Endoscopic Management of Acute Pancreatitis

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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

- k I: idiopathic
- **G:** gallstones
- * E: ethanol (alcohol)
- * **T:** trauma
- * S: steroids
- * M: mumps (and other infections) / malignancy
- * A: autoimmnue
- * **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 synthesissecretion 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 hypertriglyceridemia 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 peripancreatic 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 \geq 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



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</p>

Morgan DE: CGH 2008

Acute Necrotic Collection



Fluid and necrotic collection of the pancreatic parenchyma or peripancreatic 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

Entity	Disease weeks	Solid debris present?	Encapsulated wall?
Acute Fluid Collection	<4	No	No
Acute Necrotic Collection	<4	Yes	No
Pseudocyst	>4	No	Yes
Walled Off Necrosis	>4	Yes	Yes

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

< 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

A

-Needle passed and contrast is injected
-Wire insertion under fluoro
-Tract balloon dilation
-Stent deployment under both views









Talreja JP GIE 2008

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

Axios Stent



Therapeutic EUS scope

Axios stent

Axios Stent



*Gornals, et al. Surg Endosc 2012.

Axios Metal Stent Deployment



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





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





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





4. Deploy Proximal Anchor Unlock stent and move stent hub up to #4 on handle

Axios Stent Data

Study	EUS-guided drainage of pancreatic fluid collections using a novel lumen-apposing metal stent on an electrocautery- enhanced delivery system	EUS guided drainage of peri- pancreatic fluid collections and necrosis by using a novel lumen- apposing stent	AXIOS Stent with Electrocautery Enhanced Delivery System, IDE Trial Summary	Safety and Efficacy of Endoscopic Ultrasound-Guided Drainage of Pancreatic Fluid Collections with Lumen-Apposing Covered Self Expanding Metal Stents
Journal, year	GIE 2015	GIE 2016	Unpublished	Clinical Gastroenterology and Hepatology 2015
Key Authors	Alberto Larghi, Emanuele Rinninella	Ali Siddiqui, Doug Adler, Jose Nieto, Janak Shah, Ken Binmoeller,Tom Kowalski, David Loren	Edmundowicz, Willingham, Varadarajulu, Loren, Shah Waxman, Khashab, Nieto	Raj Shah, Janek Shah, Irving Waxman, Thomas Kowalski, Andres Sanchez Yague, Jose Nieto, Brian Brauer, Monica Gaidhane, Michel Kahaleh
Number of Patients	93	82	30	33
Design	Retrospective, 13 European Center	Multicenter Retrospective	Prospective multicenter	Prospective Multicenter
Adverse Events	Total - 5.4% (5), Perforation 1% (1), Bleeding 1% (1), Infection 1% (1), Pneumoperitoneum 1% (1), Dislodgement 1% (1)	Total - 9.8% (8), 7.3% (6) self limited bleeding, 2.4% (2) stent maledeployment	Total - 10% (3), bleeding - 3% (1), infection 3% (1), dislodgment 3% (1)	Total 15.2% (5), 9% (3) abdominal pain, 3%(1) back pain, 3% (1) stent dislodgment
Key Points	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 PFC was obtained in 86 cases (92.5%) with no recurrence during follow up	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	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	In the patients receiving LACSEMS PFCs 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

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



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	SUBACUTE (1-2 weeks	5)	CHRONIC (> 2 weeks)
Supportive Care – Intravenous fluids – Pain control ± NG* decompression ± Treatment of MSOF* ± Broad spectrum antibiotic	Nasojejunal feedings Broad spectrum antibiotics ± antifungal agents ± ERCP/transpapillary stent for amenable ductal disruption cs		 Drainage contingent upon superinfection, enlarging collection, ± clinical deterioration in sterile necrosis ± ERCP/transpapillary stent 	
	Surgical – open – laparoscopic – retroperitoneal	Percut - multi JP* of Contin • local • degr	aneous ple wide-bore drains gent upon: expertise ree of liquid co	Endoscopic - Transgastric/ transduodenal irrigation, endoscopic retroperitoneal necrosectomy
		 anat cond 	comic location of comitant fluid of	of necrosis, collections

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

Kozarek GIE 2005

Questions