Endoscopic Management of Acute Pancreatitis

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Gastroenterology and Therapeutic Endoscopy
February 13, 2018
Objectives

- Assessment of acute pancreatitis
- Early management
- Who needs an ERCP
- When to consider enteral feeding
- How to manage fluid collections
- Endoscopic necrosectomy
Acute Pancreatitis

- An acute inflammatory process of the pancreas
- Accounts for 210,000 admissions yearly in the US
- Mortality ranges
  - 3% with interstitial edematous pancreatitis
  - 17% with pancreatic necrosis
Etiology - I GET SMASHED

- **I**: idiopathic
- **G**: gallstones
- **E**: ethanol (alcohol)
- **T**: trauma
- **S**: steroids
- **M**: mumps (and other infections) / malignancy
- **A**: autoimmune
- **S**: scorpion sting/spider bites
- **H**: hyperlipidemia/hypercalcemia (metabolic disorders)
- **E**: ERCP
- **D**: drugs
Diagnosis

- Requires the presence of 2 of the following 3 criteria:
  - Acute onset of persistent, severe, epigastric pain often radiating to the back
  - Serum lipase and/or amylase > 3 ULN
  - Classic CT or MRI findings
Clinical Features

* Most have acute onset of persistent, severe epigastric pain
* In 50%, the pain radiates to the back and may be partially relieved by sitting up or bending forward
* 90% have associated n/v which may persist for several hours
* With gallstone pancreatitis, the pain is well localized and the onset is rapid, reaching max intensity in 10-20 minutes
* With alcohol, hereditary, or metabolic causes, the onset may be less abrupt and poorly localized
* Patients with severe pancreatitis may have dyspnea due to diaphragmatic inflammation, pleural effusions, or RDS
Laboratory Findings

- There is a breakdown in the synthesis-secretion coupling of pancreatic digestive enzymes.
- Synthesis continues while there is a blockade of secretion.
- As a result, digestive enzymes leak out of acinar cells through the basolateral membrane to the interstitial space and enter circulation.
Serum Amylase

- Rises within 6-12 hours
- Has a short half-life of approximately 10 hours
- In uncomplicated attacks, returns to normal within 3-5d
- Elevation of greater than 3 times the upper limit of normal has a sensitivity of 67-83 & specificity of 85-98%
- May not be seen 20% with alcoholic pancreatitis due to the inability of the parenchyma to produce amylase and 50% due to hypertriglycerideridemia as TGs interfere with the amylase assay
- Given the short half-life, the diagnosis may be missed in patients who present >24 hours after the onset
Serum Lipase

- Rises within 4-8 hours, peaks at 24 hours, and returns to normal within 8-14 days
- Lipase elevations occur earlier and last longer as compared to amylase
- More useful in patients who present >24 hours after the onset of pain
- Serum lipase is also more sensitive than amylase in patients with pancreatitis secondary to alcohol
Revised Atlanta Classification 2012

Interstitial edematous pancreatitis:
- acute inflammation of the pancreatic parenchyma and peri-pancreatic tissues

Necrotizing pancreatitis:
- inflammation with pancreatic or peri-pancreatic necrosis

Banks et al. Gut 2013
Initial Assessment and Risk Stratification

* Revised Atlanta Classification 2012

* Mild acute pancreatitis
  * Absence of organ failure
  * Absence of local complications

* Moderately severe acute pancreatitis
  * Local complications and/or
  * Transient organ failure (<48 hrs)

* Severe acute pancreatitis
  * Persistent organ failure (>48 hrs)

Banks PA. Gut 2013
Severe Acute Pancreatitis (15-20%)

- Two distinct phases:
  - Early (within 1 week)
    - Systemic Inflammatory Response Syndrome (SIRS) and/or organ failure
  - Late (>1 week)
    - Local complications
      - Peri-pancreatic fluid collections
      - Pancreatic and peri-pancreatic necrosis (sterile or infected)
      - Pseudocysts
      - Walled-off necrosis (sterile or infected)

Banks PA. Gut 2013
Ranson's criteria

* One of the earliest scoring systems for severity that consists of 11 parameters

* Five of the factors are assessed at admission and six are assessed during the next 48 hours

* A later modification for biliary pancreatitis included only 10 points

* Mortality increases with an increasing score.

* Using the 11 component score, mortality was
  * 0-3% when the score was <3
  * 11-15% when the score was ≥3
  * 40% when the score was ≥6

* Although the system continues to be used, a meta-analysis of 110 studies found the Ranson score to be a poor predictor of severity
APACHE II Score

- Score was originally developed for critically ill patients in the ICU
- It has 12 physiologic measures and extra points based upon age and presence of chronic disease
- Most widely studied severity scoring system in acute pancreatitis
- The AGA recommends using the APACHE II for prediction of severe disease, using a cutoff of ≥8
Bedside Index of Severity in Acute Pancreatitis

- The presence of three or more criteria in the first 24 hrs has been associated with an increased in hospital mortality
  - BUN >25
  - Impaired mental status
  - Systemic inflammatory response (SIRS)
  - Age >60
  - Pleural effusion

Wu BU. Gut 2008
CT severity index (Balthazar)

* Pancreatic inflammation
  * Normal pancreas 0
  * Focal or diffuse enlargement of the pancreas 1
  * Pancreatic or peri-pancreatic fat inflammatory changes 2
  * Single, ill-defined fluid collection 3
  * Two or more collections or presence of gas 4

* Pancreatic necrosis
  * None 0
  * ≤ 30% 2
  * >30% and ≤50% 4
  * >50% 6

Balthazar EJ. Rad 1990
Diagnosis of Acute Pancreatitis

Hemodynamic instability/organ failure. Use BISAP > 3 to assess bedside index of severity

YES: Transfer / Direct Triage to ICU
NO: Admit to Medicine

Initial Fluid Resuscitation

1-2 L LR (20ml/kg) bolus then 150-300 cc/hr (approx. 3 ml/kg/hr) for first 24 hours

Fluid Responsive (uop > 0.5 cc/kg/hr, 10% drop in Hct in 24 hr, improved BUN)
- Continue IVF at 2/ml/kg/hr

Fluid Refractory 20ml/kg bolus then 3ml/kg/hr
- Reassess
Nutrition

- Patients with mild pancreatitis can often be managed with IV hydration alone since recovery occurs rapidly.
- The time to reinitiate oral feedings depends on the severity of the pancreatitis.
- In the absence of ileus, nausea or vomiting, oral feeds can be initiated as soon as the pain is decreasing and inflammatory markers are improving.
Enteral Feedings

* Often required in patients with moderately severe pancreatitis and almost invariably with severe pancreatitis as they are unlikely to resume oral intake within 5-7d

* Nasojejunal tube feeding is preferred to TPN
Parenteral Nutrition

Advantages
- Practical
- Mathematical
- Standardized solution for specific conditions

Disadvantages
- The gut is not used
- Cost issues
- Complications related to IV access
- Metabolic issues
- Sepsis
Enteral vs Parenteral Nutrition

- Less hyperglycemia
- Fewer septic complications
- Decreased morbidity in groups receiving enteral nutrition
- Decreased rates of organ failure
- Faster return of bowel motility
- Lower hospital costs

Macik BE. BMJ 2005
Acute Fluid Collection

- Associated with interstitial pancreatitis
- Homogenous collection with fluid density confined by normal peri-pancreatic fascial planes with no definable wall
- Adjacent to pancreas (no intrapancreatic invasion)
- <4 weeks

Morgan DE: CGH 2008
Acute Necrotic Collection

- Fluid and necrotic collection of the pancreatic parenchyma or peri-pancreatic tissue
- No definable wall
- Higher intervention rates and increased morbidity and mortality

Morgan DE: CGH 2008
Pancreatic Pseudocyst

- Well circumscribed, encapsulated fluid collection with a well defined inflammatory wall
- Usually outside the pancreas
- Little or no necrosis
- Maturation requires > 4 weeks after onset of AP

Banks PA. Gut 2013
Walled-off Necrosis (WON)

- Matured, encapsulated collection of pancreatic or peri-pancreatic necrosis
- Well-defined inflammatory wall
- Maturation typically requires 4 weeks after onset of acute necrotizing pancreatitis

Morgan DE: CGH 2008
<table>
<thead>
<tr>
<th>Entity</th>
<th>Disease weeks</th>
<th>Solid debris present?</th>
<th>Encapsulated wall?</th>
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<tbody>
<tr>
<td>Acute Fluid Collection</td>
<td>&lt;4</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acute Necrotic Collection</td>
<td>&lt;4</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Pseudocyst</td>
<td>&gt;4</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Walled Off Necrosis</td>
<td>&gt;4</td>
<td>Yes</td>
<td>Yes</td>
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</tbody>
</table>
Endoscopic Retrograde Cholangiopancreatography (ERCP)

* Should be performed within 24 hours for patients with gallstone pancreatitis and cholangitis

* Other indications for ERCP
  * Common bile duct obstruction (visible stone on imaging)
  * Dilated common bile duct
  * Increasing liver tests without cholangitis

* When in doubt an MRCP could be performed to determine if there are stones in the CBD
Issues to Consider Prior to EUS Cyst Gastrostomy

- Alternative diagnoses
  - No history or risk factors for pancreatitis
  - Cystic pancreatic neoplasms
- Possible presence of a pseudoaneurysm
- Type of collection
- Bulging?
- Intervening vessels
- Role of conservative management
  - Some studies showed about 60% resolution or stable PFC
- Is there a pancreatic duct disruption
Drainage Prerequisites

* Cross sectional imaging: “road map”
* Skills in interventional endoscopy/EUS
* Multidisciplinary approach: “backup”
* General anesthesia: “complexity”
* Carbon dioxide only
EUS Cyst Gastrostomy

- Confirm diagnosis
  - Routine EUS before drainage leads to change in management in 5-37% cases
- Identify vascular structures
- Measure lumen to cyst distance
- Characterize cyst contents
- Localize non-bulging pseudocysts
EUS Cyst Gastrostomy Techniques

- Prophylactic antibiotics
- Linear array echoendoscope (3 mm channel)
- Puncture with 19 gauge needle
- Placement of a 0.035-inch wire
- Dilation with creation of a fistula
  - Soehendra (6 Fr)
  - Balloon (4-6 mm)
- Stent placement: FC SEMS, double pigtails
- Consider if ERCP needed to seal PD leak
- Needle passed and contrast is injected
- Wire insertion under fluoro
- Tract balloon dilation
- Stent deployment under both views
EUS Cyst Gastrostomy
EUS Cyst Gastrostomy

Talreja JP GIE 2008
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>#</th>
<th>Complications</th>
<th>Success</th>
<th>% Success</th>
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<tbody>
<tr>
<td>Binmoeller</td>
<td>1995</td>
<td>27</td>
<td>Bleeding (2)</td>
<td>21/27</td>
<td>78%</td>
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<tr>
<td>Giovannini</td>
<td>2001</td>
<td>35</td>
<td>Pneumoperitoneum (1)</td>
<td>31/35</td>
<td>89%</td>
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<tr>
<td>Azar</td>
<td>2006</td>
<td>23</td>
<td>Pneumoperitoneum (1)</td>
<td>21/23</td>
<td>91%</td>
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<tr>
<td>Antillon</td>
<td>2006</td>
<td>33</td>
<td>Bleeding (4)</td>
<td>31/33</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pneumoperitoneum (1)</td>
<td></td>
<td></td>
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<tr>
<td>Kruger</td>
<td>2006</td>
<td>35</td>
<td>None</td>
<td>33/35</td>
<td>94%</td>
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<tr>
<td>Kahaleh</td>
<td>2006</td>
<td>46</td>
<td>Bleeding (2), Stent Migration (1), Superinfection (4),</td>
<td>43/46</td>
<td>96%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pneumoperitoneum (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barthet</td>
<td>2008</td>
<td>28</td>
<td>Superinfection (5)</td>
<td>25/28</td>
<td>89%</td>
</tr>
<tr>
<td>Hookey</td>
<td>2006</td>
<td>32</td>
<td>Pneumoperitoneum (2), Bleeding (1)</td>
<td>29/32</td>
<td>91%</td>
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<tr>
<td>Lopes</td>
<td>2007</td>
<td>51</td>
<td>Pneumoperitoneum (1), migration (1)</td>
<td>48/51</td>
<td>94%</td>
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<tr>
<td>Varadarajulu</td>
<td>2007</td>
<td>21</td>
<td>None</td>
<td>21/21</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>331</td>
<td>28 (9%)</td>
<td>303</td>
<td>91.5%</td>
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</table>
Axios Stent

Therapeutic EUS scope

Axios stent
Axios Stent

Axios Metal Stent Deployment

1. **Advance the Stent Catheter**
   Lock catheter lock once on place

2. **Deploy Distal Anchor**
   Move stent hub up to #2 on handle

3. **Retract & Align Stent**
   Unlock catheter, retract until 2-3mm of black marker visible, lock catheter lock

4. **Deploy Proximal Anchor**
   Unlock stent and move stent hub up to #4 on handle
## Axios Stent Data

<table>
<thead>
<tr>
<th>Study</th>
<th>EUS-guided drainage of pancreatic fluid collections using a novel lumen-approving metal stent on an electrocautery-enhanced delivery system</th>
<th>EUS guided drainage of peri pancreatic fluid collections and necrosis by using a novel lumen-approving stent</th>
<th>AXIOS Stent with Electrocautery Enhanced Delivery System, IDETrial Summary</th>
<th>Safety and Efficacy of Endoscopic Ultrasound-Guided Drainage of Pancreatic Fluid Collections with Lumen-Approving Covered Self Expanding Metal Stents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients</td>
<td>93</td>
<td>82</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>Design</td>
<td>Retrospective, 13 European Center</td>
<td>Multicenter Retrospective</td>
<td>Prospective multicenter</td>
<td>Prospective Multicenter</td>
</tr>
<tr>
<td>Adverse Events</td>
<td>Total - 5.4% (5), Perforation 1% (1), Bleeding 1% (1), Infection 1% (1), Pneumoperitoneum 1% (1), Dislodgement 1% (1)</td>
<td>Total - 9.8% (8), 7.3% (6) self limited bleeding, 2.4% (2) stent maledeployment</td>
<td>Total - 10% (3), bleeding - 3% (1), infection 3% (1), dislodgment 3% (1)</td>
<td>Total 15.2% (5), 9% (3) abdominal pain, 3% (1) back pain, 3% (1) stent dislagement</td>
</tr>
<tr>
<td>Key Points</td>
<td>Successful stent placement was accomplished in all but 1 patient, direct endoscopic necrosectomy was carried out in 31 of 52 cases (59.6%), Complete resolution of the FPC was obtained in 88 cases (92.5%) with no recurrence during follow up</td>
<td>LAMS were successfully placed in 80 patients (97.5%). The median stent in dwelling time was 2 months, Endoscopic debridement with the LAMS in WON performed in 54 patients, There was 1 PFC recurrence during the 3 month median follow up period, the median number of endoscopy sessions to achieve PFC resolution was 2</td>
<td>The AXIOS stent was successfully implanted in all study subjects (100%), 93% of subjects experienced no serious events related to the device or index procedure, Successful removal of the AXIOS stent was achieved in all subjects (100%), Total procedure time ranged from 13 to 63 minutes, with an average of 28.1 minutes</td>
<td>In the patients receiving LACSEMS PFCa resolved in 27/29 patient (93%), The LACSEMS removal success rate was 96.7% (29 of 30), Advantages of LACSEMSs over other stents include single-step deployment and the ability to perform endoscopic debridement with minimal stent migration</td>
</tr>
</tbody>
</table>
Pancreatic Duct Disruption

- Common in persistent smoldering pancreatitis, pancreatic trauma, pancreatic necrosis, and in acute pancreatic fluid collections
- Leakage of pancreatic secretions through these disruptions can result in the development of chronic fistulas
- Closure of fistulas depends upon
  - Site and size of duct disruption
  - There is superinfection downstream of the obstruction
  - Disruption is a consequence of a stricture or stone
  - Ductal disruption is partial or complete
Pancreatic Duct Disruption

- Findings on ERCP include:
  - extravasation of contrast during injection of the pancreatic duct
  - the presence of fluid collections or pseudocysts that communicate directly with the main pancreatic duct

- Resolution of fluid collections and patient symptoms determine efficacy

- Stents are usually retrieved after four to six weeks.
Management of PD Disruption

* Transpapillary stenting leads to successful resolution of PD disruptions, particularly when the stent bridges the disruption

Varadarajulu S. GIE 2005
Pancreatic Duct Stenting

* Indications
  * pancreatic duct stones
  * pancreatic duct strictures
  * pseudocysts
  * pancreatic duct disruptions
  * pancreas divisum
  * pancreatic sphincterotomy
  * prevention of post-ERCP pancreatitis
Pancreatic Necrosectomy

- Both infected pancreatic necrosis and symptomatic sterile necrosis are accepted indications for debridement

- Goal
  - Excise all dead and devitalized pancreatic and peripancreatic tissue
  - Preserve viable functioning pancreas and limit extraneous organ damage

- Optimal time is approximately 4 weeks after the onset
  - Vascular inflammation has decreased
  - Organization of the process has occurred
  - Delineation of live from dead tissue is complete
Pancreatic Necrosectomy

Seewald GIE 2005
Pancreatic Necrosectomy
Not for the Uncommitted!

- May require nasocystic drain
- Multiple sessions
- Inpatient management
- Antibiotics
- Complications
- Multidisciplinary approach

Baron TH. GIE 2002
Complications

- Overall complication 5-35%
- Occlusion
- Infection
  - Antibiotics before and after
  - Antifungal
- Hemorrhage
- Stent migration
Algorithm For Treatment of Pancreatic Necrosis

**PRESENTATION**
- Supportive Care
  - Intravenous fluids
  - Pain control
  - \(\pm\) NG* decompression
  - \(\pm\) Treatment of MSOF*
  - \(\pm\) Broad spectrum antibiotics

**SUBACUTE (1-2 weeks)**
- Nasojejunal feedings
- Broad spectrum antibiotics
  - \(\pm\) antifungal agents
- \(\pm\) ERCP/transpapillary stent for amenable ductal disruption

**CHRONIC (> 2 weeks)**
- Drainage contingent upon superinfection, enlarging collection, \(\pm\) clinical deterioration in sterile necrosis
- \(\pm\) ERCP/transpapillary stent

**Surgical**
- Open
- Laparoscopic
- Retroperitoneal

**Percutaneous**
- Multiple wide-bore JP* drains

**Endoscopic**
- Transgastric/transduodenal irrigation, endoscopic retroperitoneal necrosectomy

**Contingent upon:**
- Local expertise
- Degree of liquid component
- Anatomic location of necrosis, concomitant fluid collections

* NG=Nasogastric, MSOF=multi-system organ failure, JP=Jackson-Pratt
Questions