MANAGEMENT OF COMPLICATED PANCREATITIS

Overview

- Epidemiology
- Hemorrhage
- Pancreatic/Enteric Fistula
- Timing of Cholecystectomy
- Nutrition
- Infected Necrosis
- Venous Thromboembolism
- Ischemic Colon/GB
- Minimally and Maximally Invasive Necrosectomy

INCIDENCE

- Acute pancreatitis – 240,000/yr
- Third most common inpatient G.I. disease (~2B)
- Necrotizing pancreatitis – 15-20%
  - Mortality: 15 – 20%
- Breast cancer – 178,480/yr
  - Mortality: 22%
- Prostate cancer – 218,890/yr
  - Mortality: 12%

Jemal, et al. CA 2007; 57: 47

Atlanta Classification – 1992

<table>
<thead>
<tr>
<th>Acute Pancreatitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intestinal pancreatitis</td>
</tr>
<tr>
<td>Sterile necrosis</td>
</tr>
</tbody>
</table>

Working Group Classification – 2007*

<table>
<thead>
<tr>
<th>Acute Pancreatitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intestinal edematous pancreatitis (IEP)</td>
</tr>
<tr>
<td>Necrotizing pancreatitis (pancreatic necrosis and/or infected necrosis)</td>
</tr>
</tbody>
</table>

Fluid collections during acute pancreatitis

- Pancreatic pseudocyst
- Pancreatic abscess

- [4 weeks after onset of pancreatitis]
  - Sterile
  - Infected

- Post-necrotic pancreatic/pancreatic fluid collection (PNPFC)
  - Sterile
  - Infected

- [14 weeks after onset of pancreatitis]
  - Sterile
  - Infected

- Walled-off pancreatic necrosis (WOPN)
  - (may or may not have infected amylase/lipase activity)
  - Sterile
  - Infected

Omissions

- Scoring systems
- Lexicon / terminology*
- Physiology / SIRS
- Critical Care
- Abdominal Compartment Syndrome
- Fluid management in resuscitation
- Surveillance imaging (CT)
- Chronic Pancreatitis / DLPR…

ATLANTA SYMPOSIUM

DEFINITIONS

1. Acute pancreatitis
2. Severe AP/organ failure
3. Mild acute pancreatitis
4. Acute fluid collections
5. Pancreatic necrosis
6. Acute pseudocyst
7. Pancreatic abscess

DISCARDED TERMS

- Phlegmon
- Infected pseudocyst
- Hemorrhagic pancreatitis
- Persistent acute pancreatitis

Bradley, EL III. Arch Surg 1993; 128: 586-90
Moving from Empiricism to Determinism

Local + Systemic Causal Determinants

Local + Systemic Causal Determinants

Local + Systemic Causal Determinants

TREATMENT

IN 2016, NO SPECIFIC TREATMENT EXISTS FOR ACUTE PANCREATITIS
Mortality in Acute Pancreatitis

Mortality in Acute Pancreatitis

Timing is Everything (Almost)

Ride the Horse...
Pancreatic Necrosis
What do Patients die from?

<table>
<thead>
<tr>
<th>Death</th>
<th>Total pts.</th>
<th>Pulmonary</th>
<th>Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 24 hr</td>
<td>83 (21%)</td>
<td>79 (95%)</td>
<td>22 (26%)</td>
</tr>
<tr>
<td>1-7 days</td>
<td>160 (40%)</td>
<td>150 (94%)</td>
<td>45 (28%)</td>
</tr>
<tr>
<td>&gt; 7 days</td>
<td>162 (40%)</td>
<td>99 (62%)</td>
<td>129 (80%)</td>
</tr>
<tr>
<td>Total</td>
<td>405</td>
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Pancreatic Necrosis
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</tbody>
</table>


Delayed Surgery is SAFER!

<table>
<thead>
<tr>
<th>1980-85 (n=38)</th>
<th>1986-90 (n=40)</th>
<th>1991-97 (n=58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of surgery</td>
<td>26 (68%)</td>
<td>17 (43%)</td>
</tr>
<tr>
<td>Surgery &lt; 72 hrs.</td>
<td>19 (50%)</td>
<td>5 (13%)</td>
</tr>
<tr>
<td>Nonoperative rate</td>
<td>12 (32%)</td>
<td>23 (56%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>15 (39%)</td>
<td>6 (15%)</td>
</tr>
</tbody>
</table>

Hartwig, J Gastrointest Surg 2002; 6:481-7

RCT of Early vs. Late Necrosectomy

<table>
<thead>
<tr>
<th>Early &lt;72 hrs (n=25)</th>
<th>Late &gt; 12 days (n=11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranson’s signs</td>
<td>4.0 (1-7)</td>
</tr>
<tr>
<td># Necrosectomies</td>
<td>3.4 (1-8)</td>
</tr>
<tr>
<td>Infected necrosis</td>
<td>15 (60%)</td>
</tr>
<tr>
<td>Mortality rate</td>
<td><strong>14 (56%)</strong></td>
</tr>
</tbody>
</table>

*odds ratio 3.39

Miles, Am J Surg 1997;175:71-75

NP – IU (1993-2005)

Declining Morbidity and Mortality Rates in the Surgical Management of Pancreatic Necrosis

Howard, et al. JOGS 2007

NP – IU (1993-2005)

<table>
<thead>
<tr>
<th>Group I 1993-2001 (n=50)</th>
<th>Group II 2002-2005 (n=48)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indications for debridement</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Infected necrosis (%)</td>
<td>42 (76%)</td>
<td>34 (72%)</td>
</tr>
<tr>
<td>Symptomatic sterile necrosis (%)</td>
<td>11 (22%)</td>
<td>12 (26%)</td>
</tr>
<tr>
<td>Progressive organ failure (%)</td>
<td>2 (4%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Time to initial debridement (days±SD)</td>
<td>46±12</td>
<td>44±10</td>
</tr>
<tr>
<td>Respiratory rate (%)</td>
<td>37 (75%)</td>
<td>32 (68%)</td>
</tr>
<tr>
<td>Morbidity rate (%)</td>
<td>49 (99%)</td>
<td>34 (72%)</td>
</tr>
<tr>
<td>Pancreatic fistula rate (%)</td>
<td>27 (54%)</td>
<td>28 (58%)</td>
</tr>
<tr>
<td>Intensive care unit length of stay (days±SD)</td>
<td>13±3</td>
<td>9±3</td>
</tr>
<tr>
<td>Hospital length of stay (days±SD)</td>
<td>4±2</td>
<td>2±1</td>
</tr>
<tr>
<td>Mortality rate (%)</td>
<td>0.38</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Howard, et al. JOGS 2007
Early (<7 days) pancreatic resection

<table>
<thead>
<tr>
<th>% Resection</th>
<th>Blood loss</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4050</td>
<td>1/1 (100%)</td>
</tr>
<tr>
<td>95%</td>
<td>5700 + 4300</td>
<td>7/12 (58%)</td>
</tr>
<tr>
<td>70%</td>
<td>5900 + 4050</td>
<td>9/26 (35%)</td>
</tr>
<tr>
<td>60%</td>
<td>4700 + 3000</td>
<td>19/42 (45%)</td>
</tr>
<tr>
<td>40%</td>
<td>3000 + 700</td>
<td>2/3 (67%)</td>
</tr>
</tbody>
</table>


TIMING OF INTERVENTION

- **DO NOT DÉBRIDE EARLY (<4 wks)**
- early infection = drain

COLECTOMY

Don’t forget the gallbladder!

Hayder H. Al-Azzawi, MD
SAP – NATURAL HISTORY

(peri)pancreatic collection

Resolution

Infection

PERSISTS

Intervention

Observe

4 weeks

YES

SX?

NO

Goals of Surgical Intervention

• Delay if possible (≈ 4 weeks)
• Control infection
• Evacuation of fluid and necrotic debris
• (Externally) drain pancreatic fistulae
• Prevent recurrence (biliary)
• Establish enteral access
• Accomplish above with minimal physiologic disruption to the patient

THE MENU

• Hemorrhage
• Pancreatic/Enteric Fistula
• Timing of Cholecystectomy
• Nutrition
• Infected Necrosis
• Venous Thromboembolism
• Ischemic Colon/GB
• Minimally Invasive Necrosectomy
• Hernia (42%)*, ACS

HEMORRHAGE

• Venous
• Arterial (Pseudoaneurysm)
• Intraop - PREVENTION

HEMORRHAGE - PSA

• CT Angiogram
• Interventional Radiology***
HEMORRHAGE - PSA

<table>
<thead>
<tr>
<th>Arteries involved</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic</td>
<td>9(36)</td>
</tr>
<tr>
<td>GDA</td>
<td>6(24)</td>
</tr>
<tr>
<td>Pancreaticoduodenal</td>
<td>5(20)</td>
</tr>
<tr>
<td>Superior mesenteric</td>
<td>3(12)</td>
</tr>
<tr>
<td>Dorsal pancreatic</td>
<td>1(4)</td>
</tr>
<tr>
<td>Hepatic</td>
<td>1(4)</td>
</tr>
<tr>
<td>Duodenal / Multiple</td>
<td>2(8)</td>
</tr>
</tbody>
</table>


Pancreatic Fistula

- Pancreatic Fistula – know anatomy (MRCP/fluid)
  - Side branch – low volume, dry up
  - Main duct – disconnected duct – “El Diablo”
- Enteric fistula - may close with nonoperative mgt

Tsiotos, Arch Surg 1995; 130: 48-52
Murage, Surgery 2010; 148(4):702-9
Zarzour, J Gastrointest Surg 2008; 12:1103-9

Timing of the Cholecystectomy

DOGMA

In patients admitted with biliary pancreatitis, the gallbladder should be removed before the patient is discharged from the hospital

RECURRENT PANCREATITIS

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Recurrent AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howard and Ehrlich</td>
<td>1962</td>
<td>251</td>
<td>90 (36%)</td>
</tr>
<tr>
<td>Paleg et al.</td>
<td>1973</td>
<td>64</td>
<td>31 (48%)</td>
</tr>
<tr>
<td>Trapnell and Duncan</td>
<td>1975</td>
<td>232</td>
<td>80 (35%)</td>
</tr>
<tr>
<td>Ellensmeyer</td>
<td>1978</td>
<td>65</td>
<td>16 (25%)</td>
</tr>
<tr>
<td>Sharon et al.</td>
<td>1979</td>
<td>90</td>
<td>30 (33%)</td>
</tr>
<tr>
<td>Ramson</td>
<td>1979</td>
<td>21</td>
<td>7 (33%)</td>
</tr>
<tr>
<td>Berklandi et al.</td>
<td>1979</td>
<td>39</td>
<td>8 (20%)</td>
</tr>
<tr>
<td>Kelly</td>
<td>1980</td>
<td>14</td>
<td>5 (36%)</td>
</tr>
<tr>
<td>Osborne et al.</td>
<td>1981</td>
<td>100</td>
<td>26 (26%)</td>
</tr>
<tr>
<td>Welch and White</td>
<td>1982</td>
<td>25</td>
<td>6 (24%)</td>
</tr>
<tr>
<td>Mayer et al.</td>
<td>1984</td>
<td>37</td>
<td>4 (11%)</td>
</tr>
<tr>
<td>Batch et al.</td>
<td>1990</td>
<td>102</td>
<td>23 (22%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1038</td>
<td>334 (32%)</td>
</tr>
</tbody>
</table>
TAKE HOME MESSAGE: MILD BILIARY PANCREATITIS

- Most recurrent episodes occur within 3 months of index bout
- ?? Recurrent episode = more severe
- Same admit cholecystectomy is ideal

TIMING OF CHOLE

- Mild biliary AP
  - same admission
- Necrotizing pancreatitis
  - ok to delay (?better)
- Sphincterotomy
  - 3% recurrence

Recurrent Idiopathic Pancreatitis

65% of U/S negative gallbladders are found to have stones/sludge/crystals
46% cure rate with cholecystectomy
REMOVE THE GALLBLADDER!

Enteral vs Parenteral Nutrition in Acute Pancreatitis

Enteral Nutrition Associated with
- Decreased infections
- Fewer surgical interventions
- Shorter LOS
- No effect on Mortality
- No effect on non-infectious complications
- NO DOGMA wrt WHO CAN'T EAT!
Antimicrobials & Antifungals

### PRT ANTIBIOTIC vs NONE

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Drug</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pederzoli</td>
<td>1993</td>
<td>74</td>
<td>Imipenem</td>
<td>↓ &quot;pancreatic sepsis&quot;</td>
</tr>
<tr>
<td>Sainio</td>
<td>1995</td>
<td>60</td>
<td>Cefuroxime</td>
<td>↓ infection (UTI), ↓ death*</td>
</tr>
<tr>
<td>Luiten</td>
<td>1995</td>
<td>102</td>
<td>SGD</td>
<td>↓ pancreatitis, ↓ death</td>
</tr>
<tr>
<td>Nordbeck</td>
<td>2001</td>
<td>58</td>
<td>Imipenem/cilastatin</td>
<td>↓ surgery, no Δ mortality</td>
</tr>
<tr>
<td>Isenmann</td>
<td>2004</td>
<td>112</td>
<td>Ciprofloxime/Metronidazole</td>
<td>no Δ pancreatitis or death</td>
</tr>
<tr>
<td>Rokke</td>
<td>2007</td>
<td>73</td>
<td>Imipenem</td>
<td>↓ infection (all), no Δ death</td>
</tr>
<tr>
<td>Dellinger</td>
<td>2007</td>
<td>100</td>
<td>Meropenem</td>
<td>no Δ pancreatitis or death</td>
</tr>
<tr>
<td>Xue</td>
<td>2009</td>
<td>56</td>
<td>Meropenem</td>
<td>↓ Δ pancreatitis or death, ↑ fungal infection</td>
</tr>
<tr>
<td>Garcia</td>
<td>2009</td>
<td>41</td>
<td>Ciproflaxacin</td>
<td>no Δ pancreatitis or death</td>
</tr>
</tbody>
</table>

### AGA - Bacteria in Infected Necrosis

- **Escherichia coli**
- **Pseudomonas sp.**
- **Enterobacter sp.**
- **Streptococcus faecalis**
- **Proteus sp.**
- **Anaerobic sp.**
- **Klebsiella sp.**
- **Staphylococcus aureus**

*Beger, et al., Gastroenterology 1986; 91:433*

### CLINICAL OBSERVATION

Patients with necrotizing pancreatitis and infection with resistant bacteria and fungus appeared to have exceptionally poor outcomes.
INFECTION - RESULTS

- n = 152 patients with necrotizing pancreatitis
- 122 (80%) – “prophylactic” antibiotic Rx
- 133 (88%) – infected necrosis
- 86 (57%) – resistant bacteria in any organ system
- 56 (37%) – resistant bacteria in necrosis
- 64 (42%) – fungus in any organ system
- 45 (34%) – fungus in necrosis
  - 23 (51%) – atypical*  

*T. Glabrata, C. parapsilosis, C. Tropicalis, C. Krusei

INFECTION - SUMMARY

- Resistant bacterial infection resulted in increased LOS, reoperation, and readmission
- Fungal infection resulted in increased LOS, need for reoperation, and death
- Infection does not necessarily alter algorithm

VENOUS THROMBOEMBOLISM

<table>
<thead>
<tr>
<th>Intra-abdominal</th>
<th>Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic</td>
<td>SMV/PV</td>
</tr>
<tr>
<td>63 (41%)</td>
<td>58 (38%)</td>
</tr>
</tbody>
</table>

- 96/171 (56%) NP patients had VTE
- Think about it!
- Screening Duplex (?)

INTRAOP HEMORRHAGE

AP – NATURAL HISTORY

46 days

INFECTION RESOLUTION PERSISTS INTERVENTION

OBSERVE SX? YES NO

James Lopes, MD

Severe Acute Pancreatitis

Management

MINIMALLY INVASIVE Rx
- Percutaneous
- Endoscopic
- Laparoscopic
- VARD – “step up”

INDIVIDUALIZE APPROACH
Team Effort
Open Débridement
Gold Standard

SELECTION MATTERS

MIN INVASIVE – WHO?
- Surgeon
  - Experience – pancreatic surgery
  - Commitment
- Patient – Anatomy
  - Solid vs Fluid?
  - Head Necrosis – NO!
  - SB Mesentery - ?

HISTORY - TRANSGASTRIC
- 1996 Baron – first endoscopic transgastric
- 2002 Ammori – case report lap transgastric
- 2008 Freiburg – n=6 “laproendoscopic”
- Open Transgastric Debridement
  - Danish – n=7 (3 mos f/u)
  - Calgary – n=10 (of 51 SAP) – 18 mos f/u, 2 comp
  - Glasgow – n=44 – 2yr f/u, 2 comp (bleed, collection)

“ONE STOP SHOPPING”
- Thorough Débridement (x1)
- Durable internal drainage
  - Avoid “El Diablo”
- Cholecystectomy
- +/- Gastrostomy/G-J tube
LAPAROSCOPIC

LAPAROSCOPIC DÉBRIDEIMENT

Positive: avoid DLPR
“El Diablo”
Negative: ?? Long term f/u

OPEN TG DÉBRIDEMENT

VARD

van Santvoort HPB 2007;9:156-9

• Highly select – n=88 (of 378 screened)
• Composite end points (no Δ mortality)
• Short term f/u (6 mos)
• Criticism: narrow applicability, #OR, LOS (55d), high mortality (17%)
• *Did NOT directly compare VARD/Open
MINIMALLY INVASIVE DÉBRIDEMENT

- One size (technique) does **NOT** fit all
- Dedicated physician/team
- Long-term follow up mandatory
- Transgastric débridement – safe, effective, preferred in select patients

**TAKE HOME MESSAGES**

- Hemorrhage – r/o PSA. **BE CAREFUL** in OR
- Fistula – requires knowledge of anatomy
- Timing of chole – OK to wait in severe NP
- NO prophylactic abx please
- DO NOT débride early. Ride the horse!!
- VTE – common. Screen.
- Think of ischemia (colon/GB)
- Minimally invasive Rx*

---

**Severe acute pancreatitis for the acute care surgeon**

Chad G. Buhl, MB, MSc, S. Morad Hassand, MD, MPH, Elijah Brown, MD, MSc,
and Shael D. Liberson, MB, Calgary, Alberta, Canada

( *Emergency Acute Care Surg*
Volume 83, Number 6

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