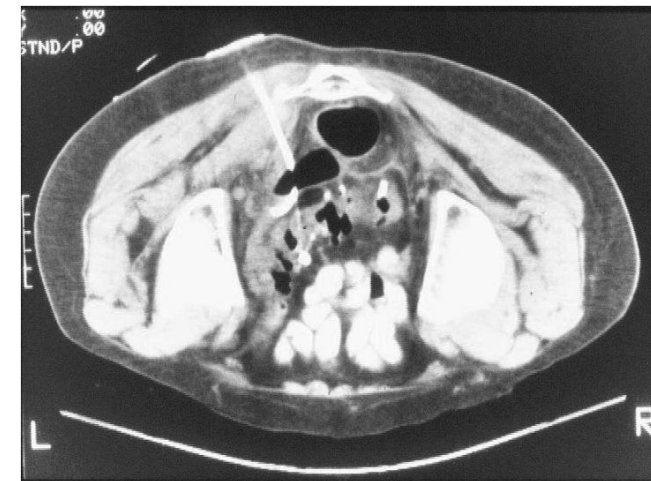
Diverticulitis in the young

"Even if it is demonstrated in some studies that younger patients have a statistically higher recurrence rate, this does not mean that they have therefore broken through some crucial barrier and must be offered elective surgery. The chance of emergency surgery or stoma is still very low."

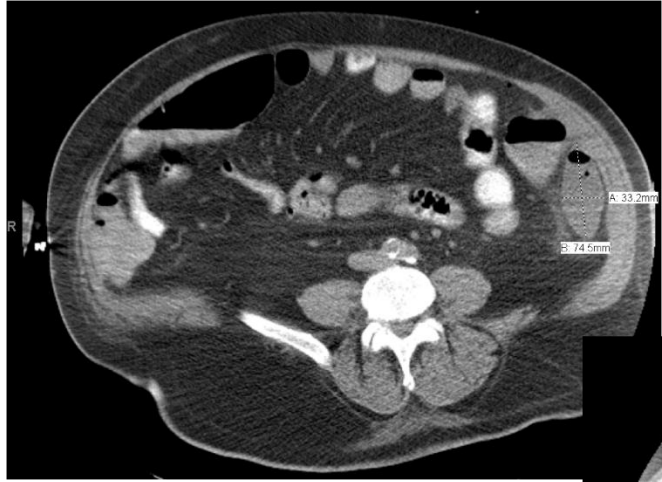
Diverticulitis

Who needs surgery?

- uncomplicated
- complicated– ongoing
- complicated– resolved



Successful percutaneous drainage

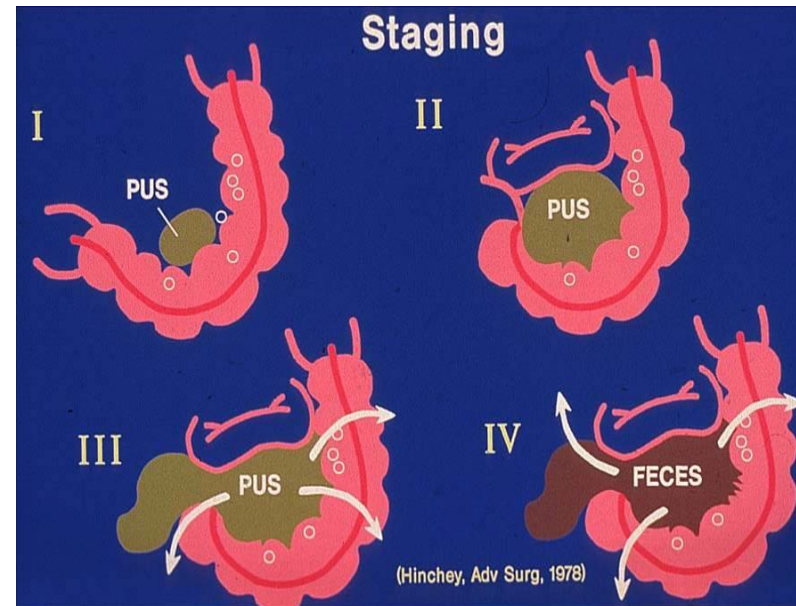


Failure!



Hinchey classification *problems!*

- does not address patient comorbidities
- does not address physiologic status
- does not address risk factors for anastomosis



Treatment of Acute Diverticulitis: Quo Vadis!

- Antibiotics
- Interventional Radiology
- Laparoscopic techniques
- Surgery- does timing matter
- Do we need surgery at all!!!!

Emergency Surgery for AD

Kockerling F Viszeralmedizin April 2015

- Hinchey 1 and 2 are initially treated by ATBs, percutaneous and/or laparoscopic techniques. Hinchey 3 laparoscopic lavage or resection
- Hinchey 4 resection
- After elimination of acute sepsis, interval elective sigmoid resection performed laparoscopically or observation and medical therapy

Laparoscopic Lavage Drainage for Acute Diverticulitis

First described 1996

- Laparoscopic exploration, followed by lavage with heated saline, and drainage of diseased colonic segment
- Extensive adhesiolysis or mobilization of colonic segment in search of perforation remains controversial

O'Sullivan et al AM J SURG 1996 171: 432-434

Rizk et al Ann Chir 1996 50: 283



Wait a minute!!!

- Patients getting better without follow up elective surgery
- Say it aint so!!!!
- May be Trump will be a good President!

Preliminary DILALA Data

Angenete E et al: Laparoscopic Lavage is Feasible and Safe for the Treatment of Perforated Diverticulitis with Purulent Peritonitis. Ann Surg 2016- 263: 117-122

- Initial diagnostic laparoscopy showing Hinchey III was followed by randomization- LLD versus HP
- 139 patients initially underwent DL- 83 patients randomized 39 LLD and 36 open HP
- Preop demographics and clinical characteristics comparable

Preliminary DILALA Data

Angenete E et al: Laparoscopic Lavage is Feasible and Safe for the Treatment of Perforated Diverticulitis with Purulent Peritonitis. Ann Surg 2016- 263: 117-122

- Operative data: LLD OR time 1:08 versus HP 2:34 ($p < 0.0001$)
- Postop outcomes
 - reflected by shorter time in recovery room (4 hours) for LLD
 - Shorter LOS for LLD group (6 days vs. 9 days)
 - Less drainage for HP 3 vs. 2 days
 - No mortality or long term reop or complication differences

Preliminary DILALA Data

Angenete E et al: Laparoscopic Lavage is Feasible and Safe for the Treatment of Perforated Diverticulitis with Purulent Peritonitis. Ann Surg 2016- 263: 117-122

Evaluation of Study

- Primary endpoint – number of reintervention could not be assessed yet because of follow up
- Exclusions are liability- but no selection bias evident
- Classification system inaccuracy- Hinchey, Clavien-Dindo

DILALA Trial

- LLD vs HP trial performed in 9 centers Sweden and Denmark
- Randomization of 83 patients occurred intraop
- Confirmed Hinchey 3
- Initial short term outcomes- no significant differences so LLD was deemed safe

DILALA Trial

- Second long term follow-up publication
- Primary outcome- reops in 12 months
- Secondary outcomes: # of reops, readmits, LOS, and adverse events

DILALA Trial

- Reop: LLD 28 to 63
- LOS: 35 percent shorter
- Fewer stoma: LLD 7 vs 28 percent
- Conclusion: LLD reduced the need for reops, however had similar safety profile to HP

AD: Therapeutic lavage

LOLA Group of Ladies Trial

- Lavage vs sigmoidectomy
- Multicenter, parallel group, randomized, open label superiority trial
- 34 teaching hospitals and 8 academic ctrs in Belgium, Italy and Netherlands

AD: Therapeutic lavage

LOLA Group of Ladies Trial

- Trial has second arm DIVA- comparing HP vs sigmoid resection + primary anastomosis
- 90 pts assigned in 2:1:1 47 LLD, 21 HP, 22 PRA
- Endpoint major morbidity and mortality in 12 months

AD: Therapeutic lavage

LOLA Group of Ladies Trial

- Morbidity: reop, dehiscence, abscess, urosepsis, MI, MSOF
- On basis of major in house morbidity or mortality 35 percent to 18 percent
- Study terminated
- Conclusion LLD is not superior to resection

SCANDIV Trial

- Multicenter, two group, open label, pragmatic superiority trial performed at 21 surgical units in Norway and Sweden
- Classified based on evidence of perforation
- 132 Hinchey 3

SCANDIV trial

- 132 of H 3 analyzed along with 12 H1 or H2
- No difference in mortality or morbidity in 2 groups
- Secondary endpoints did differ between groups
- Reop and missed Cancer rates higher in LLD group 20 to 6 percent

SCANDIV Trial

- Recommendation: no evidence to support laparoscopic lavage for treatment of perforated diverticulitis

PRCTs of LLD vs Sigmoidectomy- Deeper Dive

- Early termination of Ladies/LOLa- higher rate of inhospital reinterventions
- However long term serious adverse events same
- Reintervention not unexpected
- Sigmoidectomy definitive procedure to reduce sepsis

PRCTs of LLD vs Sigmoidectomy- Deeper Dive

- Although sigmoidectomy not curative- 6 to 9 % recurrence, resection may be superior to control sepsis
- However, 35 to 45 % stomas not reversed
- Morbidity higher for resection than LLD

Missed cancer issue

- LLD has a higher missed cancer rate in most studies- 11% of perforated AD associated with Ca
- This argument is specious as follow-up colonoscopy can be performed once sepsis resolved

SCANDIV Trial Flaws

- Most influential study
- In LLD group surgeon was registrar 32 % and CRS 46 %- whereas in resection group CRS performed surgery 77% opf time
- This introduces significant bias in data

Are there high risk patients with Diverticulitis

- What does data show?
- Should we direct our surgical interventions to selected patients?

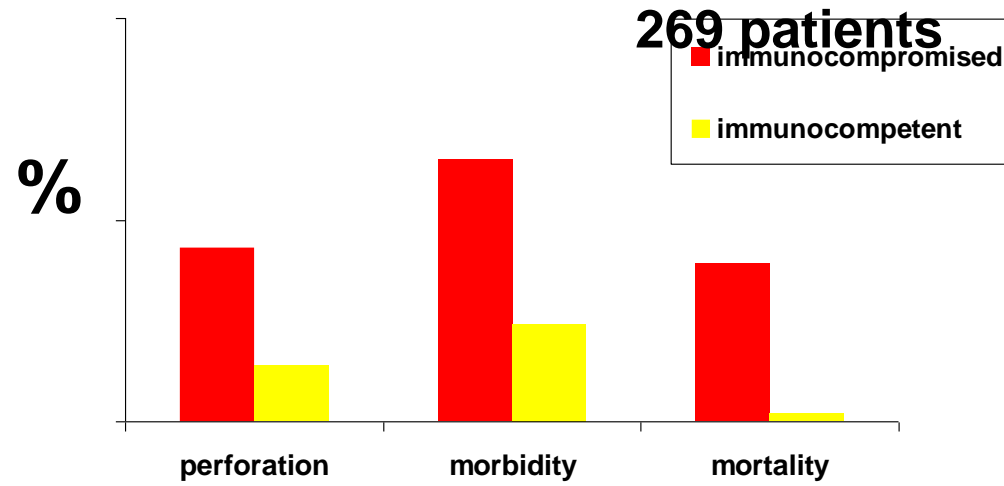
Complicated diverticular disease

Mayo Clinic 1990-2003

<u>factor</u>	<u>mortality risk (p)</u>
steroids	0.002
DM	0.006
collagen-vascular disease	0.009
immunocompromised	0.003

Diverticulitis

impact of immune compromise



Complicated diverticular disease

Mayo Clinic 1990-2003

phlegmon and abscess were associated with a previous history of diverticulitis:

	<u>p</u>
risk of pericolic abscess	0.007
risk of phlegmon	0.005

free perforation and death were associated with *no* history of diverticulitis:

	<u>p</u>
risk of perforation (contained or free)	<0.0001
risk of death	0.02

“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.”

Janes 2005

Factors associated with recurrence

25 patients- University of Minnesota

	Recurrence (n=7)	No Recurrence (n=18)	P value	RR (95% CI)
Abscess size >5cm (n=8)	7 (88%)	1 (12%)		(1.3-50)
Immunosuppressed (n=5)	4 (80%)	1 (20%)		(0.7-24)
Duration of drainage >7 days (n=12)	2 (17%)	10 (83%)	0.4	0.7 (0.4-1.2)
Previous episodes of diverticulitis (n=12)	5 (42%)	7 (58%)	0.2	1.4 (0.8-1.5)

INTRODUCING...

DOC PALIN!

I'm not one of those phony-baloney "insiders" who went to "medical school"!

I just go by my God-given sense of RIGHT and WRONG!



Diverticular disease

indications for elective surgery

- continued symptoms of inflammation
 - *ongoing 'grumbling' symptoms*
- immunosuppression
- multiple documented episodes
 - *increasing tempo of attacks*
- symptomatic stricture
- persistent fistula
- unable to rule out cancer
- life style
 - *remote location; frequent travel*

Acute Diverticulitis

Optimal Time of Elective Surgery

“Surgery in inflammation-free interval significantly reduced postoperative morbidity.” Reissfelder 2006

“Early elective surgery in patients with acute sigmoid diverticulitis results in a higher conversion rate. If patients respond to initial antibiotic therapy, delayed colectomy after an interval of six weeks or more is recommended.” Zingg 2007

good judgment comes from
experience...

good judgment comes from
experience...

...but experience comes from bad
judgment!

Hartford Hospital Indications Currently

- If radiologic evidence of free air on admission- diagnostic laparoscopy to establish H3 or H4
- If H3- LLD to hopefully convert situation so semi urgent resection with PRA can be accomplished to save patient stoma
- If successful, resection and PRA
- If does not improve in short period of time, Hartmann's procedure
- Our goal is to reduce stomas and thereby reduce additional surgery



**“The bold
surgeon’s patients
take all the risks.”**



Ward O. Griffen, Jr.

Acute Diverticulitis Presentations

- Symptomatic, uncomplicated disease
- Recurrent, uncomplicated disease
- Smoldering (no symptom free between episodes or initial episode)
- Complicated disease

Acute Diverticulitis

COMPLICATED PRESENTATIONS

- Abscess- small, large, mesenteric, pelvis
- Perforation- purulent, fecal
- Fistula- colovesicular, colovaginal
- Stenosis/ stricture
- Hemorrhage

Acute Diverticulitis

Shakespearean Dilemma

To Resect or

To Not Resect



Acute Diverticulitis

Short term Mortality Readmission + Recurrence in treatment of AD with Abscess Formation

- Retrospective, cohort review entire Danish population 6,641,672 from 2000 to 2012 via Danish Registries
- Stratified HI +HII- operation vs. PTC/ATB
- Outcomes: 30 day mortality, 2 outcomes: mortality, readmission, recurrence

Gregerson R et al. Int J
Colorectal Dis March 2016

Acute Diverticulitis

Short term Mortality Readmission + Recurrence in treatment of AD with Abscess Formation

- 3148 eligible pts/ mean age 65.1 yrs
- 25.6 previous admissions for AD
- 48.1 significant co-morbidities
- 2.5% mortality, 24 % readmission, 5.9% readmitted 2 to AD
- Glucocorticoid use or immunosuppression increase odds ratio for readmit or complications

Gregerson R et al. Int J
Colorectal Dis March 2016

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD

- Cohort analysis of all patients admitted with Diverticulitis
- 2005 to 2009, analysis of risk factors
- F/U to December 2009
- 291 pts : 111 (38%) pts treated ATB 180 (62%) pts treated with Surgery

Klarenbeek et al. Ann Surg 2010 251(4):
670- 674

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD

INDICATIONS FOR ELECTIVE SURGERY

- Stenosis 40%
- Fistula 14 %
- Persistent abscesses 3 %
- Recurrent diverticular bleed 7 %

Klarenbeek et al. Ann Surg 2010 251(4):
670- 674

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD

INDICATIONS FOR EMERGENCY SURGERY

- Abscesses 22%
- Stenosis with obstruction 11%
- Failure of Conservative RX 6%
- Diverticular hemorrhage 4%

Klarenbeek et al. Ann Surg 2010 251(4):
670- 674

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD

POSTOPERATIVE RESULTS

- Morbidity 56 %
- Mortality 13 %
- Perforation associated with 10% mortality
- Of patients having acute surgery, 20% had previous history

Klarenbeek et al. Ann Surg 2010 251(4):
670- 674

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD

RISK FACTORS IDENTIFIED

- Immunosuppressive therapy
- Chronic renal failure
- Collagen vascular disease
- 5X increase (36% to 80%) of perforation in recurrent episodes of diverticulitis

Klarenbeek et al. Ann Surg 2010 251(4):
670- 674



Elective Surgery after Acute Diverticulitis

- Medline literature search, with references added
- Diverticular disease 25% of Western cultures- Inc frequency with inc age
- After 1 episode AD, another 1/3 recur
- Similarly after second, another 1/3
- Perforation common in 1st episode

Janes et al Br J Surg 2005 92(5): 133-143

Elective Surgery after Acute Diverticulitis

- After recovery from first episode of AD, risk of perforation 1/2000 patient years of follow up
- Surgery has real complication (morbidity and mortality associated)
- 25 % of patients have recurrent symptoms postoperatively
- No evidence to support elective surgery after 2 attacks

Janes et al Br J Surg 2005 92(5): 133-143

SCOAP Certain Collaborative

Flum et al: Ann Surg 2014; 260 (3): 533-539

- Prospective cohort study of 2724 (from 2009 to 2013)
- 29.4% had chronic complicated disease as indication for surgery
- 70.5% episode based indication for surgery
- At outset of study, 31% failed to meet indications of 3 or more episodes or complicated disease

SCOAP Certain Collaborative

Flum et al: Ann Surg 2014; 260 (3): 533-539

- Over time with education, 56% of procedures performed met indications
- Annual rate of emergency resections unchanged from initiation to conclusion of study (5.6% to 5.9% annually)



ASCRS Guidelines

“Strongly advise “ against elective resection for uncomplicated acute diverticulitis

First episode non resolving or smoldering episode

Multiple episodes or complicated disease on presentation

ACUTE DIVERTICULITIS

NATURAL HISTORY

- Most emergency surgery occurs at first episode
- Likelihood of recurrent hospitalization is 5 to 13 percent
- Emergency colostomy < 5%
- Elective resection rate: 5% to 11 %
- Elective resection risk is 1 to 3 % vs stoma for anast. leak at 25 %

LLD take home message

- Patient must be able to tolerate recurrent infx- sepsis control is not as good as resection for LLD
- If patient fails nonop management with phlegmon, or abscess on CT with interloop abscesses may need definite resection not LLD

LLD take home message

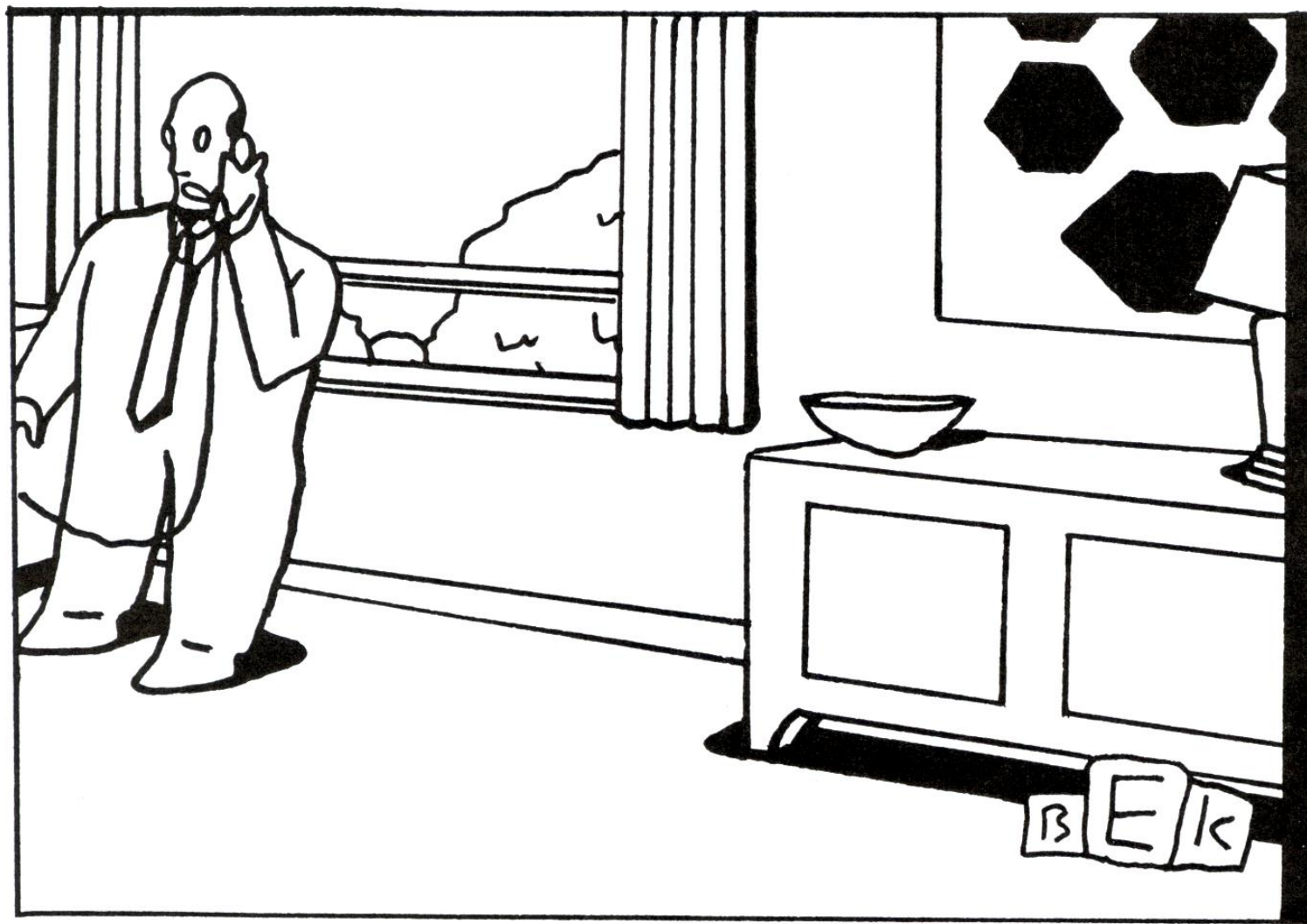
- Laparoscopic lavage used in management of Hinchey 3 AD may lead to more interventions in first 30 days but does not increase long-term morbidity or mortality compared to resection

Marshall et al, Ann
Surg 265, 5: 670-
676, april 2017

ACUTE DIVERTICULITIS

OLD SURGICAL DOGMA

- Elective resection after 2nd episode requiring hospitalization to prevent potential complications including emergency surgery and colostomy
- Contemporary data fails to demonstrate that “preventative surgery” actually decreases incidence of emergency surgery at population level!



"You'll have to excuse me—I'm myself today."

Future is not what it used to be

What do I do?

- Hinchey 3 or 4 diagnostic laparoscopy
- H4- immediate HP
- H3- minimal contamination, no adhesiolysis, no bowel mobilization-
placement of drains
- If improves- semi-elective procedure without STOMA


What do I do?

- If no improvement in 24 to 48 hours- exploration for resection and HP
- LLD is – for me a bridge- to convert from mandatory Hartmann to semi elective resection with no stoma if possible
- I don't believe it is definitive therapy for most patients

To cut to cure!

Ad cadcumen per clunem

- Objective in operating on Hinchey 3 or 4 patients is to stop ongoing sepsis from perforation- if drainage alone from small perf and contamination- ok
- Otherwise- resection with stoma is workhorse and treatment of choice in my hands- also I do emergent open- elective/semi-laparoscopic



A large billboard with a black border and a light gray background. The text is written in bold, black, sans-serif capital letters, arranged in four lines. The billboard is mounted on a metal structure with two spotlights at the top. In the foreground, there is a dark gray, horizontally-slatted fence. The background shows a clear blue sky and a portion of a building with a tiled roof.

**BEING CREMATED
IS MY LAST HOPE
FOR A SMOKING
HOT BODY**

SCOAP DIVERTICULITIS SURGERY DICTATION GUIDE

1. If non-elective colectomy for DD was it for:
 - a. Ongoing AD
 - b. Current GI bleed
 - c. Colovesicular fistula
 - d. Colonic Stricture
 - e. Other (specify)

SCOAP DIVERTICULITIS SURGERY DICTATION GUIDE

2. For elective colectomy for DD was it for:

DOES PATIENT HAVE HISTORY OF CONFIRMED
EPISODE OF COMPLICATED DIVERTICULITIS (YES OR
NO!)

SCOAP DIVERTICULITIS SURGERY DICTATION GUIDE

3. For elective colectomy, how many previous episodes of CAT confirmed diverticulitis has patient had (please specify actual number of episodes)
 - a. Was patient treated as inpatient for each of these episodes (yes or no)

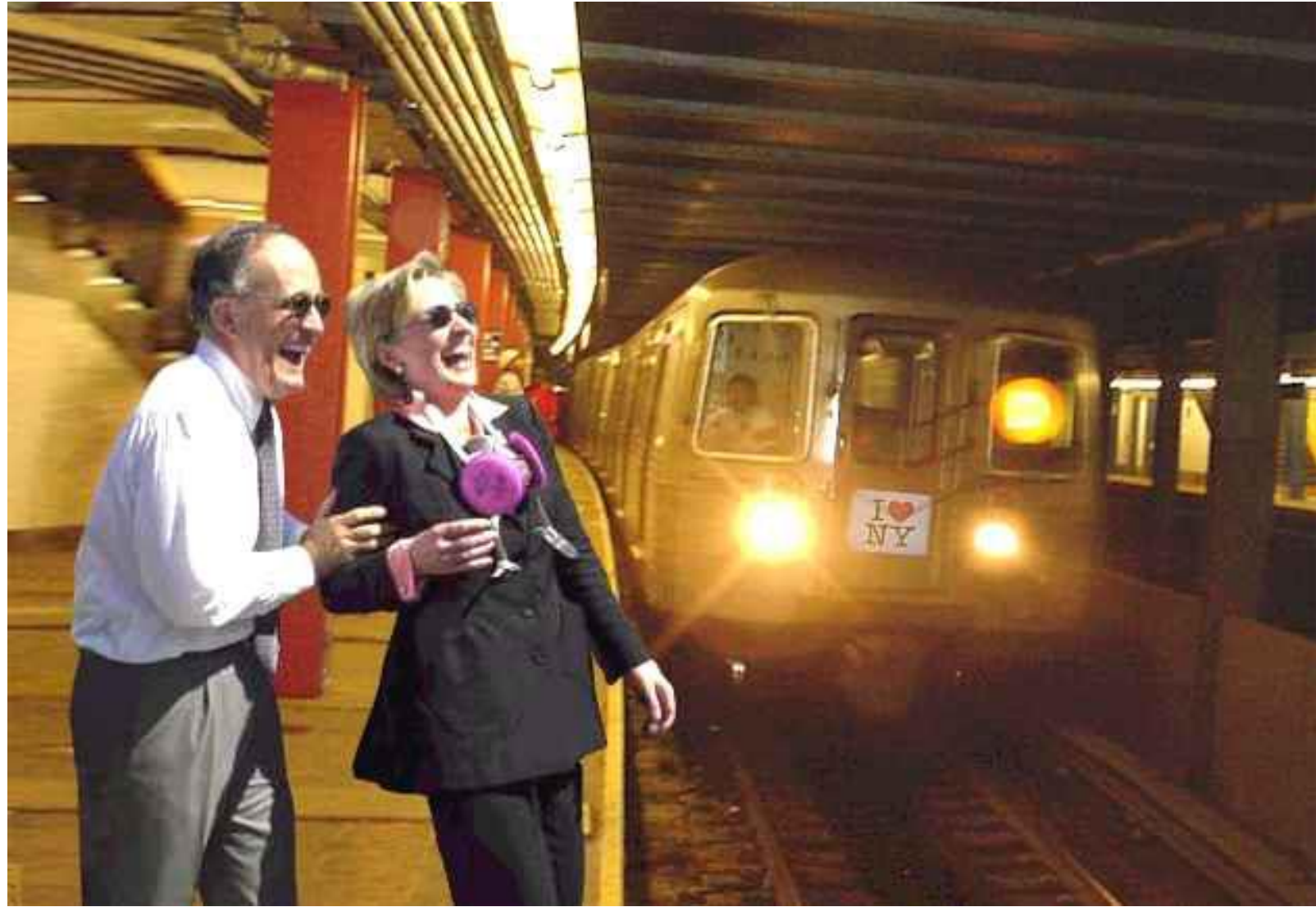
SCOAP DIVERTICULITIS SURGERY DICTATION GUIDE

SCOAP Indications

- > 3 documented/hospitalized admissions
- Smoldering/non-recovering episode
- Complicated disease

Decline of elective colectomy

- Population based studies demonstrate lower incidence of surgery- 9.6% to 3.9% 2002 to 2011 Li et al DCR 59:4 pp 332 to 339 2016
- OR cohort- Increase BMI, increase age, higher ASA score Papageorge et al, J Gastrointest Surgery 2016



LLD vs. PR for AD

SCANDIV Randomized Clinical Trial

- Objectives: Outcome analysis of LLD vs. PR
- Multicenter, randomized, clinical superiority trial
- 21 centers Norway/Sweden
- 2010 to 2014
- Last patient follow up 12/ 2014

Schulz et al; JAMA 314 (13): 1364-1375

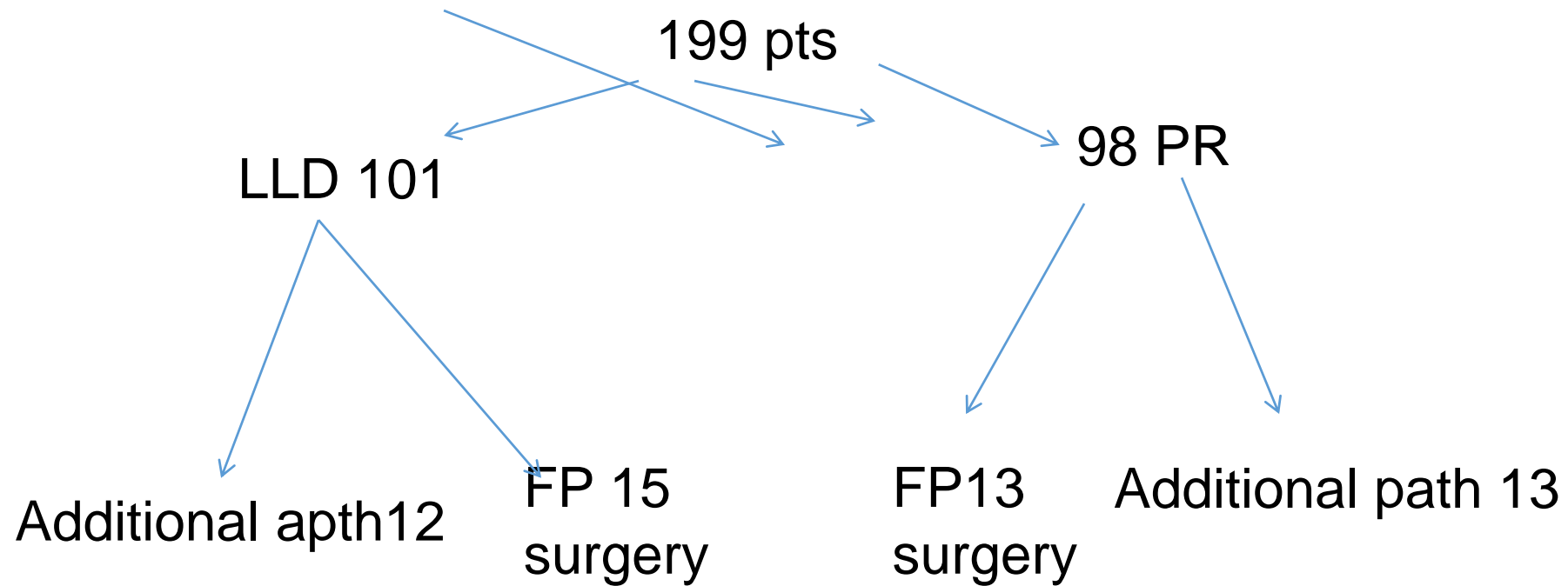
LLD vs. PR for AD

SCANDIV Randomized Clinical Trial

- Eligible patients:
 - Patients suspected with AD
 - Clinical indication for emergency surgery
 - Free air on CAT scan or other evidence of perforation
 - 509 screened- 415 eligible- 199 enrolled
-

LLD vs. PR for AD

SCANDIV Randomized Clinical Trial



Schulz et al; JAMA 314 (13): 1364-1375

LLD vs. PR for AD

SCANDIV Randomized Clinical Trial

- Primary outcomes: severe postop complications-
Clavien - Dindo > IIIa within 90 days
- Secondary outcomes: postop complications,
reoperations, mean OR time, LOS, QOL--

Schulz et al; JAMA 314 (13): 1364-1375

LLD vs. PR for AD

SCANDIV Randomized Clinical Trial

- No difference in QOL or LOS
- Mean OR time < for LLD
- 4 sigmoid cancers in LLD arm had delay in diagnosis
- Conclusion: LLD did NOT reduce severe postop complications or worse outcomes for secondary endpoints

LLD vs. PR for AD
SCANDIV Randomized Clinical Trial

**NOT
Recommended!!!!**

LADIES TRIAL with sub arms of LOLA and DIVA

- Multicenter parallel group randomized open label trial of 34 teaching hospitals and 8 academic centers in Belgium, Italy and Netherlands
- LOLA study terminated
- DIVA still accruing

LADIES TRIAL with sub arms of LOLA and DIVA

LOLA ARM:

- Purulent AD treated 90 patients 2010 to 2013
- Randomization 2:1:1
- Study terminated because increased events LLD arm
- Endpoint- M+M

LLD or PRA with DI for Hinchey III DCR 2009; 52(4): 609-615

- 1994 to 2006- 35 patients underwent treatment of Hinchey III at 3 institutions
- prospectively collected and compared to retrospective series of 24 matched HIII with PRA +DI
- LLD and PRA+DI non-inferior

LLD is feasible and safe for treatment of perforated diverticulitis with purulent peritonitis: First results
DILALA trial

- Evaluate Short term outcomes of LLD to open colon resection + stoma (HP)
- Diagnostic laparoscopy > Hinchey III
- Randomization to two arms
- LLD: irrigate 4 quadrants, 3 L warm saline, drain
- Open: via midline incision HP

LLD is feasible and safe for treatment of perforated diverticulitis with purulent peritonitis: First results DILALA trial

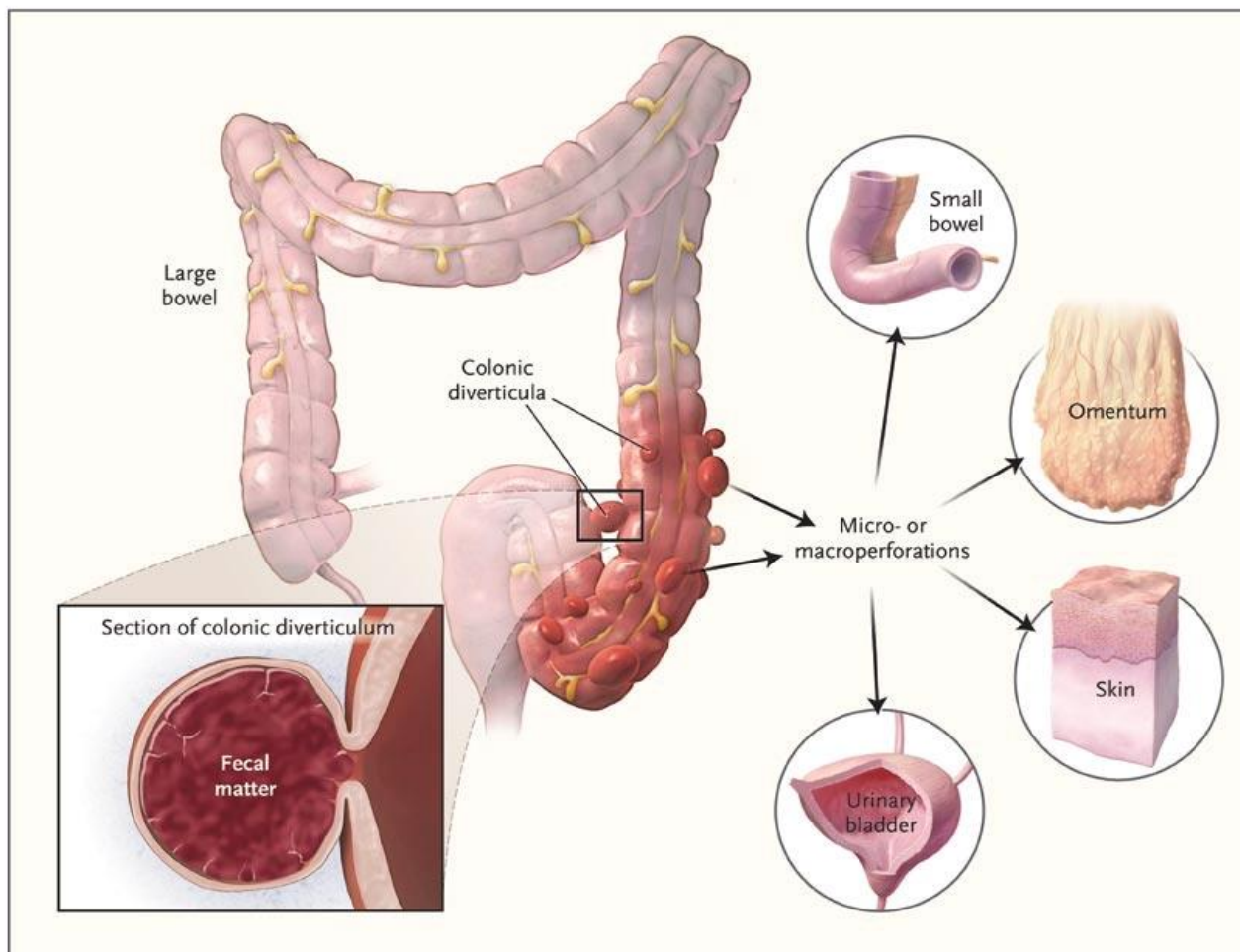
- 139 potential pts 83 randomized to 39 in LLD and 36 in open HP
- Mean OR time better in LLD 1:08 to 2:34, LOS safe for two groups
- Additional surgery was required in 5.6% of LLD
- Safe and Feasible

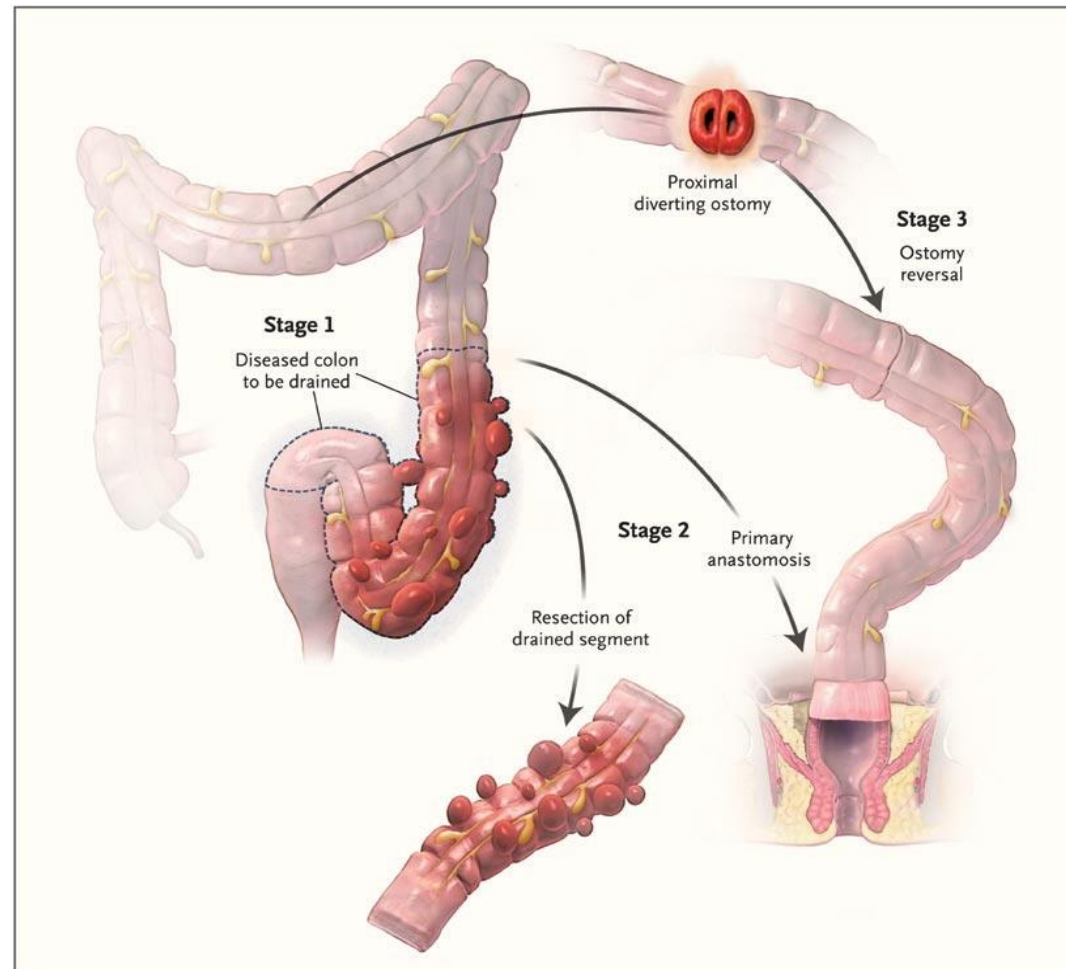
Primary vs. Secondary anastomosis after CR for perforated H III + IV : prospective outcome and cost analysis

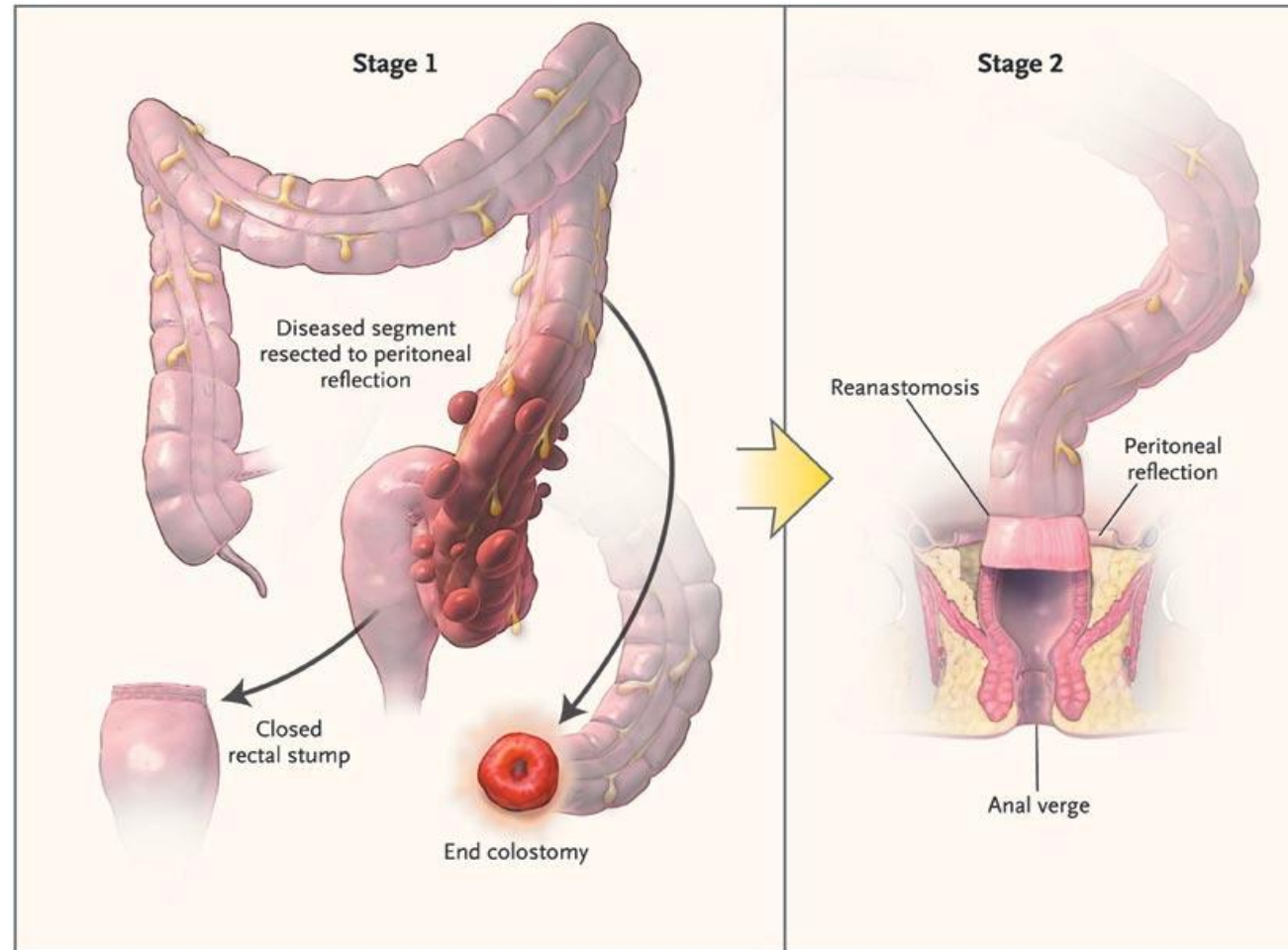
- Conclusions of this study:
- No difference between PRA + HP in regards to mean OR time, Mortality and Morbidity
- One stage can be safely done following extensive lavage

Management of Acute Diverticulitis: non perforated, no abscess

- NPO and IV resuscitation
- If evidence of ileus or obstruction, NG tube preferred
- Antibiotics – broad spectrum
- If no improvement > pain, fever, increasing leukocytosis in 2 to 3 days
- Re- image or OR







Emergent Surgery for Acute Diverticulitis

- Diverticulitis complicated by pericolic and/or pelvic abscess are most often managed conservatively with IV antibiotics more or less with PTC
- In case of failure- emergency surgery may be required for sepsis control and possible resection/or stoma
- Recent data demonstrate addition of laparoscopy has improved outcomes

Emergent Surgery for Acute Diverticulitis

Letarte F et al. Laparoscopic emergency surgery for diverticular disease that failed medical treatment. DCR 2013; 56: 1395-1402

- 24 patients LLD to 18 laparotomy
- LLD 4 fold decrease in overall complication rate
- RPA could ultimately be performed in all but one patient and conversion to open occurred in 2 patients.
- Problems : selection bias, small numbers, comparative study
- NEED RCT

Sigmoidectomy: Primary Anastomosis and HP

- Most studies in literature favor RPA over HP but these studies before laparoscopic era
- HP has lower incidence of stoma reversal than DI (90 versus 58 %)
- Need RCT to compare Lap RPA +/- DI with two stage HP and stoma closure
- Perhaps the DIVA section of the LADIES trial will offer insight into

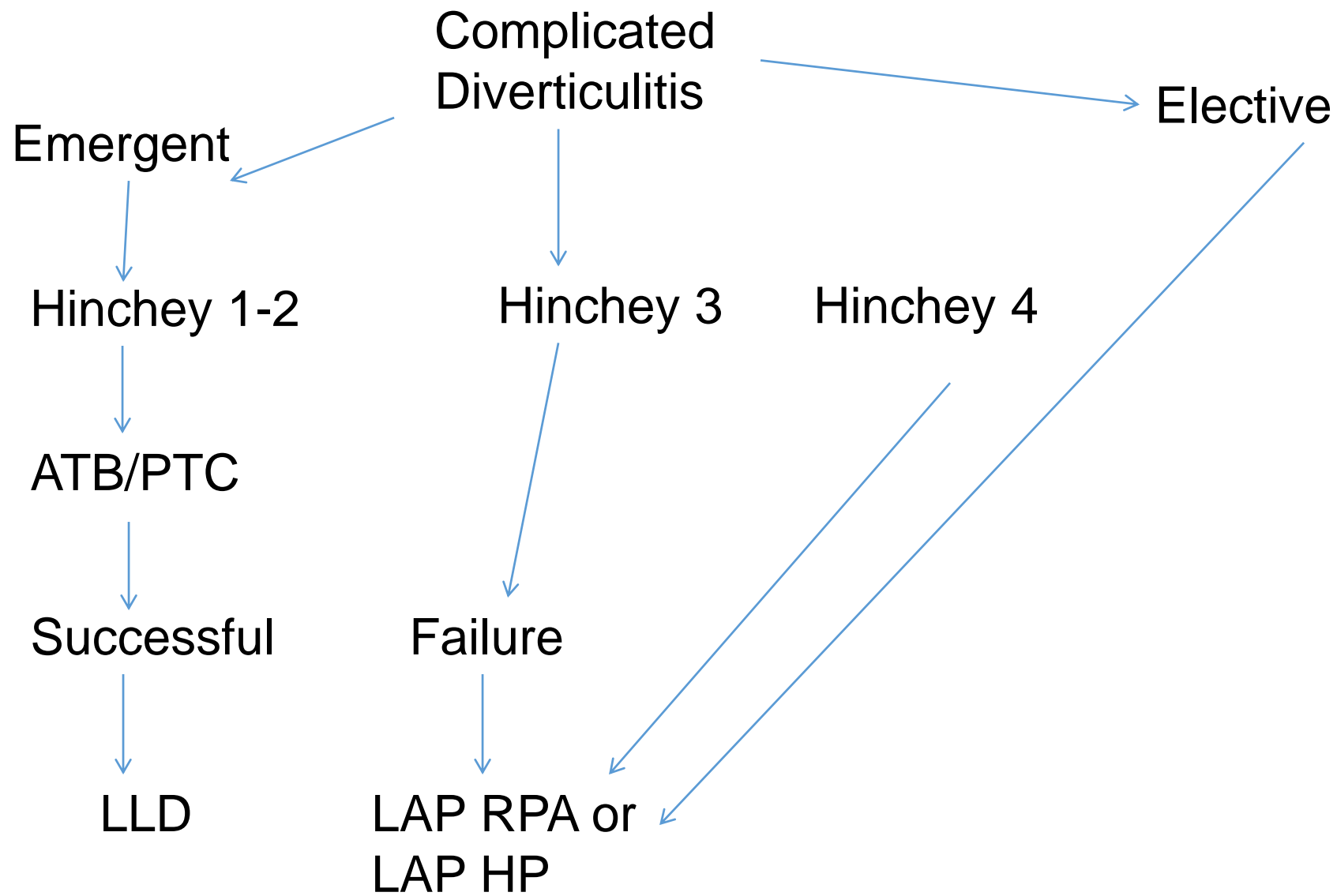
Elective Surgery for DD

- Based on large scale meta analysis and RCT- lap PRA is preferred over open PRA

- Siddiqui et al Am J Surg 2010; 200-144-161;
- Klarenbeek BR et al, Ann Surg 2009 249: 39-44;
- Gervaz P et al Ann Surg 2010 252: 3-8

Surgeon experience in minimally invasive surgery and colorectal surgery are the principal determinants of morbidity and conversion to open procedures in complicated cases!

- Pendlimari et al Br J Surg 2011 98: 431 - 435



Complicated
Diverticulitis



Inexperienced surgeon in Minimally invasive
surgery and/or Colorectal Surgery



Open surgical techniques:
Open drainage, open RPA
or HP with/without DI
Open stoma reversal

Acute Diverticulitis

Hinchey Classification 1978

- Initial report as clinical and operative classification system modified with ascent of CAT scan in the early 1980s
- Description of severity of inflammation encountered and type of septic response

Acute Diverticulitis

Hinchey Classification 1978

EAES Modification 1999

Stage I Pericolic abscess

Stage IIa Distant abscess (amenable
to CAT scan

Stage IIb Complex abscess
with/without fistula

Stage III Purulent Peritonitis

Stage IV Fecal Peritonitis

Surg Endosc 1999; 13: 430-432

Acute Diverticulitis

Surgical Options I

- Open: 3 stage
- Open : 2 stage Hartmann's Procedure (HP)
- Open : Primary resection with anastomosis with/without protective stoma

Acute Diverticulitis

Surgical Options II

- Laparoscopic: 3 stage
- Laparoscopic : 2 stage Hartmann's Procedure (HP)
- Laparoscopic : Primary resection with anastomosis with/without protective stoma
- Laparoscopic Lavage Drainage LLD

Acute Diverticulitis

Laparoscopic Lavage Drainage

Technical components

- Lavage 3 to 4 liters warmed saline
- If perforation: drain, glue, suture, omentoplasty
- Drainage of abscess or phlegmon

- goal is to convert urgent to elective *status*

Acute Diverticulitis

LLD Societal Recommendations

CAUSHAJ OLD SURGEON RECOMMENDATION:

- Don't try unless you know what you are doing, why you are doing it, how to get out of trouble if it occurs
- Need MIS and/or MIS Colorectal training

Acute Diverticulitis

Laparoscopy + PRA for Hinchey IV Technique A

- Hemodynamically stable, resuscitated
- Diagnostic laparoscopy
- Feculent peritonitis
- Fecal matter completely aspirated large bore suction or via tight sealing endobag

Bemelman et al. Surg Endosc 2016

Acute Diverticulitis

Laparoscopy + PRA for Hinchey IV Technique B

- After decontamination
- Sigmoid resection +/- HA
- Mobilize splenic flexure
- Mini-Pfannensteil to extract specimen
- Anastomosis/Air leak test/Drains

Bemelman et al. Surg Endosc 2016

Acute Diverticulitis

LLD Societal Recommendations

- ASCRS- no recommendation
- SSAT – no recommendation
- EAES- recommendation to proceed cautiously and in selected patients

Complicated Diverticulitis

3 stage open: The nightmare of my youth!

- Washout of peritoneal cavity
- Diverting colostomy
- Drainage
- Abandoned because of high morbidity, high mortality, ostomy rarely reversed at 3rd operation
- Haven for bad surgeons!!!!

Complicated Diverticulitis

Hartmann's Procedures

2 stage procedure:

Resection

End colostomy

Rectal stump turn in

Stoma reversal after recovery from 1st operation

COMPLICATED DIVERTICULITIS PRA

- Resection and primary anastomosis with or without diverting stoma
- Techniques can include open, Hand assist laparoscopically, and laparoscopic

Evaluation of Risk of non Restorative Resection from DD

Whether to perform PRA or what is likelihood of HP

- BMI
- Hinchey classification
- MANHEIM Peritonitis Index
- Operative urgency

Aydon et al. DCR 2006;
49(5): 628-639

Laparoscopic surgery for DD: Rate of conversion

- Elective resection- range 2 to 19 %
- Resection for complicated disease- 8 to 61%
- Most recent studies for complicated DD – 26 % upper limit

Surg Endosc 2006; 20(6): 947-951

Laparoscopic surgery for DD: Consequences of Conversion

- Longer OR time, LOS, delay return GI funx
- Increased wound + infectious complications
- If conversion occurs after 30 min into case, then morbidity increases
- ?? If change from LAC to HALS also has increase morbidity

Comparison of conversion rates in Lap CRS for comp and non comp for DD

- Conversion rate Hinchey I to IV 18.1%
- Conversion for all others 4.8%
- Hinchey 1 and II or fistula : 5 x increase in conversion – but rate was 9%

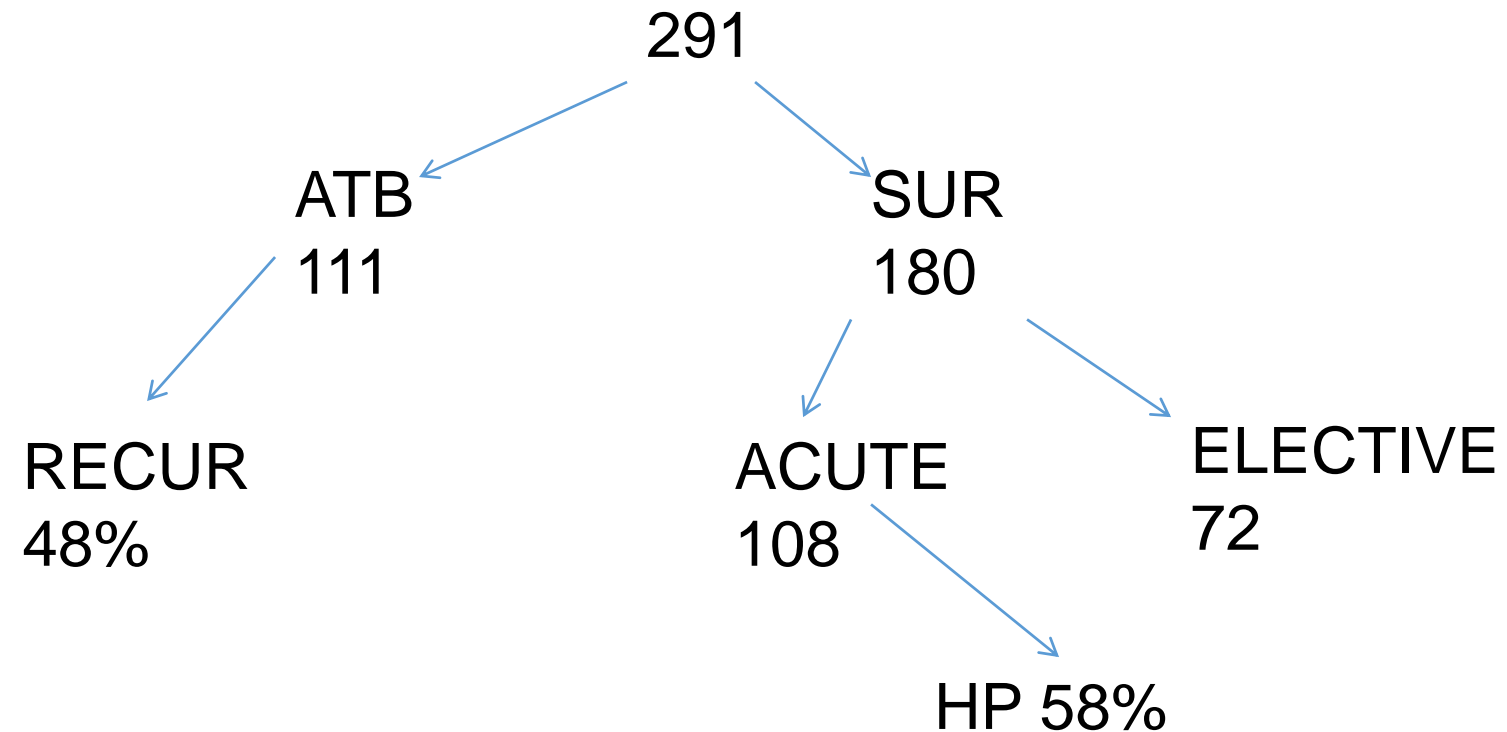
Laparoscopic Surgery for AD

Surgeon and Hospital Volume

- Operative volume of hosp and surgeons correlate with likelihood of lap colectomy performed
- If 15 colectomies/year- 8% more likely to do lap
- High volume hospitals/surgeons: 3 X more likely to do lap

Scheidbach et al. DCR
2004 47 (11): 1883-1888

INDICATIONS FOR ELECTIVE SIGMOID RESECTION IN DD



Klarenbeek et al. Ann Surg 2010 251(4):
670- 674

Other RCT for LLD

- Several ongoing: DILALA, LADIES, LOLA, LapLand, and SCANDIV- still have not achieved complete accrual and published for complete data
- LOLA group within LADIES prematurely terminated accrual because of increase in house major morbidity and mortality
- Surgical reintervention accounted for adverse events
- However mortality was 9% in LLD and 14 % in sigmoidectomy group
- Long term no differences between groups
- LLD avoided stomas in 75 % of patients

Acute Diverticulitis

Schultz et al. JAMA 2015, 314: 1343-1345

- Study review LLD
- Outcome analysis
- LLD subgroup : more readmissions, resections, complications

Laparoscopic surgery for complicated DD

- Retrospective, all complicated DD rxed, 2006-2010
- 102 pts: 64 pts Lap treated complicated DD
- Recurrent AD 37%, Colovesicular Fistula 21 %, Stricture 17%, Perf 16%
- Demographics 58 % male, median age of 59.1 yrs

Royds et al. Colorectal Dis 2012 14(10):
1248-1254

Laparoscopic surgery for complicated DD

- 88 % completed laparoscopically
- Mortality 0, Anastomotic leak 1%, SSI 7%
- For elective: AD comp vs. non comp
- Nonsig trend to inc conversion in elect comp vs. noncom (11.4 vs. 5.2)
- Elective stoma inc for comp vs. non comp (31.6 vs. 5.2)

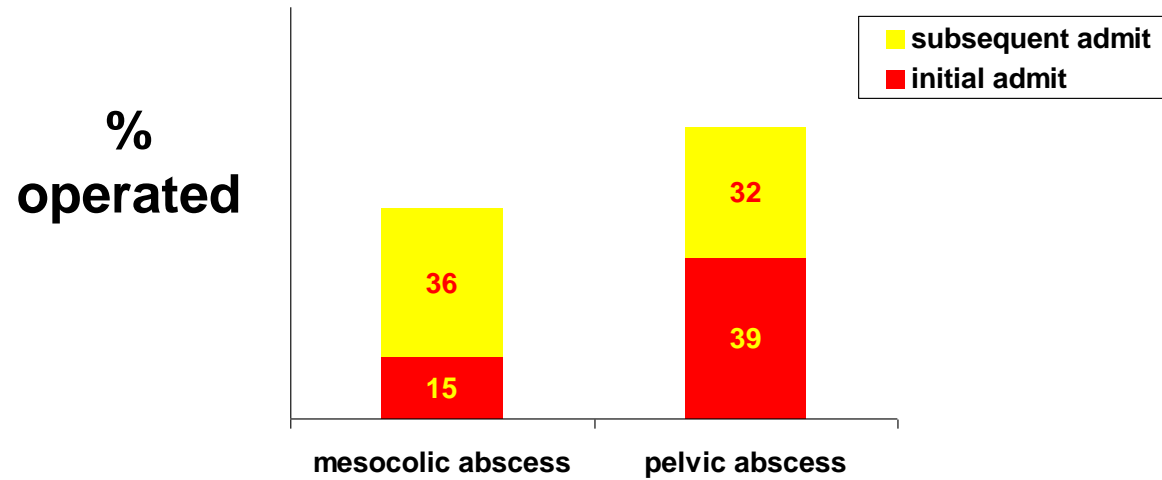
Royds et al. Colorectal Dis 2012 14(10):
1248-1254

More anecdotal evidence in favor of laparoscopic approaches in AD

- Mutter et al > Two stage totally minimally invasive approaches for Acute complicated Diverticulitis. Colorectal Dis 2006; 8(6): 501-506
- Franklin ME et al: Is laparoscopic surgery applicable for complicated colonic DD. Surg Endosc 1997; 11(10): 1021-1025

Hinchey 1-2

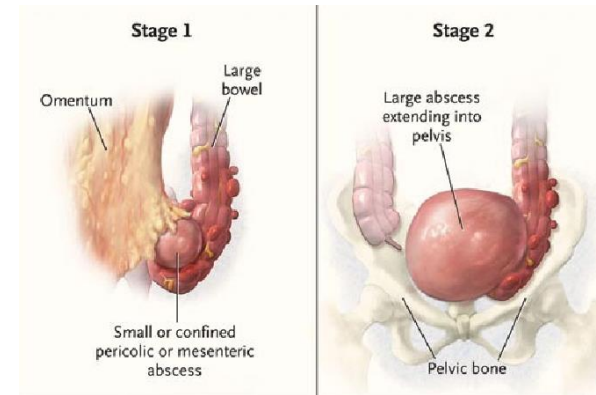
who needs surgery?



- **163 patients underwent percutaneous drainage of colonic diverticular abscesses**
- **138 (84%) underwent subsequent colonic resection**
- **25 (16%) were managed non-operatively**

- 25 patients:
 - 16 F – 9M
 - mean age 65 years
- main reasons for not offering resection:
 - severe cardiac disease (n=13)
 - immunodeficiency (n=7)
 - severe pulmonary disease (n=5)

- **most common location: sigmoid (n=22).**
- **Hinchey Classification:**
 - I: 17 (68%)
 - II: 8 (32%)
- **previous episodes (48%):**
 - 1: 6
 - 2: 2
 - ≥ 3 : 4



- **mean follow-up: 3.3 years**
- **7 patients (28%) had recurrent disease:**
 - **4: uncomplicated**
 - **2: complicated by recurrent abscess**
 - **repeat drainage with no recurrence at 2.9 years**
 - **1: diverticular bleed**
- **2 patients developed a colo-cutaneous fistula (both closed after 16 and 41 days).**

Natural History of Uncomplicated sigmoid diverticulitis

- After 1st episode of AD, overall recurrence rate in literature is 13% to 47% (variation in literature depends on definition of recurrence)
- Unless specific risk factors present risk of complicated second episode is 2% to 5%

Buchs et al World J Gastrointest
Surg 2015; 7 (11): 313:318

Natural History of Uncomplicated sigmoid diverticulitis

Risk Factors:

- CRP > 240 mg/L 3 X more likely
- Young age ?? Disproven
- H/O several previous episodes
- ATB vs. surgical management
- Male sex

Buchs et al World J Gastrointest
Surg 2015; 7 (11): 313:318

Natural History of Uncomplicated sigmoid diverticulitis

Risk Factors:

- CAT scan evidence of complicated disease on first episode
- Higher comorbidity index
- FMH positive
- Length of colon involved with inflammatory changes > 5 cm

Buchs et al World J Gastrointest Surg 2015; 7 (11): 313:318