

Management of the Complicated Enterocutaneous Fistula



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The Questions:

- What is a fistula? Are they all the same?
- Do I need to operate?
- When should I operate?
- When should I operate
- Should I reconstruct the fascia or call it a day?

Really...How bad is it?

Original article

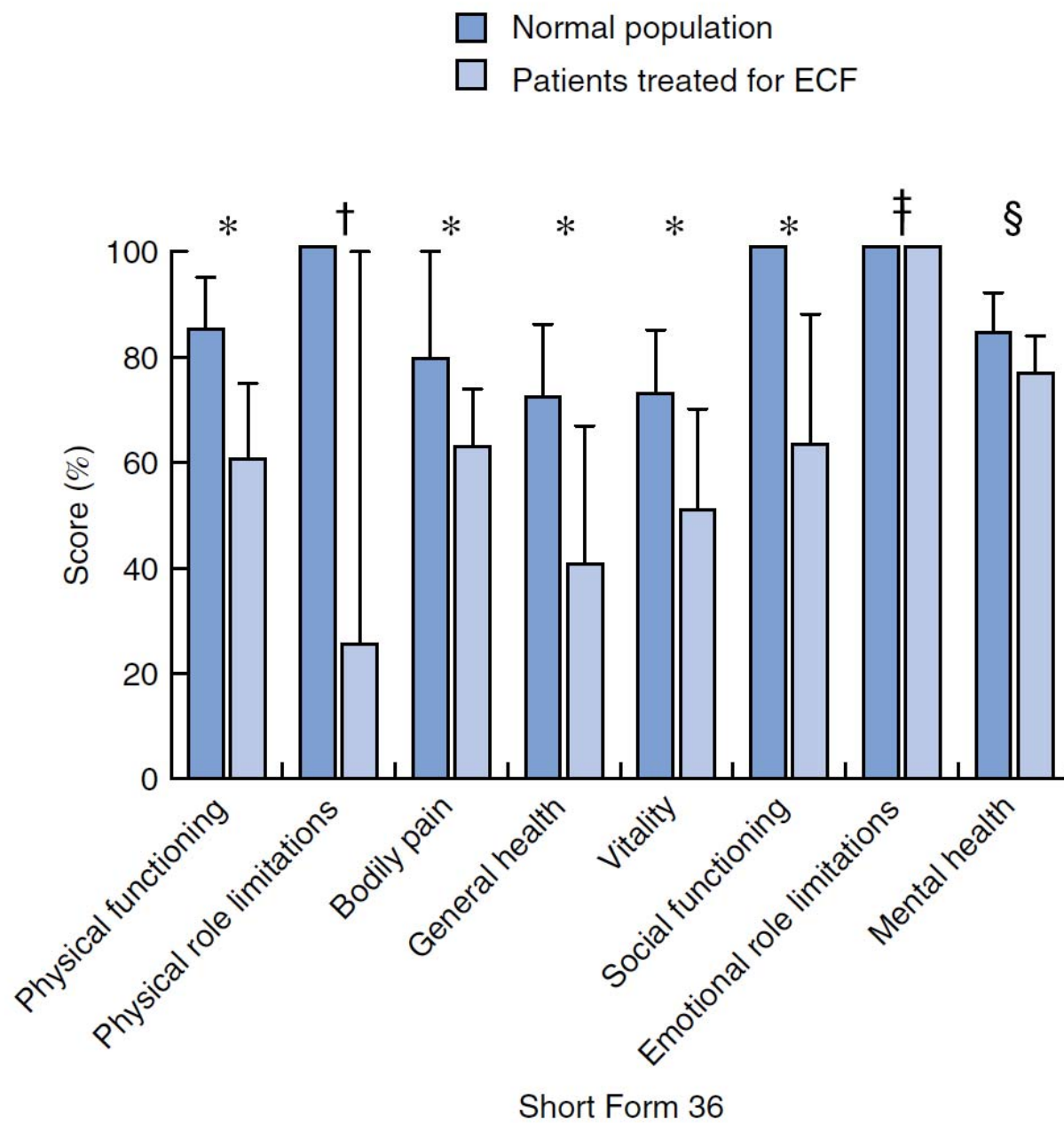
British Journal of Surgery 2008; **95**: 1280–1286

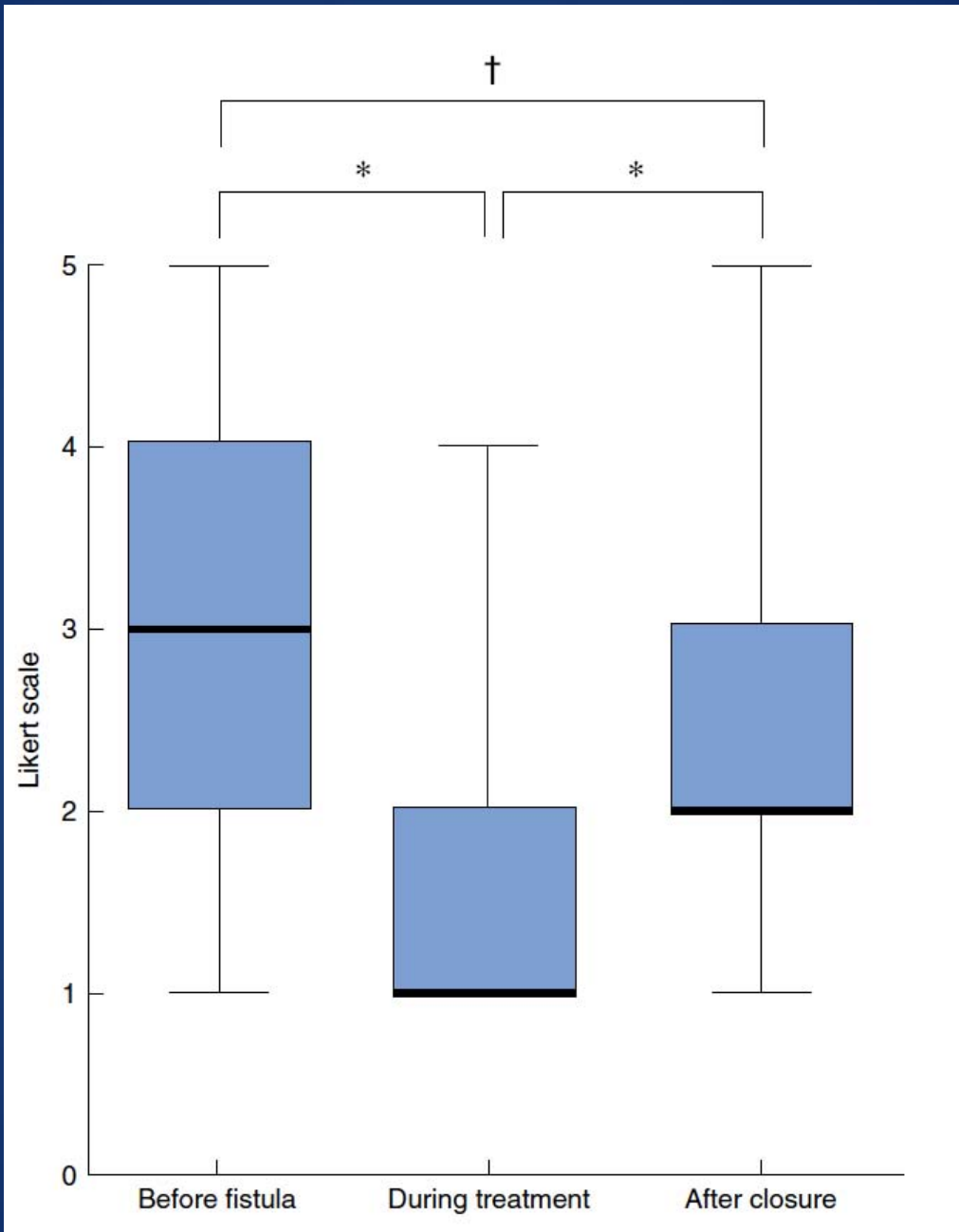
Health-related quality of life in patients treated for enterocutaneous fistula

R. G. J. Visschers¹, S. W. M. Olde Damink^{1,2}, M. van Bekkum³, B. Winkens⁴, P. B. Soeters¹ and W. G. van Gemert¹

Netherlands

- 135 pts with ECF
- 21 healed spontaneously
- 44 died, 13 died of fistula (9.7%)
- 62 pts with *healed* ECF compared to matched controls





How much is this gonna set me back?

ORIGINAL ARTICLE

(Inflamm Bowel Dis 2008;14:1707–1714)

Effects of Fistula on Healthcare Costs and Utilization for Patients with Crohn's Disease Treated in a Managed Care Environment

Russell D. Cohen, MD, Heidi C. Waters, MS, MBA,[†] Boxiong Tang, MD, PhD,[†] and Mirza I. Rahman, MD, MPH[†]*

Chicago

- **Evaluated 13,454 pts with Crohns**
- **Paid Claims in 12 months after Dx with or without fistula**

TABLE 2. Healthcare Costs for All Patients

	Fistula Cohort	Nonfistula Cohort	<i>P</i> -value ^a
Total healthcare costs (\$)	10,863 (0–1,307,019) 35,373 [104,108]	6268 (0–1,181,485) 15,564 [35,128]	<0.0001
Inpatient (\$)	0 (0–1,277,297) 21,279 [93,935]	0 (0–1,001,350) 7060 [27,648]	<0.0001
Outpatient hospital (\$)	1334 (0–169,066) 3234 [8215]	174 (0–332,569) 1697 [6182]	<0.0001
Surgery (\$)	486 (0–359,943) 5399 [25,975]	0 (0–441,714) 1662 [10,391]	<0.0001

- **Fistula doubles cost**
- Inpt hospitalization and Surgery most effected
- **Did not account for indirect costs such as lost work days, lost earnings, out of pocket costs**
- Included perianal fistula so likely underestimate

Enterocutaneous Fistula Complicating Trauma Laparotomy: A Major Resource Burden

- Retrospective case control study
- 2373 acute trauma laparotomies
- 36 (1.5%) developed ECF

	Fistula	No Fistula Controls	P value
ICU LOS (days)	28.5±30.5	7.6±9.3	0.004
Total LOS (days)	82.1±100.8	16.2±17.3	<0.001
Hospital Charges	\$539,309	\$126,996	<0.001

What is a fistula?
Are they all the same?

Definitions

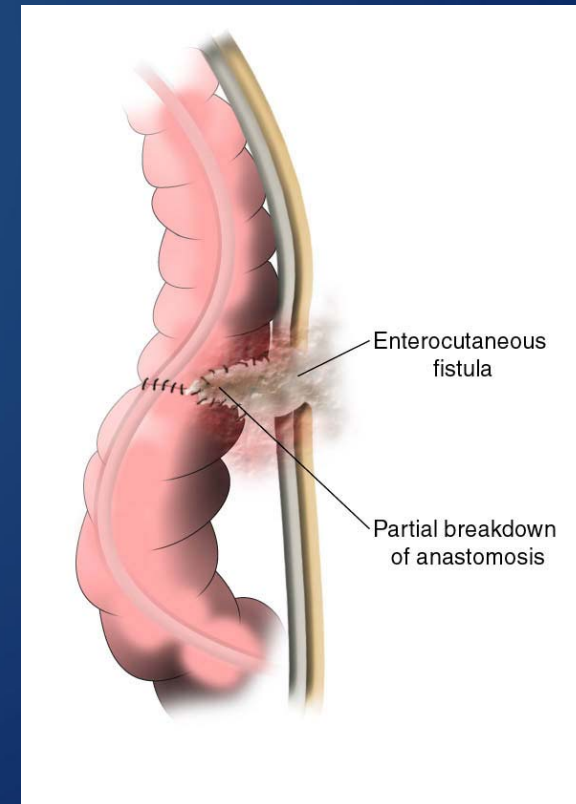
- **Fistula** - abnormal communication between two epithelialized surfaces
- **Enterocutaneous fistula** - abnormal communication between the bowel lumen and skin

Causes

Post-surgical = **75-80%**

Other = 20-25%

- IBD
- Malignancy
- XRT
- Diverticulitis
- Trauma



Classification Systems

- **Anatomic**
 - stomach, duodenum, jejunum, ileum, colon
- **Etiologic**
 - Postoperative, crohns' disease, cancer, radiation
- **Physiologic**
 - Low < 200 mL/d
 - Moderate = 200-500 mL/d
 - High > 500 mL/d
- **Why Classify?**
 - Predict closure? Mortality?

Do I need to operate?

“FRIEND”

- Foreign Body
- Radiation
- Inflammation/infection
- Epithelialization
- Neoplasm
- Distal Obstruction



A Multivariate Model to Determine Prognostic Factors in Gastrointestinal Fistulas

J Am Coll Surg

Vol. 188, No. 5, May 1999

Antonio CL Campos, MD, PhD, Dalton F Andrade, PhD, Guilherme MR Campos, MD, MS,
Jorge EF Matias, MD, PhD, Julio CU Coelho, MD, PhD

Brazil

- **188 patients over 10 yr**
- **Spontaneous closure 31%**
- **Mortality 31%**
- **Anatomic**
 - Duodenal 22%
 - Jejunoileal 29%
 - Colonic 24%
 - Biliopancreatic 25%
- **Etiologic**
 - **Postoperative 90%**
 - **Cancer 29%**
- **Physiologic**
 - Low (<500 mL/d) 50%
 - High (> 500 mL/d) 50%

Univariate Analysis

Closure	Total (n = 188)		Duodenal (n = 42)		Jejunioileal (n = 54)		Colon (n = 45)	
	n	%	n	%	n	%	n	%
Not closed (death)	58	30.9	15	35.7	21	38.9	11	24.4
Spontaneous <i>p</i> = 0.017	59	31.4	14	33.3	11	20.4	12	26.7

Potential prognostic factor	Spontaneous closure		Surgical closure		Death*	
	%	p Value	%	p Value	%	p Value
Cause		0.019		0.024		0.183
Surgical	35		35		52	
Nonsurgical	12		58		73	
Classification		0.003		0.098		0.009
High-output	21		32		63	
Low-output	41		44		37	

Multivariate Analysis for Spontaneous Closure

Table 4. Multivariate Odds Ratios of the Prognostic Factors for Spontaneous Fistula Closure

Prognostic factor	Odds ratio*	95% CI	p Value [†]
Cause			0.027
Nonsurgical (versus surgical)	0.200	0.050–0.806	
Classification			0.037
Low-output (versus high-output)	2.976	1.095–8.064	
Institutional origin			0.026
Not HC (versus HC)	0.364	0.153–0.870	
Complications			< 0.001 [‡]
Infectious (present versus not present)	0.064	0.017–0.244	
Noninfectious (present versus not present)	0.079	0.009–0.699	
Nutritional support–related (present versus not present)	1.536	0.500–4.717	
Organ of origin			0.068 [‡]
Biliopancreatic tract (yes versus no)	1.416	0.431–4.651	
Colon (yes versus no)	0.382	0.105–1.391	
Duodenum (yes versus no)	2.058	0.625–6.757	

Multivariate Analysis for Mortality

Table 6. Multivariate Odds Ratios of the Prognostic Factors for Death

Prognostic factor	Odds ratio*	95% CI	p Value [†]
Classification			0.009
Low-output (versus high-output)	0.242	0.080–0.685	
Complications			<0.001 [‡]
Infectious (present versus not present)	22.068	5.884–112.748	
Noninfectious (present versus not present)	21.485	4.499–137.848	

Summary

- Duodenal more likely and colon less likely to close vs. small bowel
- **Postoperative ECF more likely to close vs. other cause**
- Low output more likely to close vs. high output
- **Mortality increased in high output fistulas**

Systematic Management of Postoperative Enterocutaneous Fistulas: Factors Related to Outcomes

Jose L. Martinez · Enrique Luque-de-Leon ·
Juan Mier · Roberto Blanco-Benavides ·
Felipe Robledo

Mexico

- **174 patients with posoperative ECF, 10 years**
- **Spontaneous closure 37%**
- **Mortality 13%**

Location

Site of origin	Number of patients	Spontaneous closure (<i>n</i> = 65) Number (%)	Operative closure (<i>n</i> = 86) Number (%)	Total closure (<i>n</i> = 151) Number (%)	Deaths (<i>n</i> = 23) Number (%)
Esophagus	6	5 (83)	1 (17)	6 (100)	0 (0)
Stomach	8	3 (38)	4 (50)	7 (88)	1 (12)
Duodenun	20	10 (50)	9 (45)	19 (95)	1 (5)
Jejunum	48	7 (15)	27 (56)	34 (71)	14 (29)
Ileum	42	16 (38)	22 (52)	38 (90)	4 (10)
Colon	50	24 (48)	23 (46)	47 (94)	3 (6)

Spontaneous Closure

Variable	Number of patients with spontaneous closure/total	Univariate analysis <i>p</i> Value	Multivariate analysis	
			OR (95% CI)	<i>p</i> Value
Jejunum				
Yes	7/48 (15%)	0.001	0.282 (0.111–0.716)	0.008
No	58/126 (46%)			
Multiple fistulas				
Yes	5/32 (16%)	0.003	0.353 (0.119–1.052)	0.06
No	60/142 (42%)			
Hydroelectrolytic imbalance				
Yes	18/68 (26%)	0.013	0.895 (0.410–1.952)	0.78
No	47/106 (44%)			
High output				
Yes	10/57 (18%)	0.001	0.405 (0.174–0.941)	0.03
No	55/117 (47%)			

Mortality

Variable	Number of dead patients/total	Univariate analysis	Multivariate analysis	
		<i>p</i> Value	OR (95% CI)	<i>p</i> Value
Serum albumin <3 g/dl				
Yes	22/114 (19%)	0.002	5.389 (0.487–59.594)	0.170
No	1/60 (2%)			
High output				
Yes	16/57 (28%)	0.001	1.479 (0.368–5.938)	0.581
No	7/117 (6%)			
Hydroelectrolytic imbalance				
Yes	17/68 (25%)	0.001	1.512 (0.337–6.782)	0.590
No	6/106 (6%)			
Multiple fistulas				
Yes	13/32 (40%)	0.001	5.881 (1.487–23.253)	0.012
No	10/142 (7%)			
Sepsis				
Yes	22/80 (27%)	0.001	16.59 (1.84–149.05)	0.012
No	1/94 (1%)			
Jejunal fistula				
Yes	14/48 (29%)	0.001	4.628 (1.167–18.346)	0.029
No	9/126 (7%)			
Complex tract				
Yes	5/15 (33%)	0.032	1.509 (0.205–11.095)	0.686
No	18/159 (11%)			

Classification – Does it Really Matter?

- **Anatomy**
 - Small bowel ECF slightly less likely to close spontaneously and may be associated with higher mortality
- **Etiology**
 - Postoperative fistula more likely to close spontaneously but mortality similar to other causes
- **Physiology**
 - High output fistulas are less likely to close spontaneously and may be associated with higher mortality

Classification

Is there a better system?

- **Superficial vs. deep**

- **Superficial ECF**

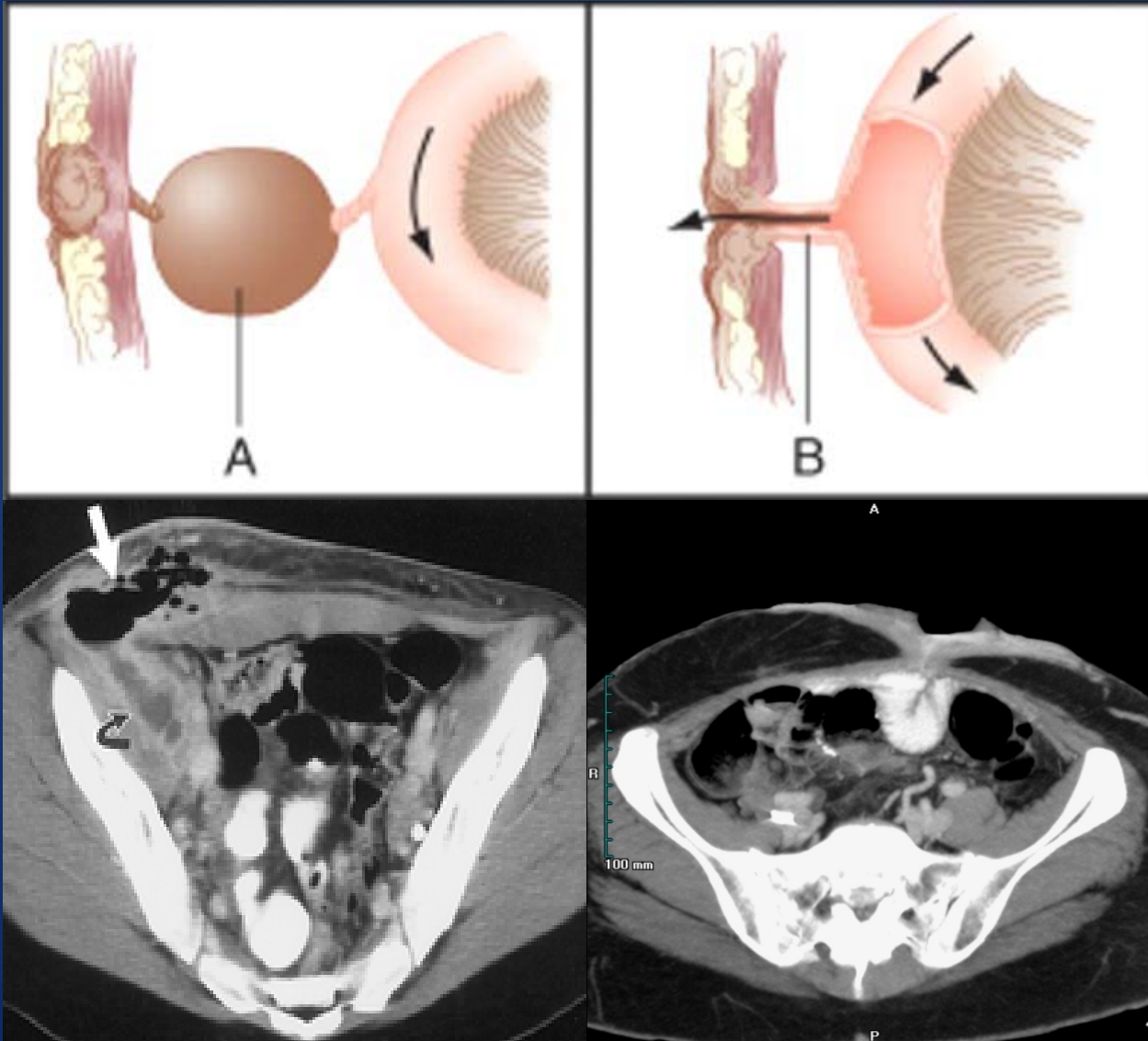
- Drains onto skin or granulating wound
 - Completely extraperitoneal process
 - Local wound problem, very low mortality

- **Deep ECF**

- Drains into peritoneal cavity
 - Associated with peritonitis, sepsis, malnutrition
 - Higher mortality

“fistula in open abdomen” “complicated fistula”
“enteroatmospheric fistula”

Deep vs. Superficial



Feasibility of Damage Control Surgery in the Management of Military Combat Casualties

Ben Eiseman, MD; Ernest E. Moore, MD; Daniel R. Meldrum, MD; Christopher Raeburn, MD

Arch Surg. 2000;135:1323-1327

Denver !!

“...involved stuffing mattresses into gaping holes, extinguishing local..., and “dogging down” watertight doors to limit the spread of damage. These measures keep the ship afloat and permit assessment of other damage and time to establish a plan for definitive repair. The analogy to care of the seriously injured is obvious.”

Risk of Mortality and Fistula with Open Abdomen

AUTHOR	YEAR	Pts	MORTALITY	DEVELOPED ECF
Barker et al.	2007	258	67/258 (26%)	13/191 (6.7%)
Jamshidi et al.	2007	69	NR	7/69 (10.1%)
Miller R. et al.	2005	344	68/344 (20%)	10/276 (3.6%)
Adkins et al.	2004	81	20/81 (25%)	12/61 (19.7%)
Howdieshell	2004	88	17/88 (19%)	0/71 (0%)
Mayberry	2004	140	117/140 (16%)	10/117 (8.5%)
Miller P. et al.	2004	53	8/53 (15%)	1/45 (2.3%)
Tsuei et al.	2004	71	23/55(42%)	14/55 (27%)
Jernigan et al.	2003	274	108/274 (39%)	10/166 (6%)
Navsaria et al.	2003	55	25 (45%)	3/30 (10%)
Miller P. et al.	2002	148	65/148 (44%)	1 (0.7%)
Tremblay et al.	2001	181	81/181 (45%)	26/100 (26%)
Barker et al.	2000	112	29/112 (23%)	5/83 (6%)
TOTAL		144	30% (15-45%)	10.5% (0-27%)

Treatment Strategies in 135 Consecutive Patients with Enterocutaneous Fistulas

Ruben G. J. Visschers · Steven W. M. Olde Damink ·
Bjorn Winkens · Peter B. Soeters · Wim G. van Gemert

Netherlands

- Median time to closure 53 days
- Recurrence after surgery 9.3%
- Mortality 9.6%
- Open abdomen main negative predictor of spontaneous closure
- Low preop albumin decreased spontaneous closure and increased mortality

Fistula in the Open Abdomen

Table 2 Overview of literature.
Results of fistulas within a
closed abdominal wall

Author	Number of patients	Surgical closure, %	Spontaneous closure, %	Overall mortality, %
Sitges-Serra et al [7] ^a	65	10.8	73.8	15.4
Conter et al. [8] ^b	36	NA	13.9	NA
Levy et al. [9] ^c	170	NA	NA	23
Schein and Decker [10] ^a	72	NA	NA	22.2
Chamberlain et al. [11] ^c	22	27.3	36.4	31.8
Hollington et al. [12] ^a	245	NA	NA	14.6 ^d
Present study ^b	82	68.3	22	6.1
<div> <div>692</div> <div>36.5%</div> <div>15.1%</div> </div>				

^a Gastrointestinal fistulas

^b Enterocutaneous fistulas

^c Small bowel fistulas

^d Success rate is 72%

Table 3 Overview of literature.
Results of fistulas with an
abdominal wall defect

Author	Number of patients	Surgical closure, %	Spontaneous closure, %	Overall mortality, %
Sitges-Serra et al. [7] ^a	10	30	10	60
Conter et al. [8] ^b	15	NA	0	NA
Levy et al. [9] ^c	165	NA	NA	44
Schein and Decker [10] ^a	45	NA	NA	60
Chamberlain et al. [11] ^c	3	0	0	100
Hollington et al. [12] ^a	32	NA	NA	18.8 ^d
Present study ^b	53	77.3	5.7	15.1
<div> <div>323</div> <div>4%</div> <div>50%</div> </div>				

^a Gastrointestinal fistulas

^b Enterocutaneous fistulas

^c Small bowel fistulas

^d Success rate is 47%

NA not available

Table 5 Outcome of treatment in the total population and specified for abdominal wall status

	Total population (<i>n</i> = 135)		Open abdomen (<i>n</i> = 53)		Closed abdomen (<i>n</i> = 82)	
	Number	%	Number	%	Number	%
Closure	118	87.4	44	83.0	74	90.2
Spontaneous	21	15.6	3	5.7	18	22.0
Surgical	97	71.9	41	77.4	56	68.3
Success of surgery	97/107	90.7	41/49	83.7	56/58	96.6
Mortality	13	9.7	8	15.1	5	6.1
Persisting fistula	4	3.0	1	1.9	3	3.7

- **Multivariate = open abdomen and TPN were the only independent predictors for spontaneous closure**
- **Spontaneous closure 5 times less likely in open abdomen**
- **TPN increased rate of spontaneous closure by factor of 5**

An analysis of predictive factors for healing and mortality in patients with enterocutaneous fistulas

J. E. MAWDSLEY*, P. HOLLINGTON†, P. BASSETT*, A. J. WINDSOR‡, A. FORBES‡ & S. M. GABES **UK**

- **277 pts, 10 years**
- **Overall healing rate = 69%**
 - Conservative management = 50% (55/110)
 - Definitive surgery = 82% (137/167)
- **Mortality = 15%**
 - **75% attributed to complication of fistula itself**

Fistula Healed

Conservative Management

Table 5. Univariate analysis of factors affecting fistula healing in patients managed conservatively

Variable	Group	Healed N (%)	Odds ratio (95% CI)	P-value
Age*	–	–	0.75 (0.59, 0.95)	0.02
Source of referral	St Marks	38 (69)	1	<0.001
	Outside	17 (30)	0.20 (0.09, 0.44)	
Laparostomy present	No	52 (55)	1	0.02
	Yes	2 (15)	0.15 (0.03, 0.72)	
Fistula output	Low	44 (68)	1	<0.001
	High	11 (26)	0.17 (0.07, 0.40)	
Fistula complexity	Simple	16 (76)	1	0.002
	Complex	23 (36)	0.17 (0.06, 0.54)	

- **Open Abdomen = 3 times less likely to close**
- **Complex fistula = 2 times less likely to close**
- **Location and etiology no impact**

Successful Surgical Closure

Table 3. Univariate analysis of factors affecting fistula healing in patients managed with definitive surgical fistula closure

Variable	Group	Healed N (%)	Odds ratio (95% CI)	P-value
Age*	–	–	0.99 (0.76, 1.30)	0.96
Source of referral	St Marks	43 (91)	1	0.05
	Outside	93 (78)	0.33 (0.11, 1.01)	
Laparostomy present	No	120 (83)	1	0.12
	Yes	13 (68)	0.43 (0.15, 1.25)	
Fistula output	Low	87 (88)	1	0.01
	High	44 (72)	0.36 (0.16, 0.81)	
Fistula complexity	Simple	40 (93)	1	0.03
	Complex	79 (77)	0.24 (0.07, 0.87)	

- Only fistula complexity remained significant on multivariate analysis
- Complex fistula 4 times higher recurrence than simple fistula

When should I operate?

Timing of Surgery

- **Median time to repair = 6 months**
- **Recurrence Rate**
 - Operation b/t 2 and 12 weeks = 28%
 - Operation after 12 weeks = 15%
- **Delaying surgery may result in lower recurrence**

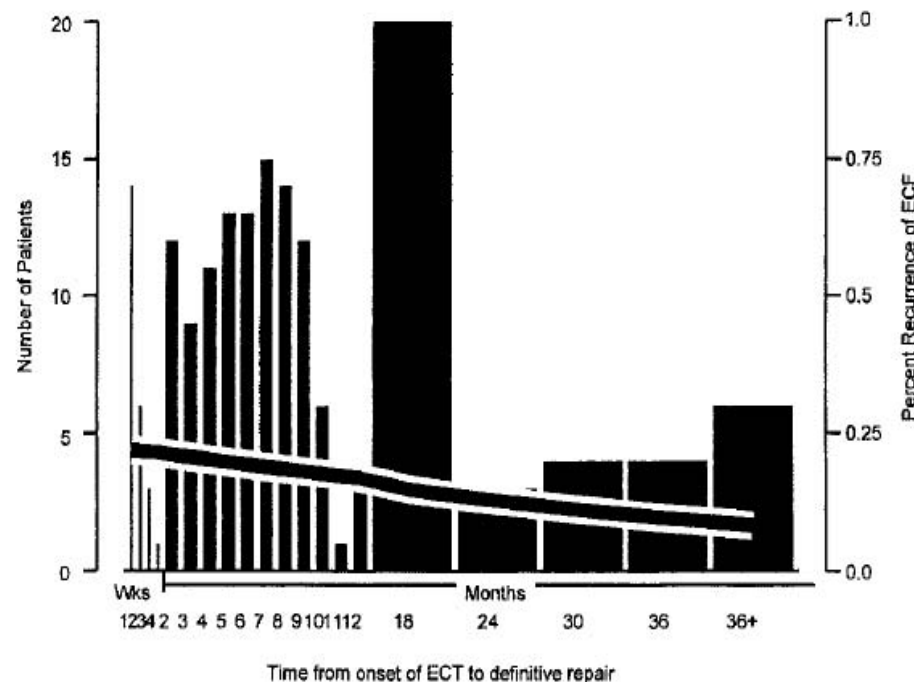


FIGURE 2. Relationship between number of definitive surgical procedures performed and probability of fistula recurrence relative to time since fistula onset (n = 203). Number of patients are represented by columns (left Y-axis) and recurrence by the black line (right Y-axis).









Surgical Treatment of Complex Enterocutaneous Fistulas in IBD Patients Using Human Acellular Dermal Matrix

Timucin Taner, MD, PhD, Robert R. Cima, MD, MA,[†] David W. Larson, MD,[†] Eric J. Dozois, MD,[†] John H. Pemberton, MD,[†] and Bruce G. Wolff, MD[†]*

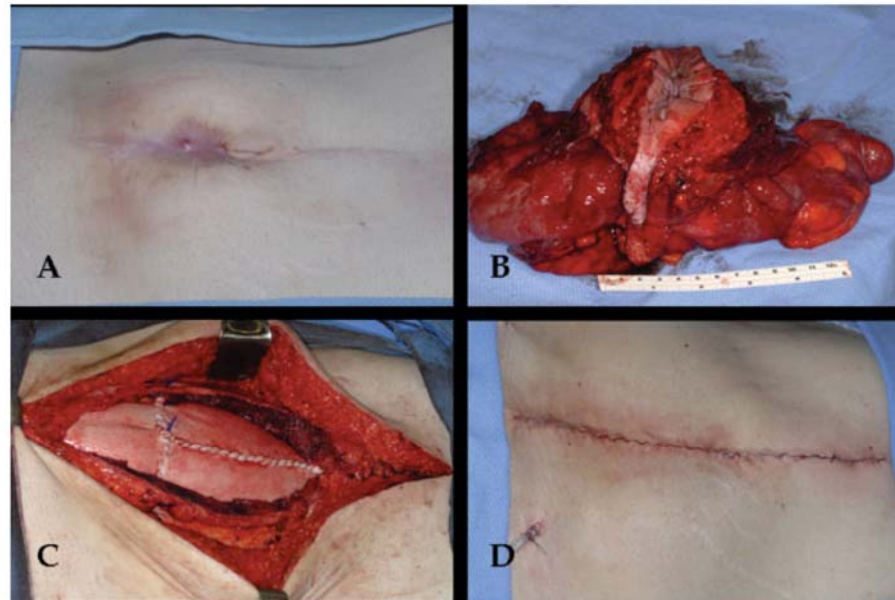


FIGURE 1. Preoperative photograph of a patient with enterocutaneous fistula (A), whereby hADM was used to reconstruct the abdominal wall after resection of the fistulizing bowel, overlying abdominal wall and skin (B,C). The same patient (D), after completion of the reconstruction.