Diverticulitis Evolution in Management
Wash, Drain or Divert?

20th Annual Conference of the Egyptian Group of Colon and Rectal Surgeons



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Diverticulitis: It is Really Increasing?

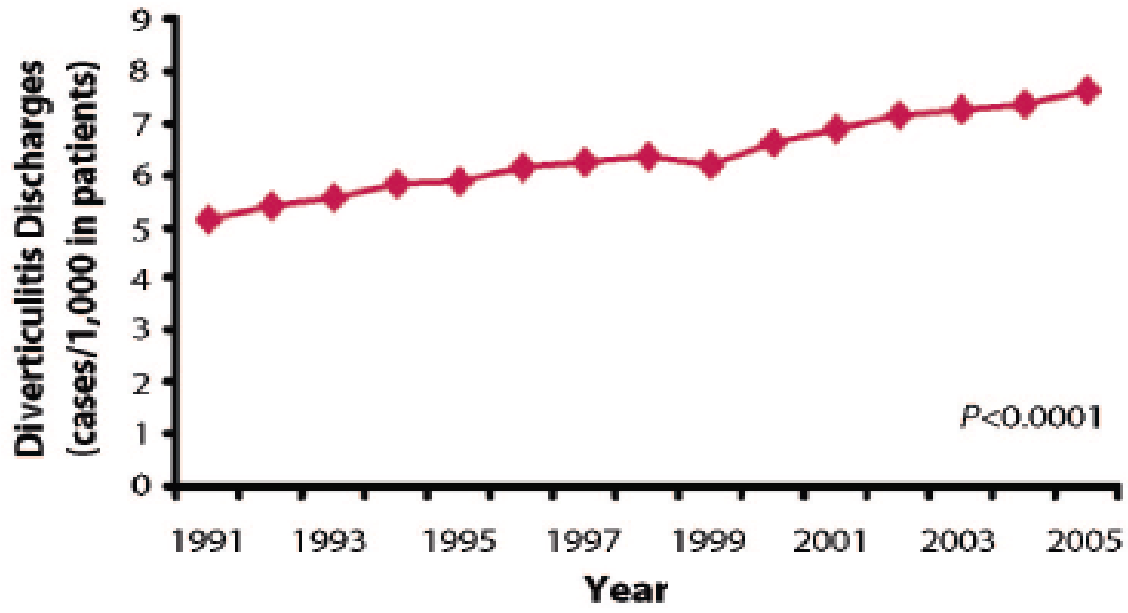


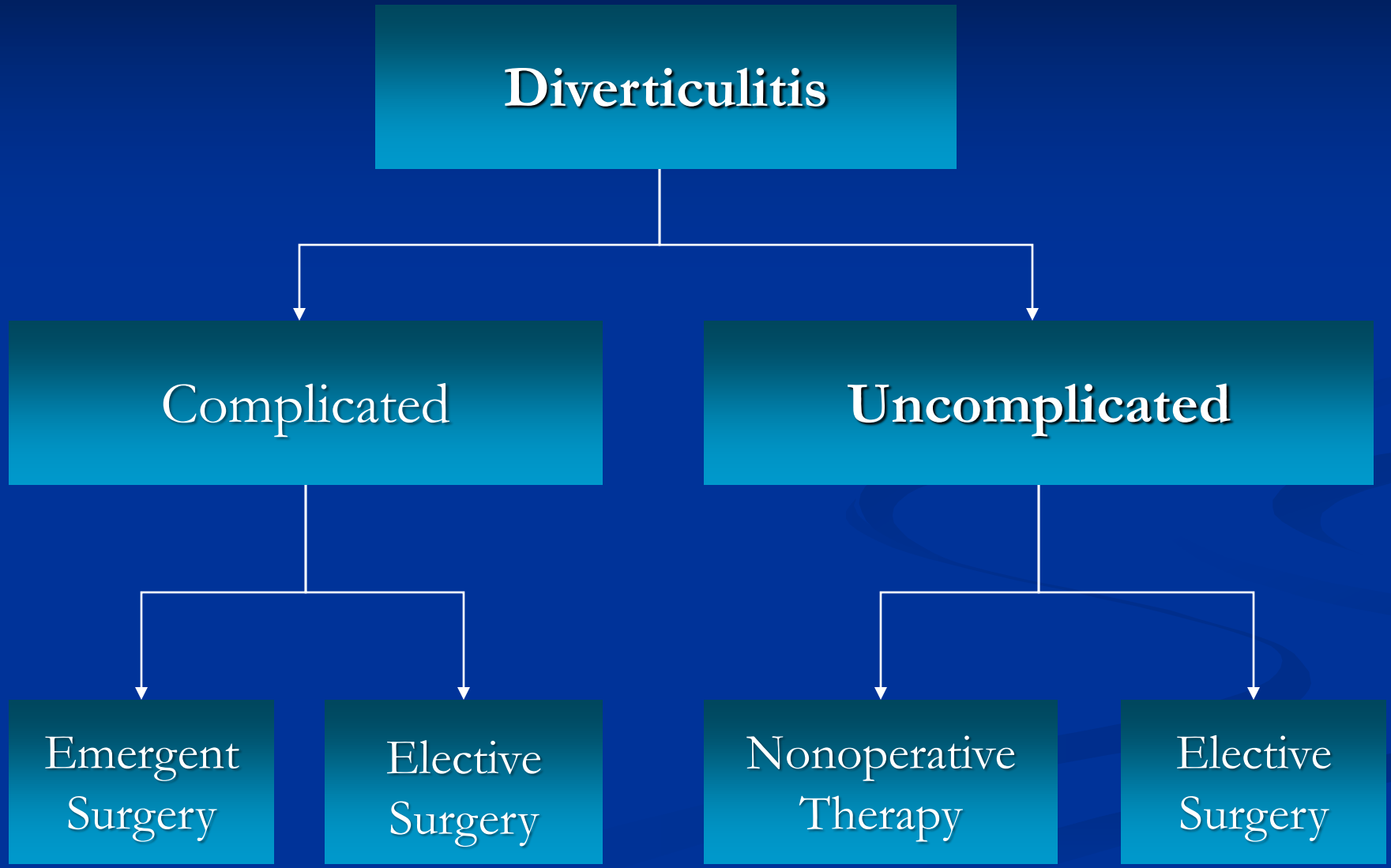
FIGURE 1. Diverticulitis discharges (complicated and uncomplicated) in Nationwide Inpatient Sample hospitals as a proportion of all inpatients. Significance determined by joinpoint analysis and confirmed with nonparametric Kendall correlation analyses.

Ricciardi et al. Dis Colon Rectum. 2009; 52:1558-63

Classic Teachings…

- Diverticulitis is a progressive disease
  - mild inflammation→ abscess→ free perforation
- Surgery recommended to
  1. avoid emergent surgery with high mortality
  2. possibility of a stoma

Traditional
Complicated vs. Uncomplicated



Uncomplicated disease

Minimal symptoms

- Outpatient treatment
- Oral antibiotics

Fever, Systemic Symptoms

- Inpatient treatment
- IV antibiotics
- Transition to oral

Length of treatment
7 – 14 days

Indications for Elective Management
"Old Rules"

Uncomplicated

Nonoperative Therapy

Elective Surgery

2 attacks
1 attack if < 50 years

American College of Gastroenterology, 2006 American Society of Colon and Rectal Surgeons PP, SSAT, European Association for Endoscopic Surgery
Stollman et al Am J Gastro 1999, Wong et al Dis Colon Rectum 2000, J Gastrointest Surg 1999, Surg Endosc 1999

Complicated Disease

Nonoperative Therapy

Elective/Emergent Surgery

1 attack

American College of Gastroenterology, American Society of Colon and Rectal Surgeons, SSAT, European Association for Endoscopic Surgery
Stollman et al Am J Gastro 1999, Wong et al Dis Colon Rectum 2000, J Gastrointest Surg 1999, Surg Endosc 1999

PRACTICE PARAMETERS

Practice Parameters for the Treatment of Sigmoid Diverticulitis

Daniel Feingold, M.D. • Scott R. Steele, M.D. • Sang Lee, M.D. • Andreas Kaiser, M.D.
Robin Boushey, M.D. • W. Donald Buie, M.D. • Janice Frederick Rafferty, M.D.

Prepared by the Clinical Practice Guideline Task Force of the American Society of Colon and Rectal Surgeons

The American Society of Colon and Rectal Surgeons is dedicated to ensuring high-quality patient care by advancing the science, prevention, and management of disorders and diseases of the colon, rectum, and anus. The Clinical Practice Guideline Committee is composed of Society members who are chosen because they have demonstrated expertise in the specialty of colon and

plicated," "uncomplicated," "stents," "ureter," "bowel preparation," "Hinchey," "CT," "MRI," "ultrasound," "antibiotics," "resection," "percutaneous drainage," "laparoscopic," and "colectomy." Directed searches of the embedded references from the primary articles were also performed in selected circumstances. Although not intended to be exclusionary, the authors primarily focused on English language manu

Dis Colon Rectum. 2014 Mar;57(3):284-94.

Major Changes

- The decision to recommend elective sigmoid colectomy after recovery from uncomplicated acute diverticulitis should be individualized. 1B.
- Routine elective resection based on young age (<50 years) is no longer recommended. 1C.
- Following resection, the decision to restore bowel continuity must incorporate patient factors, intraoperative factors, and surgeon preference. 1C
- When expertise is available, the laparoscopic approach to elective colectomy for diverticulitis is preferred. 1A.

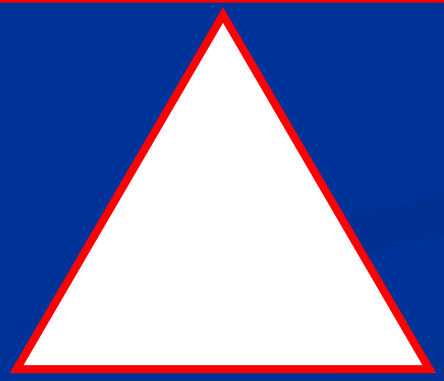
Primary Anastomosis vs. Lavage vs. Diversion

Potential Benefits

- Avoids another surgery
- Up to 50% with stoma won't be reversed
- Morbidity equivalent
- QOL
- ? Cost

Potential Negatives

- Leak
- Recurrence (lavage)
- Death



Resection: Two-Stage Procedures

- **Hartmann's resection**
  - Traditional gold standard
  - ? Safer
  - Maggard, Am Surg, 2004
    - **35% of patients did no undergo stoma reversal**
- **Primary colorectal anastomosis with protecting stoma**
  - Landen, Acta Chir Belg, 2002
    - 20 patients, retrospective
    - Mortality/Morbidity – 15%/50%
    - All stomas closed through peristomal incision
  - Bax, Am J Surg, 2007
    - 1% anastomotic failure rate
    - Major/minor stoma complications - 13%/24%
    - 3% stoma closure complication rate

Selection Bias?

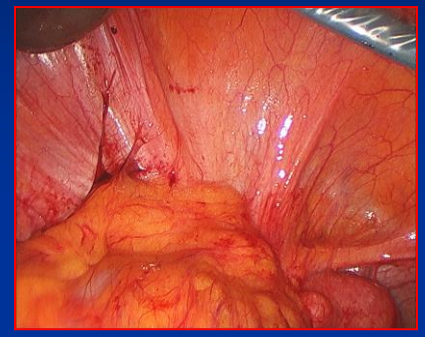
Resection with Primary Unprotected Anastomosis?

- An alternative in highly selected patients in ideal clinical circumstances
- Salem, DCR, 2004
  - Meta-analysis comparing primary anastomosis to Hartmann's resection
    - Mortality -10/20%
    - Wound infection – 10/29%
    - Anastomotic leak – 14/4%
- Abbas, Int J Colorectal Dis, 2007
  - Meta-analysis comparing primary anastomosis to Hartmann's resection
    - No difference in morbidity or mortality

Hartmann's Procedure *vs.* Primary Resection With and Without Stoma

Abbas 2007; 18 Studies	N	Mortality	Stoma Compl	Abdominal Abscess	Anastomotic Leak	Wound Infection
HP	526	19%	7-12%	8%		22.6%
HPR					8%	
PRA	358	9%	18%	4%	5%	14%
Salem 2004; 54 Studies						
HP	1051	18%	10.3%			24.2%
HPR	787	0.8%			4.3%	4.9%
PRA	569	9.9%				9.6%
Constantinides 2006; 15 Studies						
HP	416	15.1%		8.7%		22.3%
HPR			3.9%			
PRA	547	4.9%		3.9%		9.6%
PRA/St			8.3%			

Primary Anastomosis vs. Hartmann's For Diverticulitis



- Systematic review of 98 studies
- Mortality
  - Hartmann's 19.6% (0.8% for reversal)
  - Primary Anastomosis 9.9% (0 - 75%)
- Wound infection
  - Hartmann's 24.2% (4.9% for reversal)
  - Primary Anastomosis 9.6% (0 - 26%)
- Stoma complications 10.3%; Leak 4.3% in reversal; Leak 13.9% (0 – 60%) in PA

Salem, Flum. Dis Colon Rectum, 2004.

Updated Systematic Review

- 59 studies
- Mortality: 3.05%
  - 10.6% Urgent vs. 0.5% Elective
  - 0.75% Lap vs. 4.69% Open
  - 1.96% Primary anastomosis vs. 14.18% Hartmann's
- Morbidity 32.64% all comers
  - 18.96% surgical and 13.93% medical

Haas JM, et al. United European Gastroenterol J. 2016

DIVERTI RCT: Hartmann's vs. PA

Generalized Peritonitis from Diverticulitis

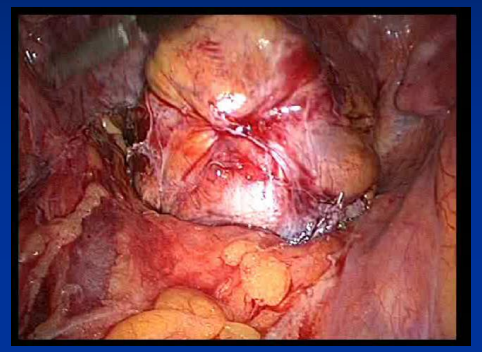
- Multi-center trial France (2008-2012)
- 102 patients purulent / feculent peritonitis
- Randomized to PA or Hartmann's (18 mos f/u)

	Mortality	Morbidity	Absence of Stoma
Hartmann's	7.7%	39%	**65%**
Primary Anastomosis	4% (NS)	44% (NS)	**96% (P=0.0001)**

Bridoux V et al. J Am Coll Surg 2017 Sept

Does the Surgeon Matter?

- N = 136 (Acute Diverticulitis)
- 65% Non-CR and 35% CR Surgeons
- Hartmann's 68% vs. 41% (p=0.01)
- Similar demographics, ASA, Hinchey
- LOS, time to stoma reversal, ICU LOS, complications lower in CRS (43% vs. 16%, p=0.02)



Jafferji MS, Hyman N. J Am Coll Surg 2014.

Lap vs. Open Restorative Emergent Colectomy

- All em
- NSQI
- Lap gr
- MVR:
- Simila

"Laparoscopic emergent colon resection with primary anastomosis has postoperative morbidity and mortality rates comparable to those seen with the open approach, and it reduces the total and postoperative length of hospital stay."

Ballian N, et al. World J Surg, 2012.

Emergency Primary Anastomosis & Outcomes

Year Study Type	Author Journal	HP n	PA n	Disease (Bias)	Correlation with Outcomes *vs.* Hartmann's
2003 RR	**Regenet** Int J Colorectal Dis	33	27	Diverticulitis (Selection)	Better Mortality/Compl/LOS
2006 SR	**Constantinides** *Dis Colon Rectum*	414	549	Diverticulitis (Selection)	Better Mortality
2006 RR/CM	**Aydin** *Dis Colon Rectum*	123	731	Diverticulitis (Selection)	Better Mortality/Compl/LOS
2012 SR	**Toro** *Chirurgia*	800	1010	Diverticulitis (Multiple)	Better Mortality/Compl
2015 RR	**Reyes-Espejel** *Rev Gastro Mex*	32	45	Hinchey III-IV Diverticulitis	Similar Compl/Mortality

A Multicenter Randomized Clinical Trial of Primary Anastomosis or Hartmann's Procedure for Perforated Left Colonic Diverticulitis With Purulent or Fecal Peritonitis

Oberkofler, Christian Eugen MD*; Rickenbacher, Andreas MD*; Raptis, Dimitri Aristotle MD, MSc*; Lehmann, Kuno MD*; Villiger, Peter MD†; Buchli, Christian MD†; Grieder, Felix MD‡; Gelpke, Hans MD‡; Decurtins, Marco MD‡; Tempia-Caliera, Adrien A. MD§; Demartines, Nicolas MD§; Hahnloser, Dieter MD§; Clavien, Pierre-Alain MD, PhD*; Breitenstein, Stefan MD*

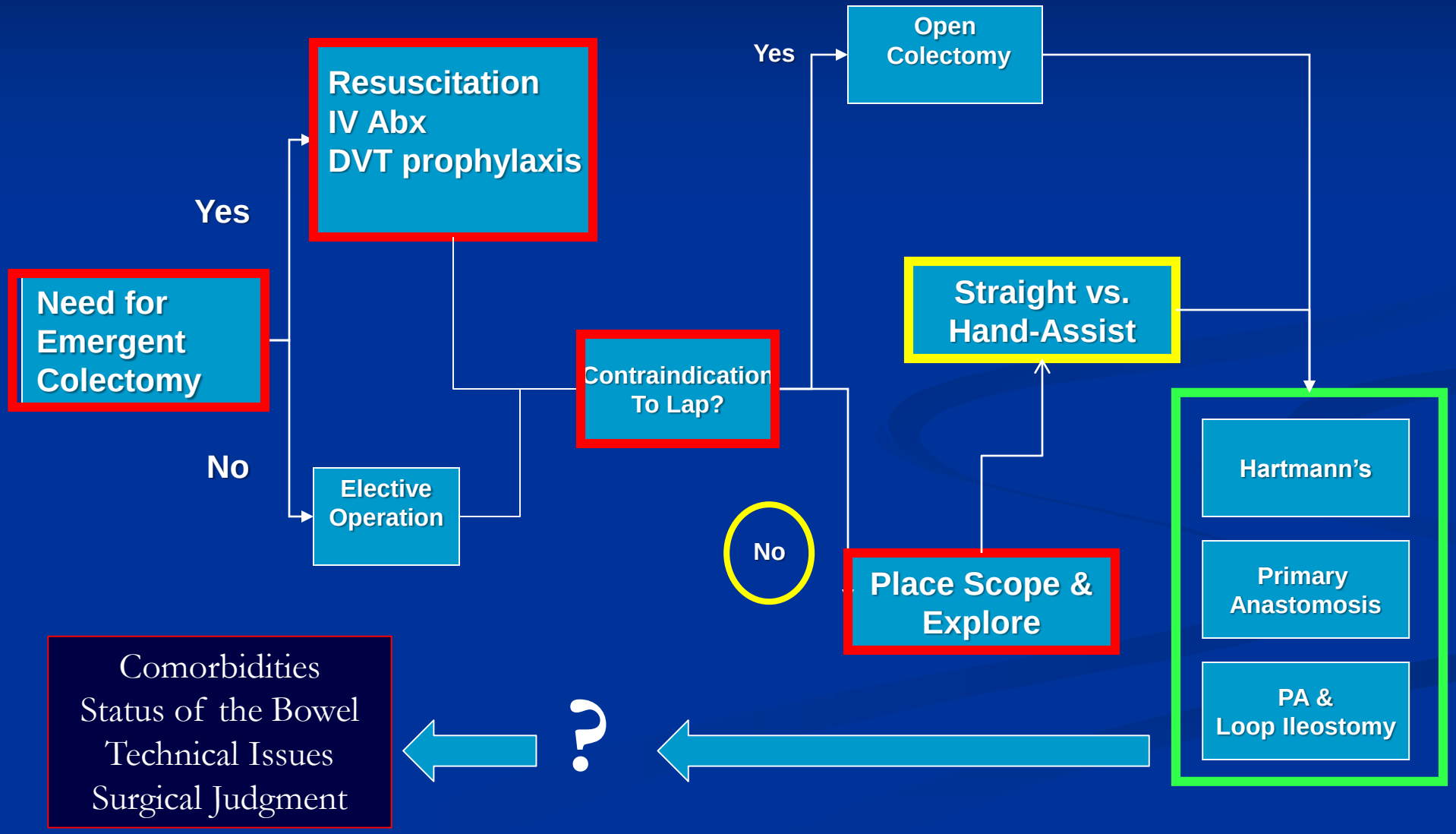
- 62 patients (Hinchey III/IV); 4 centers
- RCT HP (n-30) and PA/DLI (n=32)
- Complication (80 vs. 84%; p=0.813)
- Mortality (13% HP vs. 9% PA/DLI)
- Stomal reversal (57% HP vs. 90% PA/DLI)
- Costs ($24,014 HP vs. $16,717 PA/DLI)

Oberkofler CE, et al. Ann Surg, 2012.

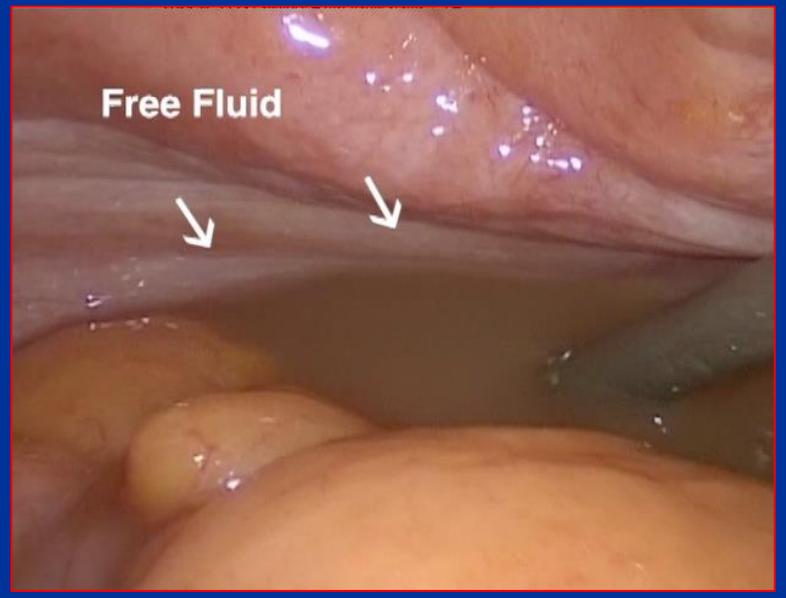
What are the Barriers to Primary Anastomosis?

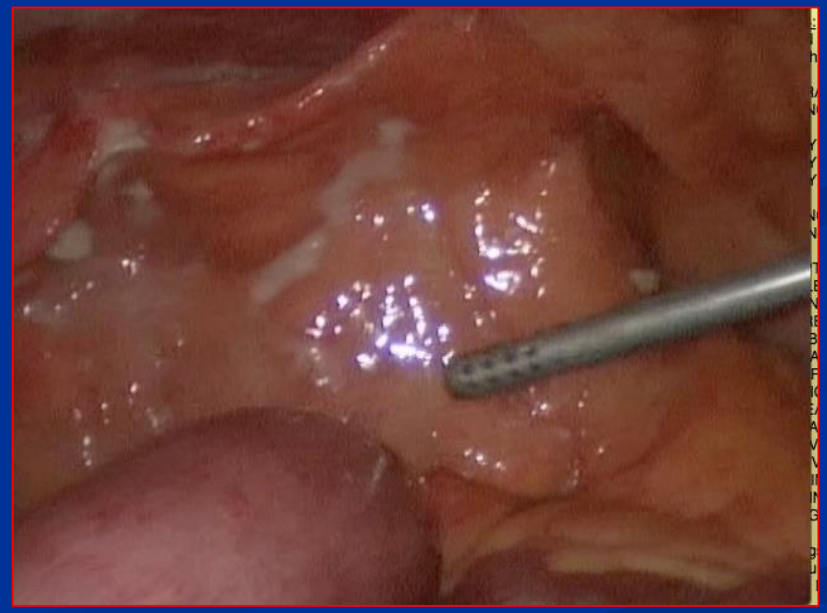
- **Timing / Condition**
  - How sick is the patient?
  - How severe is the disease?
- **Patient Selection**
  - Comorbidities
  - BMI
  - Ability to tolerate a leak
- **Experience / Operation**
  - **Site of disease (total vs. right vs. left vs. stoma)**
  - **Experience of provider**
  - **Experience of the team**

Management Algorithm
Emergency Colectomy



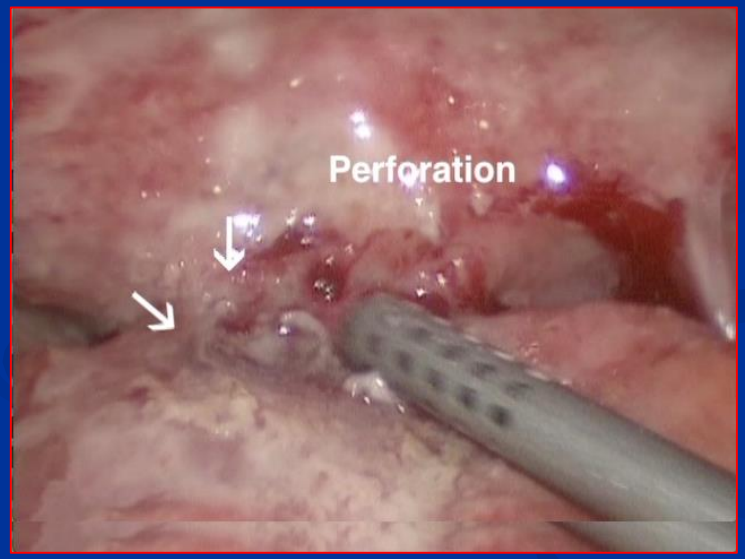
Laparoscopic Lavage





What is the Role for Laparoscopic Peritoneal Lavage and Drainage?

- 4-15 liters warm saline, drains, antibiotics
- Taylor, ANZ J Surg, 2006
  - 14 patients (II-2, III-10, IV-2)
  - 79% (11) recovered and discharged
  - 73% (8) underwent elective colectomy
- Franklin, World J Surg, 2008
  - 40 patients of undefined severity
  - No acute treatment failures
  - 50% underwent elective resection
- Myers, Br J Surg, 2008
  - Prospective, multi-institutional study, 100 patients
  - 8% Class IV- Hartmann's resection
  - 92% successfully treated with 4% morbidity and 3% mortality
  - 2% with recurrent diverticulitis at 36 months



Laparoscopic Lavage in Diverticulitis

Study	Year	N	Hinchey (Grade 4)	Morbidity %	Mortality %	Urgent Surgery (%)
O' Sullivan	1996	8	III	25	0	0
Rizk	1998	10	III/IV (2)	20	0	0
Faranda	2000	18	III/IV	19	0	0
Taylor	2006	14	II/III/IV (2)	0	0	21
Myers	2008	100	II/III/IV (8)	4	3	8
Franklin	2008	40	II/III/IV (3)	25	0	0
Lam	2009	11	II/III	-	0	63
Karoui	2009	35	III	16	0	3
Rogers	2012	427		14	4	
Sorrentino	2015	63	II/III/IV	14.3	1.6	16

Laparoscopic Lavage
Published Studies

- 1996-2009 : 10 studies 255 pts (7-92)
- Age : 58 yrs Majority : Hinchey 3
- Lavage
- Conversion :2.3%
- Morbidity : 11.4% Mortality : 1.2%
- LOS : 8.2 days (1-32)
- Resection : 42% at 38 months

ORIGINAL CONTRIBUTION

Laparoscopic Lavage for Perforated Diverticulitis: A Population Analysis

Ailín C. Rogers, M.B., B.Ch., B.A.O.[1,2] • Danielle Collins, M.D.[1]
Gerald C. O'Sullivan, F.R.C.S.I.[1,†] • Desmond C. Winter, M.D., F.R.C.S.I.[1,2]

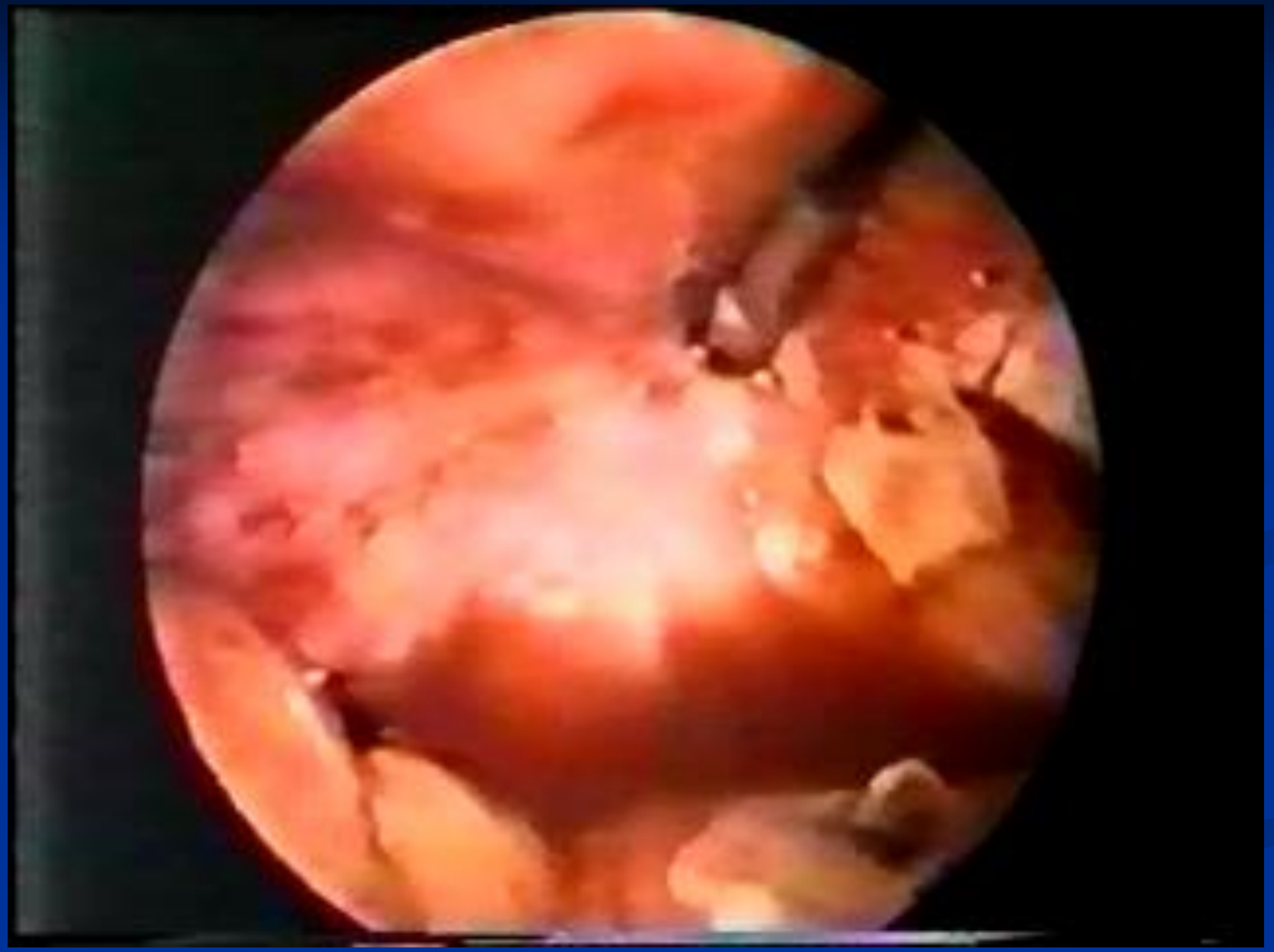
1 Institute for Clinical Outcomes Research & Education (iCORE) and Centre for Colorectal Disease, St. Vincent's University Hospital, Elm Park, Dublin, Ireland
2 School of Medicine & Medical Science, University College Dublin, Dublin, Ireland

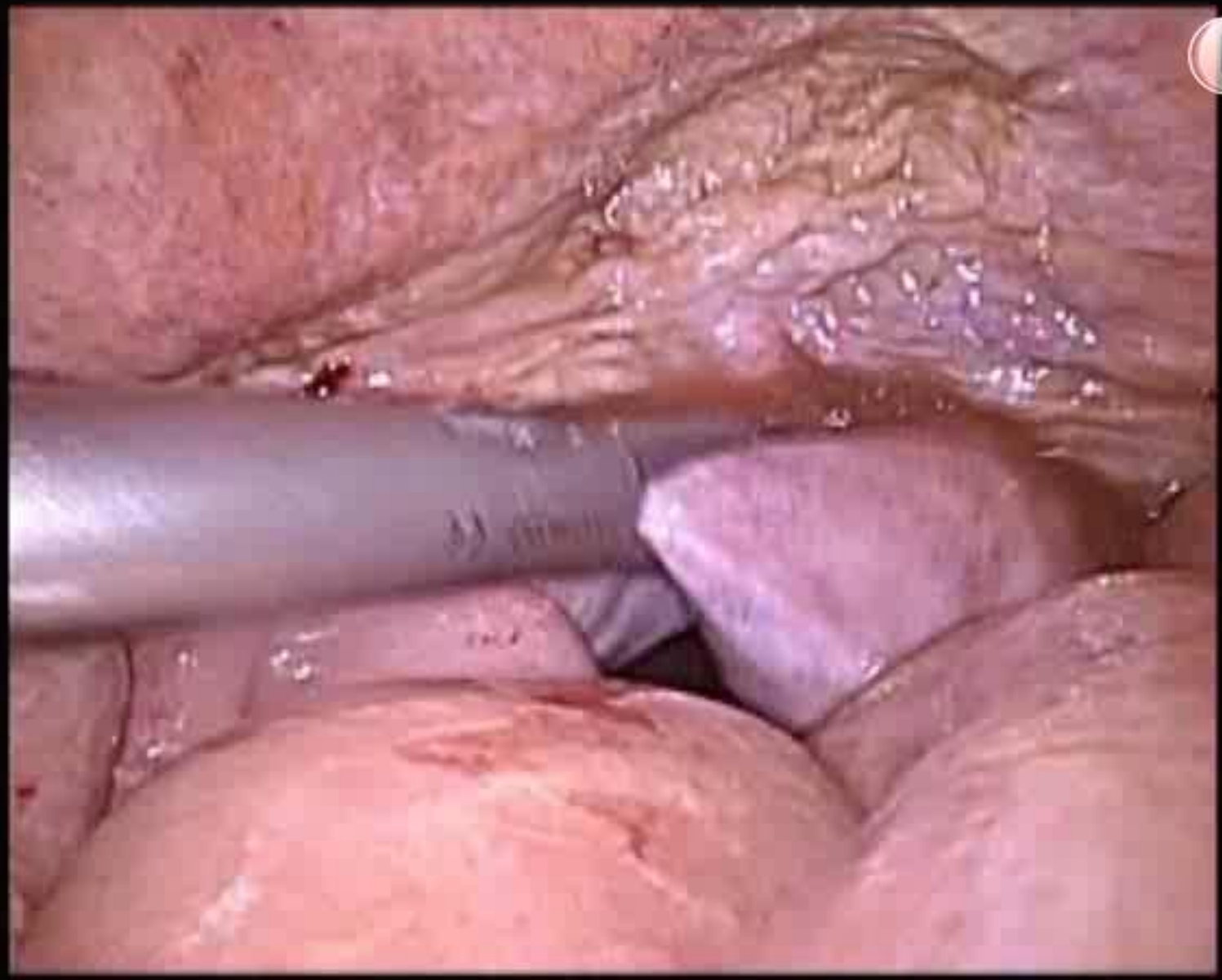
- 2457 patients - 427 with laparoscopic lavage
- Mortality (4% vs. 10.4%; P<0.001)
- Morbidity (14.1% vs. 25%; P<0.001)
- LOS (10d vs. 20d; P<0.001)

Dis Colon Rectum 2012; 55: 932–938
DOI: 10.1097/DCR.0b013e31826178d0

	Study characteristics			Patient outcomes		
Authors	*No. of patients*	*Study design*	*Country*	*Length of stay, d*	*Complication n (%)*	*Mortality n (%)*
O'Sullivan et al[7]	8	Case series	Ireland	10	2 (25)	0
Aouad et al[25]	1	Case report	France		0	0
Taylor et al[9]	12[a]	Case series	Australia	7	1 (12)	0
Mutter et al[26]	10	Case series	France	9	1 (10)	0
Galleano et al[27]	4	Case series	Italy	-	0	0
Myers et al[10]	92[a]	Cohort study	Ireland	8	5 (4)	3 (3)
Bretagnol et al[14]	24	Cohort study	France	12	2 (8)	0
Franklin et al[13]	40	Case series	USA	3	2 (5)	0
Mazza et al[28]	25	Case series	France	14	3 (12)	0
Lam et al[29]	6	Case series	Belgium	11	3 (50)	0
Favuzza et al[30]	7	Case series	USA	8	2 (28)	0
Jaffer et al[31]	1	Case report	UK	5	0	0
Karoui et al[32]	35	Case series	France	8	7 (17)	0
Lippi et al[33]	13[a]	Case series	Italy	-	2 (15)	3 (23)
White et al[15]	35	Case series	Australia	14	12 (34)	0
Huscher et al[34]	1	Case report	Italy	5	0	0
This study	427	Population study	Ireland	10	[illegible] (14)	17 (4)
Total	768			10	13	3

Our population study is the larg[illegible]t to date. Out[illegible]mes in our population study are comparable to those from pre[illegible]us groups.
[a]Only those solely undergoing laparoscopic lavage for nonfeculent peritonitis were included for this table.






VIDEOSCOPY

RCTs for Lap Lavage Since 2008

Source	Country	Type	Hinchey	Patients	Lavage	Procedure For Resection	F/U
Shultz 2015	Norway	RCT	I-III	199	>4L Saline	PA or Hartmann's	12
Vennix 2015 (LADIES)	Netherlands	RCT	III	90	≤6L Saline	PA vs. Hartmann's	12
Angenete 2016	Sweden / Denmark	RCT	III	83	3L Saline	Hartmann's	3

Prospective RCTs since 2009

Laparoscopic lavage										
Source	No.	Median length of stay (days)	n (%)							
			Reoperations				Percutaneous abscess drainage	Patients with stoma	Deaths - all causes	Diverticulitis related deaths
			Total	With resection	For Infection	Other indication				
Schultz, 2015[10]	74	6.5	15 (20.2)	*	10 (13.5)	5 (6.8)	8 (10.8)	11/64 (17.2)	6 (8.1)	4 (5.4)
Vennix, 2015[11]	46	8	9 (19.6)†	8 (17.4)†	9 (19.6)†	0†	9 (19.6)†	9 (19.6)†	2 (4.3)†	2 (4.3)†
Angenete, 2016[13]	38	6	5 (13.2)†	*	4 (10.5)†	1 (2.6)†	*	1 (2.6)†	3 (7.9)	*

Colon resection										
Source	No.	Median length of stay (days)	n (%)							
			Reoperations				Percutaneous abscess drainage	Patients with stoma	Deaths - all causes	Diverticulitis related deaths
			Total	With resection	For Infection	Other indication				
Schultz, 2015[10]	70	7.5	4 (5.7)	*	0	4 (5.7)	2 (2.9)	43/62 (69.4)	5 (7.1)	2 (2.9)
Vennix, 2015[11]	42	10	3 (7.1)†	0	0†	3 (7.1)†	0†	35 (83.3)†	1 (2.4)†	1 (2.4)†
Angenete, 2016[13]	35	9	6 (17.1)†	*	3 (8.6)†	3 (8.6)†	*	35 (100)†	4 (11.4)	*

Lap Lavage vs. Resection
Summary of RCTs; F/U 90 days

Outcome	No. of studies	No. of patients	Pooled RR	95% CI	p	Tests for heterogeneity		Anticipated absolute effects	
						I^2	P	Assumed risk with colon resection* (%)	Corresponding risk with laparoscopic lavage (%)
Total reoperations	3	305	2.07	1.12, 3.84	0.021	54%	0.113	8.8%	9.5% **higher** with lavage
Reoperations for infection	3	305	5.56	1.97, 15.69	0.001	65%	0.057	2.0%	9.3% **higher** with lavage
CT-guided abscess drainage	2	232	6.54	1.77, 24.16	0.005	0%	0.326	1.8%	9.9% **higher** with lavage
Stoma formation	3	288	0.18	0.12, 0.27	<0.001	65%	0.056	81.4%	66.8% **lower** with lavage
Mortality	3	307	1.03	0.45, 2.34	0.95	0%	0.759	6.8%	0.2% **higher** with lavage

Source	Laparoscopic lavage n								Colon resection n							
	No.	LOS	Reoperations			Perc. drain	Pts. with stoma	Deaths	No.	LOS	Reoperations			Perc. drain	Pts. with stoma	Deaths
			Total	For Infection	Other indic.						Total	For Infection	Other indic.			
Karoui, 2009[1]	35	8	1	0	1	1	*	0	24	17	2	0	2	1	0	0
Rade, 2014[14]	71	12	11	11	*	*	*	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sorrentino, 2015[15]	63	7	6	6	0	*	*	*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Horesh, 2015[16]	10	11	0	0	0	3	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Observational Studies

=

Lots of Them!

Most under 50 patients of Lavage!

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, 1C


PRACTICE PARAMETERS

Practice Parameters for the Treatment of Sigmoid Diverticulitis

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Prepared by the Clinical Practice Guideline Task Force of the American Society of Colon and Rectal Surgeons

Primary Anastomosis for Emergency Diverticulitis Surgery

- **Is it Feasible?**
  - Absolutely
- **Are Outcomes Improved?**
  - Some
    - Permanent stoma
    - ? Mortality
    - ? Morbidity
- **Is there a Downside?**
  - If they leak
- **Is it the Future?**
  - Surgeon Judgment

Abbas S. Int J Colorectal Dis, 2007.

Wash, Drain or Divert: Have the New Treatments Made Hartmann's Procedure Obsolete?

Not Yet!

Conclusions

- Primary anastomosis feasible with good surgical judgment
- Protective ileostomy likely better than Hartmann
- Laparoscopic lavage
  - Evolving indications and role
  - Smoldering / Undrainable abscess / other?
  - Best technique remains to be determined

Cleveland Clinic

Every life deserves world class care.