Management of the Complicated Enterocutaneous Fistula

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Department of Surgery Grand Rounds
University of Colorado Health Sciences Center
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?

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

R. G. J. Visschers¹, S. W. M. Olde Damink¹², M. van Bekkum³, B. Winkens⁴, P. B. Soeters¹ and W. G. van Gemert¹

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

Netherlands
Short Form 36

- Physical functioning
- Physical role limitations
- Bodily pain
- General health
- Vitality
- Social functioning
- Emotional role limitations
- Mental health

Normal population
Patients treated for ECF

Score (%)
How much is this gonna set me back?

Original Article

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†

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

**TABLE 2. Healthcare Costs for All Patients**

<table>
<thead>
<tr>
<th></th>
<th>Fistula Cohort</th>
<th>Nonfistula Cohort</th>
<th>P-value a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total healthcare costs ($)</td>
<td>10,863 (0–1,307,019)</td>
<td>6268 (0–1,181,485)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Inpatient ($)</td>
<td>35,373 [104,108]</td>
<td>15,564 [35,128]</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Outpatient hospital ($)</td>
<td>21,279 [93,935]</td>
<td>7060 [27,648]</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Surgery ($)</td>
<td>1334 (0–169,066)</td>
<td>174 (0–332,569)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>3234 [8215]</td>
<td>1697 [6182]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>486 (0–359,943)</td>
<td>0 (0–441,714)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5399 [25,975]</td>
<td>1662 [10,391]</td>
<td></td>
</tr>
</tbody>
</table>
Enterocutaneous Fistula Complicating Trauma Laparotomy: A Major Resource Burden

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

<table>
<thead>
<tr>
<th></th>
<th>Fistula</th>
<th>No Fistula Controls</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU LOS (days)</td>
<td>28.5±30.5</td>
<td>7.6±9.3</td>
<td>0.004</td>
</tr>
<tr>
<td>Total LOS (days)</td>
<td>82.1±100.8</td>
<td>16.2±17.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospital Charges</td>
<td>$539,309</td>
<td>$126,996</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Teixeira (USC), American Surgeon, 2009
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, crohn’s 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
• 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

<table>
<thead>
<tr>
<th></th>
<th>Total (n = 188)</th>
<th>Duodenal (n = 42)</th>
<th>Jejunoileal (n = 54)</th>
<th>Colon (n = 45)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Not closed</td>
<td>58</td>
<td>30.9</td>
<td>15</td>
<td>35.7</td>
</tr>
<tr>
<td>(death)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>59</td>
<td>31.4</td>
<td>14</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>p = 0.017</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Potential Prognostic Factors

<table>
<thead>
<tr>
<th>Potential Prognostic Factor</th>
<th>Spontaneous closure</th>
<th>Surgical closure</th>
<th>Death*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>%</td>
<td>p Value</td>
<td>%</td>
</tr>
<tr>
<td>Surgical</td>
<td>35</td>
<td>0.019</td>
<td>35</td>
</tr>
<tr>
<td>Nonsurgical</td>
<td>12</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>Classification</td>
<td></td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>High-output</td>
<td>21</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Low-output</td>
<td>41</td>
<td></td>
<td>44</td>
</tr>
</tbody>
</table>

*Statistical significance levels are marked in red.*
Table 4. Multivariate Odds Ratios of the Prognostic Factors for Spontaneous Fistula Closure

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

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

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

<table>
<thead>
<tr>
<th>Prognostic factor</th>
<th>Odds ratio*</th>
<th>95% CI</th>
<th>p Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-output (versus high-output)</td>
<td>0.242</td>
<td>0.080–0.685</td>
<td>0.009</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious (present versus not present)</td>
<td>22.068</td>
<td>5.884–112.748</td>
<td>&lt;0.001‡</td>
</tr>
<tr>
<td>Noninfectious (present versus not present)</td>
<td>21.485</td>
<td>4.499–137.848</td>
<td></td>
</tr>
</tbody>
</table>
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%
<table>
<thead>
<tr>
<th>Site of origin</th>
<th>Number of patients</th>
<th>Spontaneous closure (n = 65) Number (%)</th>
<th>Operative closure (n = 86) Number (%)</th>
<th>Total closure (n = 151) Number (%)</th>
<th>Deaths (n = 23) Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophagus</td>
<td>6</td>
<td>5 (83)</td>
<td>1 (17)</td>
<td>6 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Stomach</td>
<td>8</td>
<td>3 (38)</td>
<td>4 (50)</td>
<td>7 (88)</td>
<td>1 (12)</td>
</tr>
<tr>
<td>Duodenum</td>
<td>20</td>
<td>10 (50)</td>
<td>9 (45)</td>
<td>19 (95)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Jejunum</td>
<td>48</td>
<td>7 (15)</td>
<td>27 (56)</td>
<td>34 (71)</td>
<td>14 (29)</td>
</tr>
<tr>
<td>Ileum</td>
<td>42</td>
<td>16 (38)</td>
<td>22 (52)</td>
<td>38 (90)</td>
<td>4 (10)</td>
</tr>
<tr>
<td>Colon</td>
<td>50</td>
<td>24 (48)</td>
<td>23 (46)</td>
<td>47 (94)</td>
<td>3 (6)</td>
</tr>
</tbody>
</table>
### Spontaneous Closure

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

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

“...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

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

- 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

Netherlands
# Fistula in the Open Abdomen

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

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

### Notes:
- 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

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

### Notes:
- a Gastrointestinal fistulas
- b Enterocutaneous fistulas
- c Small bowel fistulas
- d Success rate is 47%
- NA not available
• **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

- 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

• Open Abdomen = 3 times less likely to close
• Complex fistula = 2 times less likely to close
• Location and etiology no impact
• 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).

Ann Surg 2004, Cleveland clinic
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.