Banner University Medicine

Acute Pancreatitis

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Banner Advanced Endoscopy

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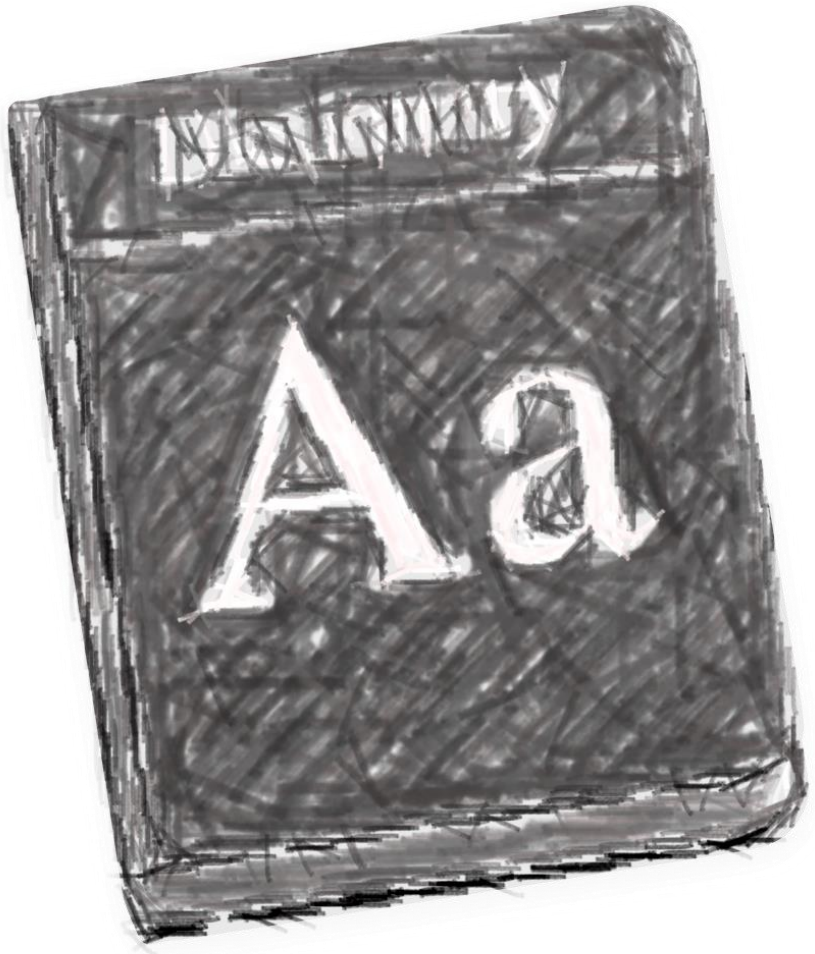
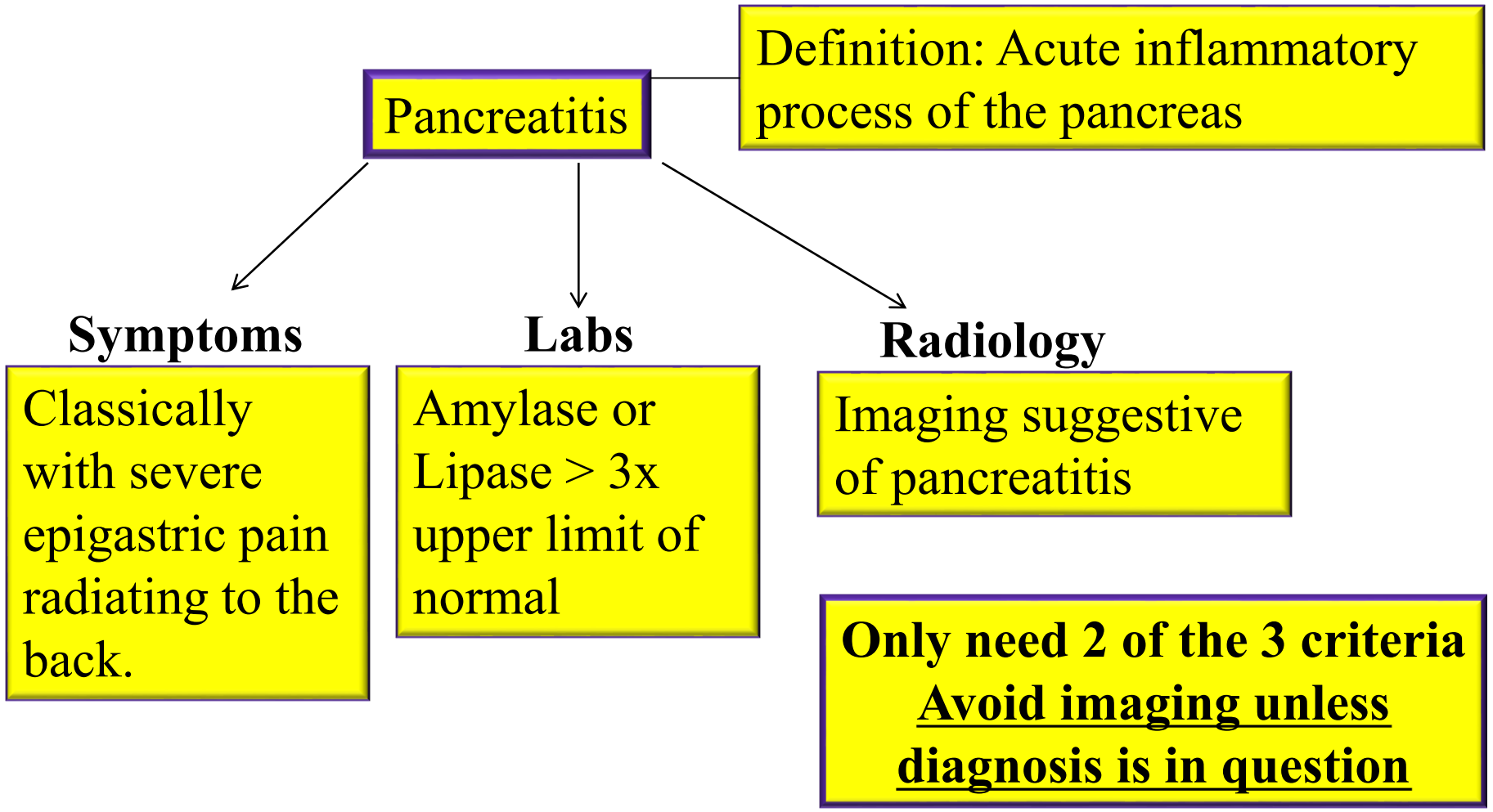
“You rarely hear anyone use the word pancreas in a not-horrible context”

Christian Finnegan



Definitions and Diagnosis

Making the Diagnosis



Acute Pancreatitis
When is Imaging Needed?

ACR Appropriateness Criteria

The ACR Appropriateness Criteria® (AC) are evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition. Employing these guidelines helps providers enhance quality of care and contribute to the most efficacious use of radiology. Learn more »

The newest ACR AC are listed below.

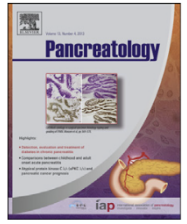
Pancreatitis suspected, typical presentation	US abdomen	0 mSv O	0 mSv [ped] O	Usually appropriate	
	MRI abdomen without IV contrast with MRCP	0 mSv O	0 mSv [ped] O	May be appropriate	
	CT abdomen and pelvis with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate	
	MRI abdomen without and with IV contrast with MRCP	0 mSv O	0 mSv [ped] O	May be appropriate	
	US duplex Doppler abdomen	0 mSv O	0 mSv [ped] O	May be appropriate	
	US abdomen with IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate	
	CT abdomen and pelvis without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate	
	CT abdomen and pelvis without and with IV contrast	10-30 mSv ☢☢☢☢	10-30 mSv [ped] ☢☢☢☢☢	Usually not appropriate	

So… When is Imaging Needed?

Contents lists available at SciVerse ScienceDirect

Pancreatology

journal homepage: www.elsevier.com/locate/pan



Original article

IAP/APA evidence-based guidelines for the management of acute pancreatitis

Working Group IAP/APA Acute Pancreatitis Guidelines[a,b,*,1]

[a] International Association of Pancreatology, UNSW Clinical School Locked Bag 7103, Liverpool, BC NSW 1871, Australia
[b] American Pancreatic Association, PO Box 14906, Minneapolis, MN 55414, USA

C. Imaging

6. The indication for initial CT assessment in acute pancreatitis can be: 1) diagnostic uncertainty, 2) confirmation of severity based on clinical predictors of severe acute pancreatitis, or 3) failure to respond to conservative treatment or in the setting of clinical deterioration. Optimal timing for initial CT assessment is at least 72–96 hours after onset of symptoms.(GRADE 1C, strong agreement)

Acute Pancreatitis
Definitions

ATLANTA CLASSIFICATION

- Interstitial edematous pancreatitis: Inflammation of the pancreatic parenchyma and peripancreatic tissues without necrosis
- Necrotizing pancreatitis: Inflammation associated with parenchymal or peripancreatic necrosis

Acute Pancreatitis
Definitions

BY SEVERITY

- Mild: Absence of organ failure or local/systemic complications
- Moderately severe: Transient organ failure and/or local/system complications (< 48 hours)
- Severe: Persistent organ failure of one or more organs

The "severity" cannot be categorized as above upon admission

Major Tools to ‘Immediately’ Assess Severity

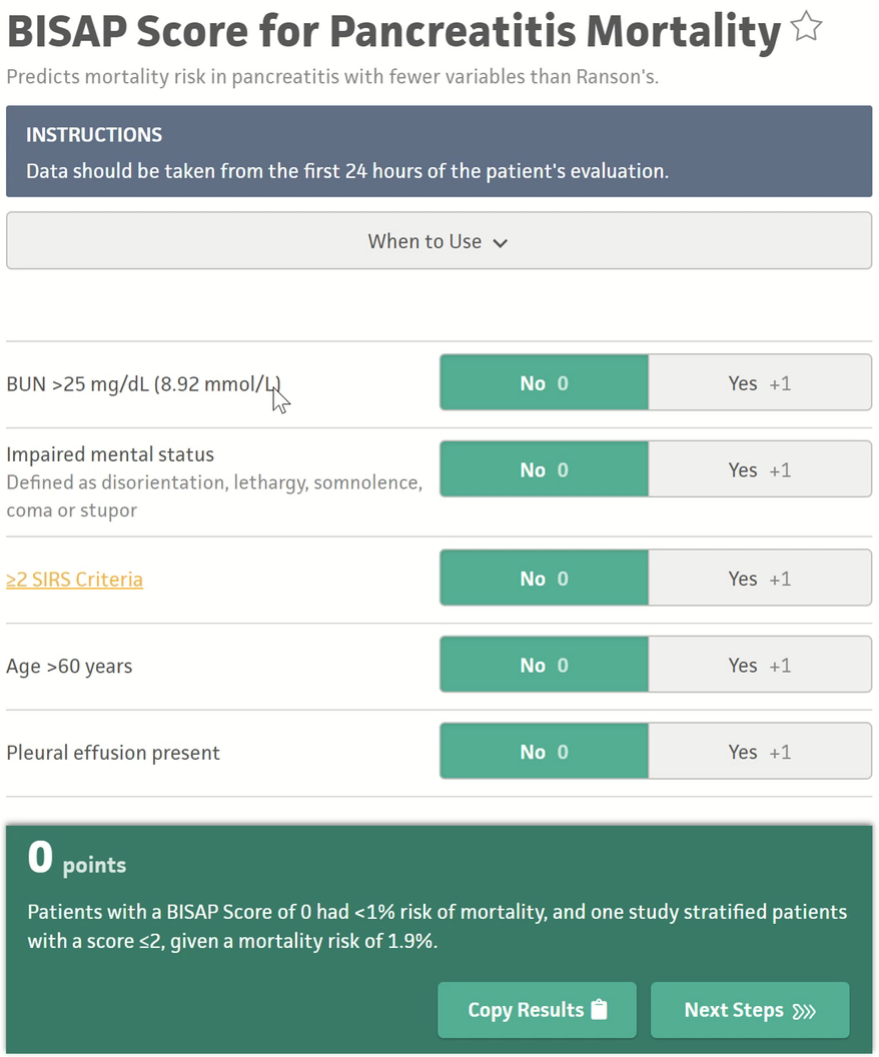
- **Hemoconcentration**
- SIRS Criteria
- CT Severity Index
- **BISAP score**

Hemoconcentration

- Variable literature that suggests that two factors associated with hemoconcentration might be associated with pancreatitis severity
  - Hemoconcentration upon admission (Hematocrit > 44%) and/or
  - Failure to have a decrease in Hematocrit at 24hours
- However, while associated with severity, may also be a marker of resuscitation

- Overall, the literature suggests that **lack** of hemoconcentration is a reasonable **negative** predictor for severe pancreatitis

BISAP Score


BISAP Score for Pancreatitis Mortality
Predicts mortality risk in pancreatitis with fewer variables than Ranson's.
INSTRUCTIONS
Data should be taken from the first 24 hours of the patient's evaluation.
When to Use
BUN >25 mg/dL (8.92 mmol/L)
No 0
Yes +1
Impaired mental status
Defined as disorientation, lethargy, somnolence, coma or stupor
No 0
Yes +1
≥2 SIRS Criteria
No 0
Yes +1
Age >60 years
No 0
Yes +1
Pleural effusion present
No 0
Yes +1
0 points
Patients with a BISAP Score of 0 had <1% risk of mortality, and one study stratified patients with a score ≤2, given a mortality risk of 1.9%.
Copy Results
Next Steps

Acute Pancreatitis - *Pitfalls of Diagnosis*

- Amylase is nonspecific and may be elevated in
  - Diseases of salivary glands and fallopian tubes
  - Intestinal ischemia
  - Renal disease
  - Macroamylasemia (due to impaired clearance of macroamylase complex)
- Amylase may be closer to normal in pancreatitis due to elevated triglycerides
- Diagnosis of pancreatitis should be **strongly avoided** with nonspecific elevations of amylase or lipase
- Radiology not needed for confirmation of disease but can be helpful in equivocal cases

Avoid Checking Amylase!

Etiologies

Acute Pancreatitis
Etiology

- Biliary
  - Gallstones
  - Sludge
  - Microlithiasis

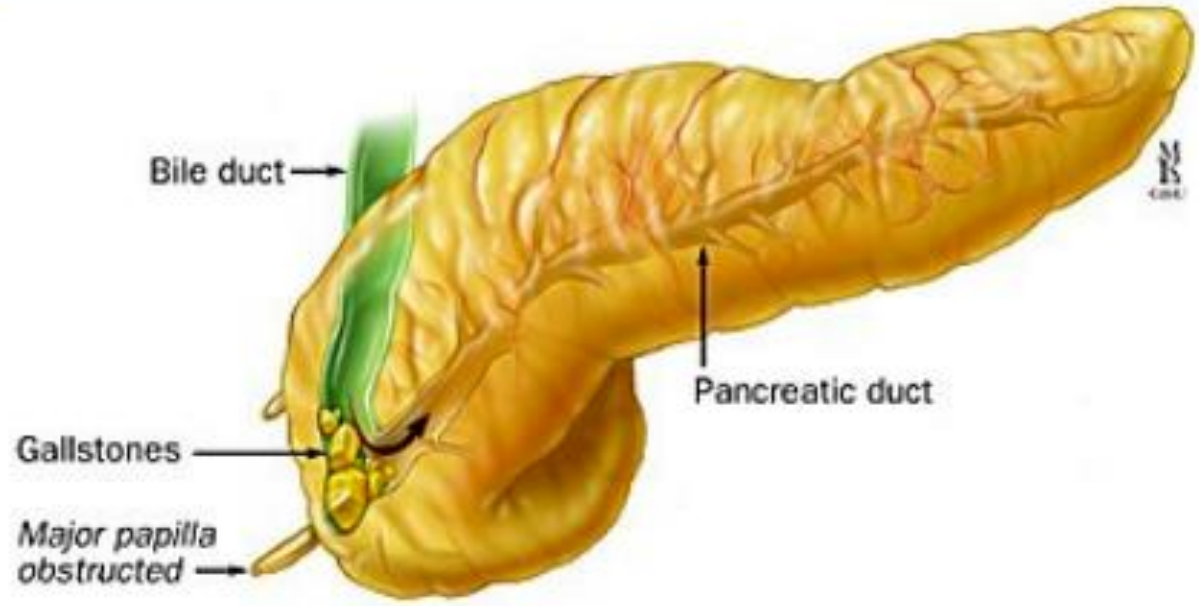


Figure 7. Gallstone obstruction.

How to Approach Suspected Bile Duct Stones?

- The management of the patient with suspected bile duct stones must consider both value and safety
- Diagnostic options include
  - ERCP
  - EUS
  - MRCP
  - Intraoperative Cholangiogram

What Should We Do?

- A 55-year old male presents to the hospital on Thursday with a 12-hour history of acute right upper quadrant pain.
- Ultrasound demonstrates cholelithiasis and bile duct diameter is 7 mm without filling defect
- Initial Labs: AST normal, ALT 105 (upper normal 40), bilirubin 1.2, alkaline phosphatase 120 (upper normal 104)
- The next day he is largely pain free and labs are repeated
  - AST normal, ALT 85 (upper normal 40), bilirubin 3.5, alkaline phosphatase 115 (upper normal 104)
- What would you do?

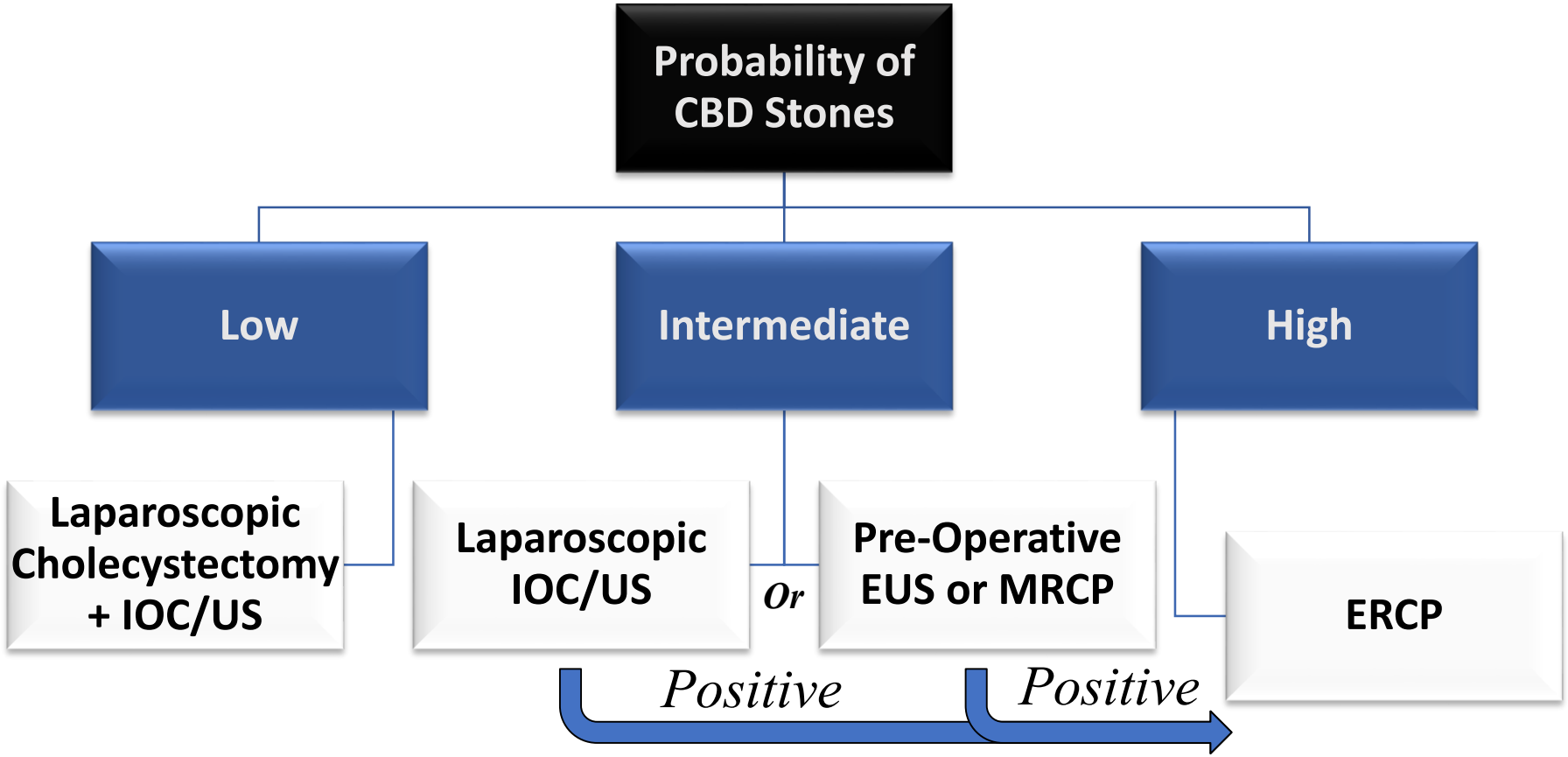
ERCP?	**Endoscopic Ultrasound?**
Cholecystectomy with IOC?	**Discharge Patient?**
MRCP?	

Predictors of Choledocholithiasis

	Probability		
Predictors	**High**	**Intermediate**	**Low**
	CBD Stone Visualized, *or*	Abnormal liver chemistry tests, *or*	**No predictors**
	Clinical ascending cholangitis, *or*	Age > 55, *or*	
	Bilirubin > 4 mg/dL **and** dilated common bile duct	Dilated common bile duct	

ASGE Guidelines, 2019

Management of Suspected Choledocholithiasis



ASGE Guidelines, 2019

Acute Pancreatitis Etiology
Alcohol

- Alcohol use
  - Can be the sole cause **or** increase the susceptibility to other causes
  - Alcohol abuse increases pancreatitis risk 4-fold
  - Effect of alcohol on risk of pancreatitis is **dose-dependent**

Table 2. Risk of Acute Pancreatitis, Chronic Pancreatitis, and Total Pancreatitis According to Updated Consumption of Alcohol Intake, Copenhagen, Denmark, 1976–2007

Alcohol Intake, drinks/week	Acute Pancreatitis					Chronic Pancreatitis					Total Pancreatitis				
	No. of Cases	Hazard Ratio[a]	95% Confidence Interval	Hazard Ratio[b]	95% Confidence Interval	No. of Cases	Hazard Ratio[a]	95% Confidence Interval	Hazard Ratio[b]	95% Confidence Interval	No. of Cases	Hazard Ratio[a]	95% Confidence Interval	Hazard Ratio[b]	95% Confidence Interval
0	35	1.0	Referent	1.0	Referent	18	1.0	Referent	1.0	Referent	52	1.0	Referent	1.0	Referent
1–6	44	1.2	0.7, 1.8	1.2	0.7, 1.8	25	1.2	0.6, 2.1	1.2	0.7, 2.3	61	1.1	0.7, 1.6	1.1	0.8, 1.6
7–13	36	1.5	0.9, 2.4	1.4	0.9, 2.3	17	1.1	0.6, 2.2	1.2	0.6, 2.4	46	1.2	0.8, 1.8	1.2	0.8, 1.8
14–20	17	1.4	0.8, 2.6	1.3	0.7, 2.4	12	1.5	0.7, 3.2	1.5	0.7, 3.2	26	1.4	0.8, 2.2	1.3	0.8, 2.1
21–34	17	2.0	1.1, 3.6	1.7	0.9, 3.2	9	1.4	0.6, 3.3	1.3	0.6, 3.1	20	1.4	0.8, 2.4	1.3	0.7, 2.2
35–48	13	4.3	2.2, 8.5	3.5	1.8, 7.1	8	3.2	1.3, 7.8	2.7	1.1, 6.6	16	3.1	1.7, 5.6	2.6	1.4, 4.8
>48	9	4.3	1.9, 9.3	3.3	1.5, 7.3	8	4.4	1.8, 11	3.3	1.3, 8.3	14	3.8	2.0, 7.2	3.0	1.6, 5.7
P_{trend}			<0.001		<0.001			<0.001		0.004			<0.001		<0.001

[a] Adjusted for age and sex.
[b] Adjusted for age, sex, smoking, education, and body mass index.

KRISTIANSEN L ET AL, AMERICAN JOURNAL OF EPIDEMIOLOGY, 2008
YADAV D ET AL, GASTROENTEROLOGY, 2014

Acute Pancreatitis Etiologies
Hereditary

- PRSS1 gene encodes cationic trypsinogen
  - Mutations result in autosomal dominant inheritance of hereditary pancreatitis
- CFTR mutations
  - Transmitted in autosomal recessive fashion
- SPINK1 mutations – generally disease modifying rather than sole etiology
  - Often transmitted in autosomal recessive fashion

Acute Pancreatitis Etiologies
Autoimmune Pancreatitis

- Increasingly recognized cause of both acute and chronic pancreatitis
- Type 1
  - Most cases are IgG4 mediated and diagnosed by elevated serum (or tissue) IgG4 levels
  - Associated with systemic IgG4 disease
- Type 2
  - Associated with autoimmune diseases, e.g., IBD
- Pancreas manifestations
  - **Painless mass (may be difficult to differentiate from malignancy)**
  - Multifocal pancreas duct stricture
  - Recurrent pancreatitis
  - Biliary stricture, often due to pancreatitis
- Treated with prolonged course of steroids with taper

Acute Pancreatitis Etiologies
Medications

- Can be difficult to diagnose as there can be a latency between drug exposure and pancreatitis
- Most important implicated medications
  - Hydrochlorothiazide
  - Azathioprine
  - Propofol
  - GLP-1 stimulators, e.g. Exenatide (Byetta) and
  - ? sitagliptin (Januvia)[1]
  - HIV Medications
    - Didanosine

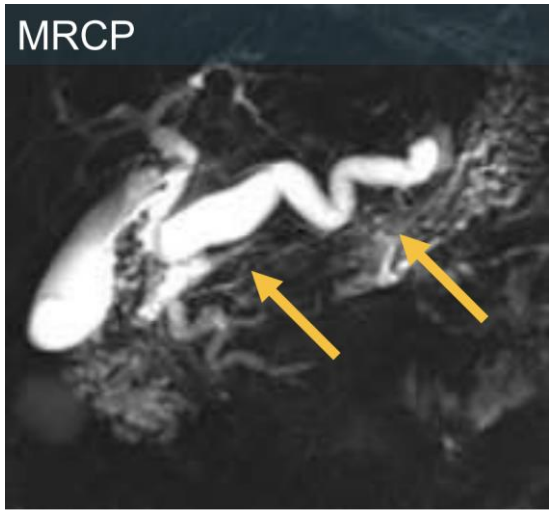
[1] Singh S et al., *JAMA Internal Medicine*, 2013

Acute Pancreatitis Etiologies
Post-ERCP

- Pancreatitis may occur in up to 15% of patients after ERCP and may in part be due to
  - Papillary swelling after ERCP (possibly as a delayed result of sphincterotomy)
  - Wire/cannula manipulation within the pancreas duct
  - Contrast injection into pancreas duct which independently increases the risk of pancreatitis
- For this reason, MRCP has replaced ERCP in almost all diagnostic cases

Acute Pancreatitis Etiologies
Pancreas Neoplasia

- Ductal obstruction from pancreas cancer
  - Occurs in ~3% of patients with PDAC
- Obstruction with mucinous from IPMN (generally main duct)

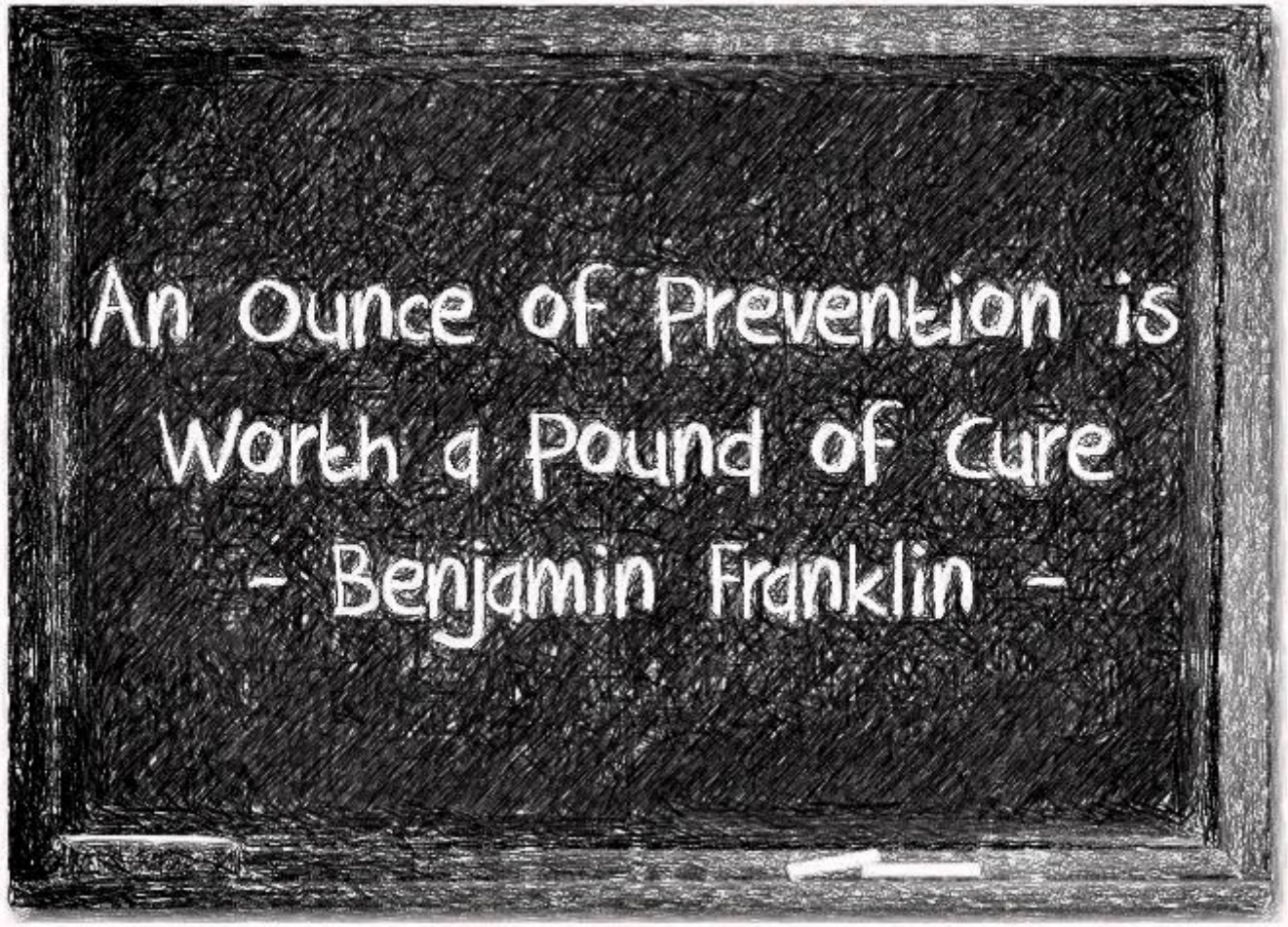


Acute Pancreatitis
Other Etiologies

- Tobacco use
- Chronic pancreatitis
- Elevated triglycerides (> 500-1000 mg/dl)
- Infections
- Trauma
- Pancreas divisum
- Sphincter of Oddi Dysfunction?
- Celiac Disease
- Idiopathic

NIH Consensus Statement on ERCP (2002)

- Patients undergoing cholecystectomy do not require ERCP preoperatively if there is a low probability of having choledocholithiasis
- ERCP should be avoided if there is a low likelihood of biliary stone or stricture, especially in women with recurrent pain, a normal bilirubin, and no other objective sign of biliary disease.
- With newer diagnostic imaging technologies emerging, ERCP is evolving into a predominantly therapeutic procedure.


An Ounce of Prevention is
Worth a Pound of Cure
- Benjamin Franklin -

Prevention

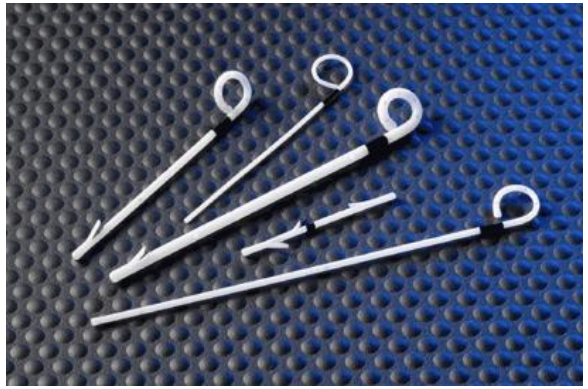
Where is My Patient?

- A 26 year old female is admitted to the hospital with choledocholithiasis
- She goes down for ERCP and does not return for a long period of time.
- When you call the room to ask what is going on, the nurse informs you the procedure has been difficult with regards to bile duct cannulation

- What should the ERCP team do to reduce the risk of pancreatitis?
  - A. Antibiotics
  - B. Rectal indomethacin
  - C. Pancreatic duct stent placement
  - D. LR boluses given intra-procedurally

Rationale for Protecting the Pancreas Duct with a Stent

- Pancreatitis may occur in up to 15% of patients after ERCP and may in part be due to
  - Papillary swelling after ERCP (possibly as a delayed result of sphincterotomy)
  - Contrast injection into pancreas duct which independently increases the risk of pancreatitis
  - Multiple studies have shown that placement of a small pancreatic stent in at risk patients reduces the risk of post-ERCP pancreatitis

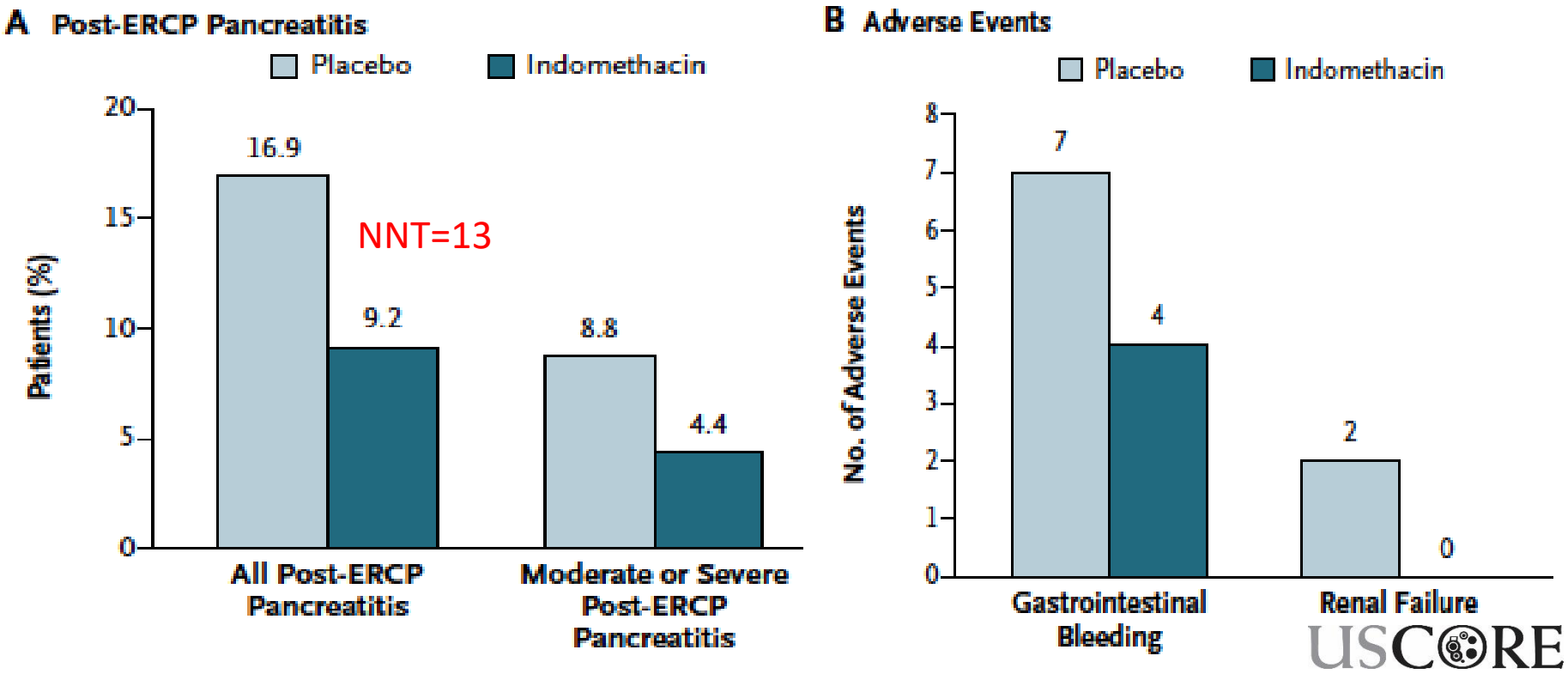


Prophylactic PD Stent Placement Studies

First author, year	Design	Patients/procedures	No.	Pancreatitis % without and with pancreatic stent		P
Smithline 1993	RCT	Biliary ES for SOD, small ducts, or precut	93	18	14	.299
Sherman 1996 (abstract)	RCT	Precut biliary ES	93	21	2	.036
Tarnasky 1998	RCT	Biliary ES for SOD	80	26	7	0.03
Elton 1998	RCC	Pancreatic ES for all indications	194	12.5	0.7	<.003
Patel 1999 (abstract)	RCT	Pancreatic ES for SOD	36	33	11	>.05
Vandervoort 1999	PCC	Pancreatic brush cytology for suspected malignancy	42	28.1	0	.08
Aizawa 2001	RCC	Biliary balloon dilatation for stone	40	6	0	.11
Fogel 2002	RCC	Biliary ± pancreatic ES for SOD	436	28.2	13.5	<.05
Norton 2002	RCC	Endoscopic ampullectomy	28	11.1	20	>.05
Fazel 2003	RCT	Difficult cannulation, biliary ES, SOD	76	28	5	<.05
Freeman 2004	PCC	Consecutive high-risk ERCP in which a major papilla PD stent was attempted	225	66.7	14.4	.06
Catalano 2004	RCC	Endoscopic ampullectomy	103	16.7	3.3	.10
Harewood 2005	RCT	Endoscopic ampullectomy	19	33.0	0	.02
Hookey 2006	RCC	Pancreatic ES (major and minor papilla) (majority with chronic pancreatitis)	572	19.3	8.8	.001
Sofuni 2007	RCT	All consecutive ERCP (excluding pancreatic cancer, PD drainage cases)	201	13.6	3.2	.02
Saad 2008	RCC	Suspected SOD with normal SO manometry	403	9.0	2.4	.006
Ito 2009 (abstract)	RCT	Pancreatic guidewire placement to assist selective biliary cannulation	69	23	2.9	.017

Freeman ML, GIE, 2010

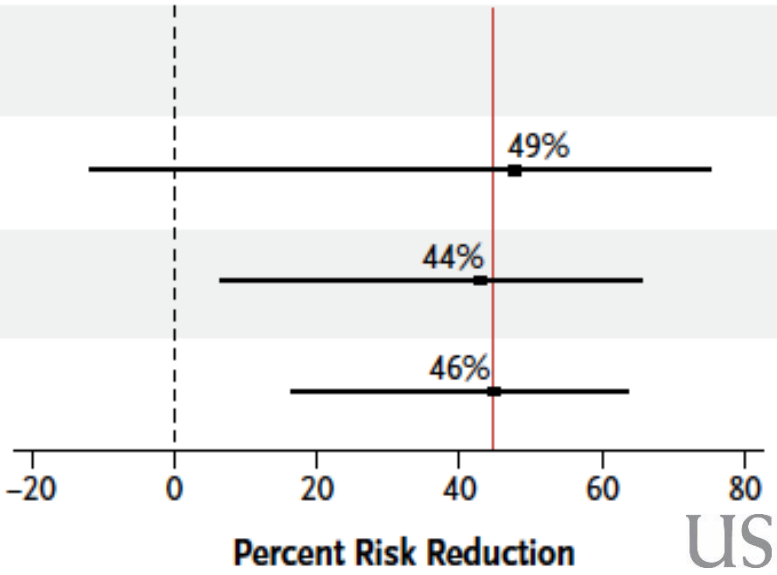
Rectal Indomethacin Reduces Risk of Post-ERCP Pancreatitis



Elmunzer BJ, NEJM, 2012

Indomethacin protective across entire range of pancreatitis risk

Subgroup	Control	NSAID	Relative Risk Reduction	No. Needed to Treat
	no. of events/total no. (%)			
PEP risk score				
1 or 2	17/134 (12.7)	8/125 (6.4)	49%	16
>2	35/173 (20.2)	19/169 (11.2)	44%	11
Any score	52/307 (16.9)	27/294 (9.2)	46%	13



USCORE

Elmunzer BJ, NEJM, 2012

Aggressive IV hydration after ERCP **may** reduce post-ERCP pancreatitis

Aggressive intravenous hydration with lactated Ringer's solution for prevention of post-ERCP pancreatitis: a prospective randomized multicenter clinical trial

Patients and methods In a prospective randomized multicenter trial, average-to-high risk patients who underwent first-time ERCP were randomly assigned to three groups (1:1:1) who received: aggressive intravenous hydration (3 mL/kg/h during ERCP, a 20-mL/kg bolus and 3 mL/kg/h for 8 hours after ERCP) with either lactated Ringer's solution (LRS) or normal saline solution (NSS), or standard intravenous hydration with LRS (1.5 mL/kg/h during and for 8 hours after ERCP). The primary end point was post-ERCP pancreatitis (PEP).

Results 395 patients were enrolled, and 385 completed the protocols. The three groups showed no significant differences in demographic characteristics. There was a significant difference in the intention-to-treat (ITT) PEP rate between the aggressive LRS group (3.0%, 95% confidence interval [CI] 0.1%–5.9%; 4/132), the aggressive NSS group (6.7%, 95%CI 2.5%–10.9%; 9/134) and the standard LRS group (11.6%, 95%CI 6.1%–17.2%; 15/129; $P=0.03$). In the two-group comparisons, the ITT PEP rate was significantly lower for the aggressive LRS group than for the standard LRS group (relative risk [RR] 0.26, 95%CI 0.08–0.76; $P=0.008$). There was no significant difference in the ITT PEP rate between the aggressive NSS group and the standard LRS group (RR 0.57, 95%CI 0.26–1.27; $P=0.17$).

Aggressive IV hydration after ERCP **may not** reduce post-ERCP pancreatitis

Findings

Between June 5, 2015, and June 6, 2019, 826 patients were randomly assigned, of whom 388 in the aggressive hydration group and 425 in the control group were included in the modified intention-to-treat analysis. Post-ERCP pancreatitis occurred in 30 (8%) patients in the aggressive hydration group and in 39 (9%) patients in the control group (relative risk 0·84, 95% CI 0·53–1·33, p=0·53). There were no differences in serious adverse events, including hydration-related complications (relative risk 0·99, 95% CI 0·59–1·64; p=1·00), ERCP-related complications (0·90, 0·62–1·31; p=0·62), intensive care unit admission (0·37, 0·07–1·80; p=0·22), and 30-day mortality (0·95, 0·50–1·83; p=1·00).

Treatment

Just Not Hungry

- A 48-year old male presents to the emergency department with alcohol-induced pancreatitis
- On hospital day #4, he remains on intravenous analgesia and NPO
- Which of the following is not a reasonable next step?

A. Parenteral nutrition (TPN)

B. Nasojeunal feeding tube placement for enteral feeds

C. Postpyloric feeding tube placement for enteral feeds

D. Nasogastric feeding tube placement for enteral feeds

E. Eating by mouth

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Acute Pancreatitis
Cornerstones of Management

- Early diagnosis of cause
- **Early goal-directed hydration with LR**
- Analgesia
- **Early Initiation of Diet**
- Appropriate testing

Acute Pancreatitis
Diagnosing the Cause – First Episode

- All patients should be ruled out for biliary cause **regardless of alcohol history**.
  - An elevated bilirubin or alkaline phosphatase is not necessary in early obstruction; ALT elevation is most sensitive
  - Alcohol history should be obtained but should not be assumed to be the cause
- Laboratory testing at first episode
  - LFT's
  - Calcium
  - Triglycerides
- Medication history

Acute Pancreatitis
Imaging

- Right upper quadrant ultrasound is necessary in all patients
  - Most useful to assess for cholelithiasis, less so for choledocholithiasis
  - Cholelithiasis and significantly elevated ALT essentially diagnostic for biliary etiology
- A CT scan on admission is almost never needed and should be **avoided when diagnosis is known**
- An MRCP can be useful to evaluate for a retained CBD stone but is generally **not** needed at first episode to evaluate for other causes
  - IV Contrast is not needed (but is preferred) for an MRCP

Acute Pancreatitis Management
IV Hydration

1. Type of fluid

- Limited data, but early study[1] demonstrated that infusion of lactated Ringer solution reduced systemic inflammation compared to normal saline
- No change in other endpoints

2. Amount and speed of resuscitation

- Theoretical advantage to aggressive resuscitation as pancreatitis can be considered an ischemic event
- However, rapid hydration can result in volume overload and tissue edema
- Not surprisingly, conflicting studies regarding aggressive resuscitation – some studies demonstrate benefit, others harm

[1] Wu B et al., Clinical Gastroenterology and Hepatology, 2011

RCT of NS versus LR in Mild Acute Pancreatitis

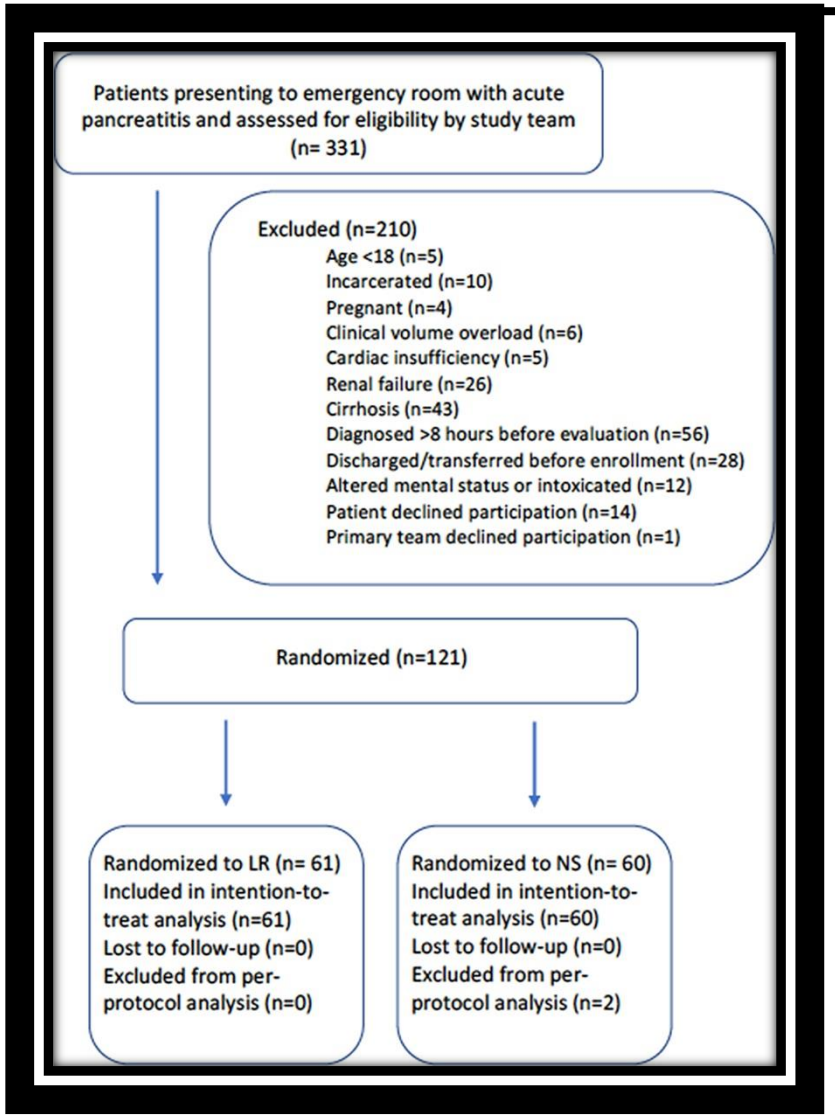


Table 1. Outcomes in Patients With AP Treated With NS vs LR Solution

	NS (n = 60) n (%)	LR (n = 61) n (%)	RR	Adjusted RR[a]
ICU admission	15 (25)	6 (9.8)	0.4 (0.2–0.9)	0.3 (0.1–0.9)
Moderate-severe pancreatitis	15 (25.0)	9 (14.8)	0.8 (0.4–1.4)	0.5 (0.2–1.1)
Local complications	9 (15)	4 (6.6)	0.4 (0.1–1.3)	0.3 (0.1–1.5)
Organ failure	9 (15)	7 (11.5)	0.8 (0.3–1.9)	1 (0.4–2.7)
Adverse events	0	1	—	—
Recurrent AP post-discharge	8 (13.1)	6 (10.0)	1.3 (0.5–3.6)	0.9 (0.4–2.0)
Hyperchloremia (Serum Cl > 108 mm/L) at 24 h	15 (25.4)	3 (5.6)	0.2 (0–0.6)	0.2 (0.1–0.6)

	NS (n = 60) n (%)	LR (n = 61) n (%)	RR	Adjusted RR [b]
SIRS 24 h	19 (32.2%)	21 (37.5%)	1.2 (0.7–1.9)	1.1 (0.7–1.6)
SIRS 48 h	18 (38.3%)	18 (41.9%)	1.1 (0.7–1.8)	1.0 (0.6–1.5)
SIRS 72 h	14 (32.6%)	11 (32.4%)	1.0 (0.5–1.9)	1.0 (0.5–1.8)

	NS Median (IQR)	LR Median (IQR)	*P* value
Length of hospitalization (*d*)	4.6 (3–7.4)	3.5 (2–5.9)	.049
Fluid administered in first 24 h following randomization (*L*)	5.8 (4.8–6.8)	6.0 (5.2–6.9)	.194

ICU, intensive care unit; IQR, interquartile range.
[a]Adjusted for pancreatitis etiology, race/ethnicity, and baseline differences in outcome of interest (ie. local complications).
[b]Adjusted for baseline SIRS prevalence.

Lee A et al; Buxbaum J, Gastroenterology, 2021

Acute Pancreatitis Management
IV Hydration

What to do in practice?

- Place resuscitation of the patient in overall clinical context; avoid volume overload in patients with tenuous cardiopulmonary status
- Maximize hydration (up to 4.5L) in first 24h when some pancreatic damage may be reversible (therapeutic window)
- Use of lactated Ringer
- Avoid hemoconcentration early by assuring adequate urine output and following hemoglobin

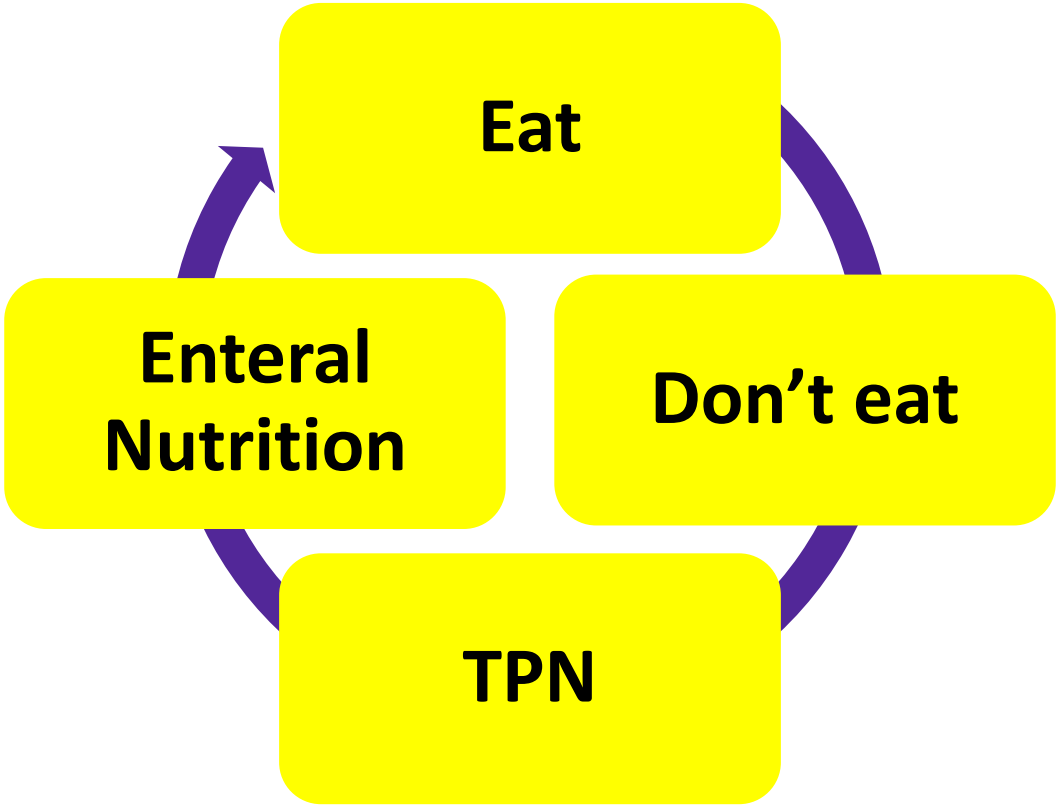
Acute Pancreatitis Management
IV Hydration

What to do in practice?

- Initial bolus: 20 mL/kg bolus (1-2 L of Lactated Ringer's) ideally within 2 hours of presentation
- Maintenance Fluids: 1.5-3 mL/kg/hour maintenance fluid for 24 hours
  - There is some benefit of 3 mL/kg/hour in at least patients with mild acute pancreatitis
- Poor urine output at 8-12 hours: If urine output at 8 hours is not at least 0.5 mL/kg/hour, administer an additional fluid bolus of 20 mL/kg (e.g., 1 L of Lactated Ringer's).
- Further work is ongoing

Acute Pancreatitis
Nutrition

- In healthy volunteers feeding stimulates pancreas via cholecystokinin leading to initial food avoidance

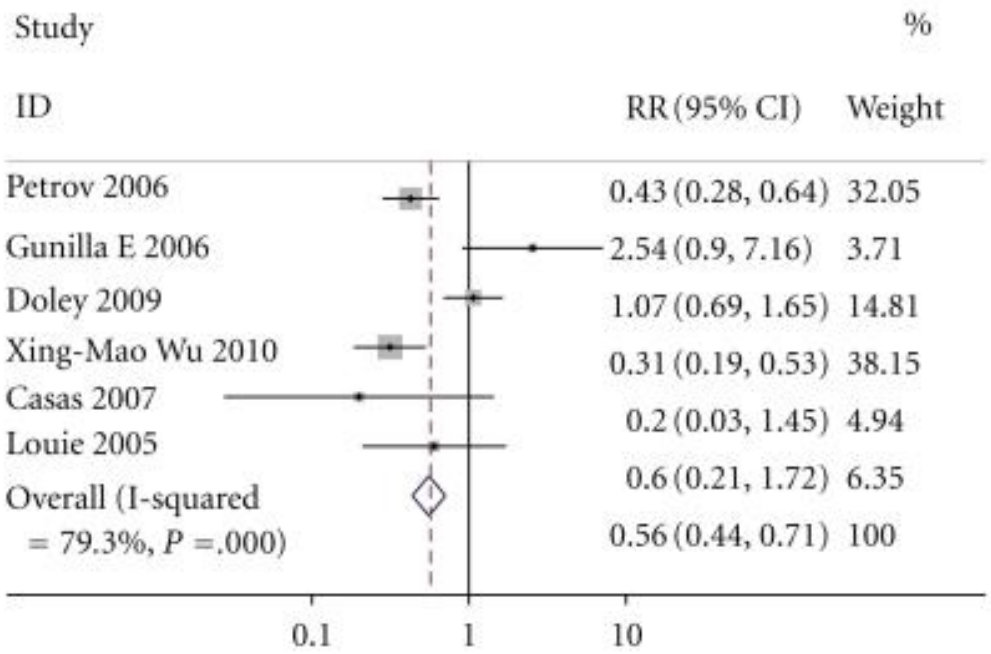


Acute Pancreatitis
Nasoenteric Feeding

- Goal is placement of tube past the ligament of Treitz
- Can be placed
  - Endoscopically
  - Fluoroscopically
  - Bedside

Acute Pancreatitis
Enteral Nutrition

- Nasojejunal feedings have been shown in multiple studies to be superior to parenteral nutrition

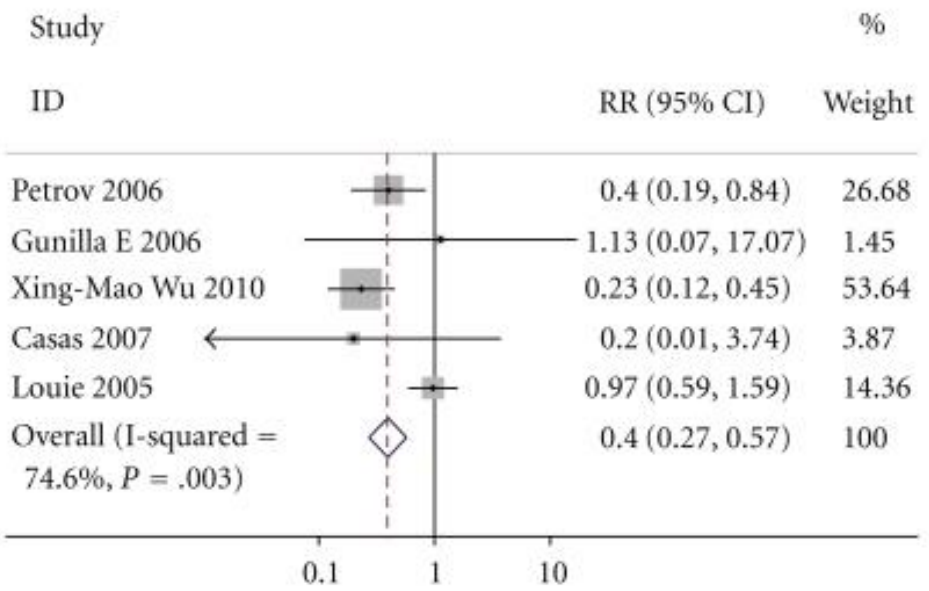


Pancreatitis Complications Reduced With Nasoenteric Feedings

Quan H et al, *Gastroenterology Research and Practice*, 2011

Acute Pancreatitis
Enteral Nutrition

- Nasojejunal feedings have been shown in multiple studies to be superior to parente



Decreased Mortality in Pancreatitis
With Nasoenteric Feedings

Quan H et al, *Gastroenterology Research and Practice*, 2011

Early Oral Nutrition

Immediate Oral Refeeding in Patients With Mild and Moderate Acute Pancreatitis

A Multicenter, Randomized Controlled Trial (PADI trial)

Elena Ramírez-Maldonado, MD, PhD,†✉ Sandra López Gordo, MD, PhD,* Eva M. Pueyo, MD,‡ Ariadna Sánchez-García, MD,§ Susana Mayol, MD,* Sergio González, MD, PhD,‡ Jordi Elvira, MD,¶ Robert Memba, MD, PhD,¶ Constantino Fondevila, MD, PhD,† and Rosa Jorba, MD, PhD¶*

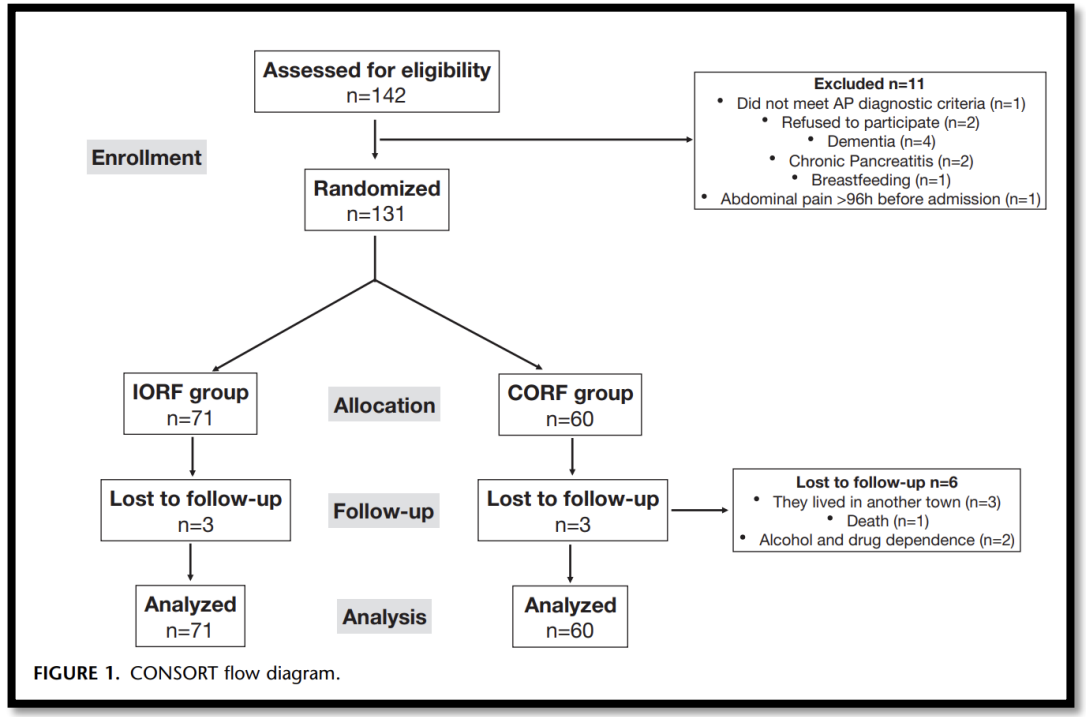


FIGURE 1. CONSORT flow diagram.

Early Oral Nutrition

TABLE 2. Outcomes Comparing Groups

Outcomes	IORF Group n = 71	CORF Group n = 60	*P* value
Length of hospital stay, days, mean (SD)	3.4 (1.7)	8.8 (7.9)	<0.001
Days from admission to refeeding, days, mean (SD)	0	2.8 (1.7)	<0.001
Days from refeeding to discharge, days, mean (SD)	3.4 (1.7)	5.4 (4.8)	<0.001
Need for opioids or analgesia infusion	0	5 (8.3)	<0.001
Intolerance diet n (%)	1 (1.4)	13 (21.6)	<0.001
Reasons for intolerance			
Relapse of pain, n (%)	0	10 (16.7)	<0.001
Nausea and vomiting, n (%)	1 (1.4)	2 (3.3)	0.37
Anorexy, n (%)	0	1 (1.6)	0.44
Progression of acute pancreatitis, n (%)	0	6 (10.0)	<0.006
Complications, n (%)	3 (4.2)	11 (18.3)	<0.009
Interventions			
Radiology, n (%)	0	2 (3.3)	0.19
Surgery, n (%)	0	1 (1.6)	0.44
ICU admission, n (%)	0	4 (6.6)	0.03
Mortality, n (%)	0	1 (1.6)	0.44
Hospital readmission, n (%)	2 (2.8)	5 (8.3)	0.15

ICU indicates intensive care unit; SD, standard deviation.

Acute Pancreatitis

Timing of Nutrition in Severe Acute Pancreatitis

ORIGINAL ARTICLE

Early versus On-Demand Nasoenteric Tube Feeding in Acute Pancreatitis

O.J. Bakker, S. van Brunschot, H.C. van Santvoort, M.G. Besselink, T.L. Bollen, M.A. Boermeester, C.H. Dejong, H. van Goor, K. Bosscha, U. Ahmed Ali, S. Bouwense, W.M. van Grevenstein, J. Heisterkamp, A.P. Houdijk, J.M. Jansen, T.M. Karsten, E.R. Manusama, V.B. Nieuwenhuijs, A.F. Schaapherder, G.P. van der Schelling, M.P. Schwartz, B.W.M. Spanier, A. Tan, J. Vecht, B.L. Weusten, B.J. Witteman, L.M. Akkermans, M.J. Bruno, M.G. Dijkgraaf, B. van Ramshorst, and H.G. Gooszen, for the Dutch Pancreatitis Study Group

Early (within 24 hours) nasoenteric feeding versus attempted oral nutrition on Day 4 (with nasoenteric nutrition if not tolerated)

Acute Pancreatitis

Timing of Nutrition in Severe Acute Pancreatitis

Table 2. Primary and Secondary End Points, According to the Intention-to-Treat Analysis.*

Outcome	Early Tube Feeding (N=101)	On-Demand Tube Feeding (N=104)	Risk Ratio (95% CI)	P Value
Primary composite end point: infection or death — no. (%)	30 (30)	28 (27)	1.07 (0.79–1.44)	0.76
Secondary end points				
Infection — no. (%)†	25 (25)	27 (26)	0.97 (0.70–1.34)	0.87
Infected pancreatic necrosis	9 (9)	15 (14)	0.74 (0.43–1.26)	0.28
Bacteremia	17 (17)	18 (17)	0.98 (0.68–1.43)	1.00
Pneumonia	12 (12)	13 (12)	0.97 (0.63–1.50)	1.00
Death — no. (%)	11 (11)	7 (7)	1.27 (0.85–1.89)	0.33
Necrotizing pancreatitis — no. (%)‡	64 (63)	65 (62)	1.06 (0.77–1.47)	0.76
CT severity index§	4±2	4±3	—	0.29
ICU admission after randomization — no. (%)	18 (18)	20 (19)	0.95 (0.66–1.38)	0.86
Mechanical ventilation — no. (%)	12 (12)	14 (13)	0.93 (0.60–1.44)	0.84
New-onset organ failure — no./total no. at risk (%)¶				
Single organ failure	26/67 (39)	31/73 (42)	0.92 (0.65–1.32)	0.73
Persistent single organ failure	10/67 (15)	10/73 (14)	1.05 (0.65–1.70)	1.00
Multiple organ failure	7/67 (10)	6/73 (8)	1.14 (0.67–1.95)	0.77
Persistent multiple organ failure	4/67 (6)	4/73 (5)	1.05 (0.51–2.14)	1.00

* Plus-minus values are means ±SD. Risk ratios are for early tube feeding as compared with on-demand tube feeding. ICU denotes intensive care unit.

† Patients may have had more than one type of infection.

‡ Necrotizing pancreatitis was defined as pancreatic parenchymal necrosis or extrapancreatic necrosis.[45,46] In nine patients (9%) in the early group and seven (7%) in the on-demand group, no CT was performed.

§ Scores on the CT severity index range from 0 to 10, with higher scores indicating more extensive pancreatic or extrapancreatic necrosis.

¶ New-onset organ failure was defined as organ failure that was not present at randomization. Persistent organ failure was defined as organ failure present on 3 or more consecutive days (>48 hours). Multiple organ failure was defined as failure of two or more organs on the same day.

Acute Pancreatitis
Parenteral Nutrition

- Parenteral nutrition should only be considered in patients who can not tolerate enteral feeds (frequently due to ileus)
  - These patients still benefit from low volume “trophic” feeds
  - Frequent challenges of enteral feeds so that TPN may be stopped

Acute Pancreatitis
Antibiotics

- There is no role for antibiotics in interstitial pancreatitis
- Conflicting evidence for **prophylactic antibiotics** in necrotizing pancreatitis
- My practice is to withhold antibiotics unless there are signs of persistent unwellness in the setting of necrosis
- If antibiotics are given, should use carabapenem or piperacillin/tazobactam due to penetration into the pancreas

Acute Pancreatitis
Testing During Early Hospitalization

- Amylase and lipase should not be followed after initial diagnosis; they have minimal prognostic value
- Calcium should be checked frequently in patients with moderately severe or severe pancreatitis as patients may become rapidly hypocalcemic
- Check serum BUN and hemoglobin early on in hospitalization to ensure adequacy of volume resuscitation
- A CT scan is **not** needed in uncomplicated disease

Acute Pancreatitis
Testing in the Deteriorating Patient

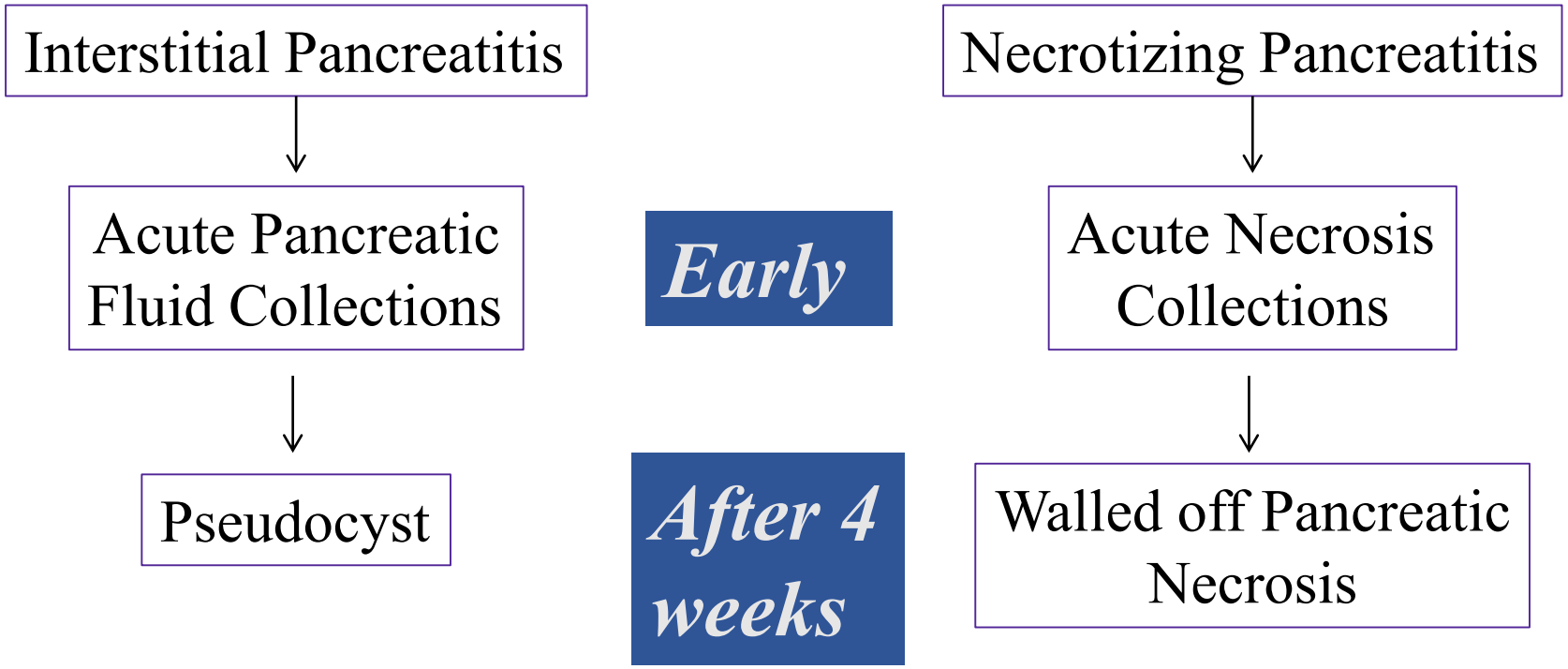
- A CT scan can be performed, ideally with intravenous contrast, on or after hospital day #3 to assess for necrosis or other sequelae of pancreatitis

Biliary Pancreatitis

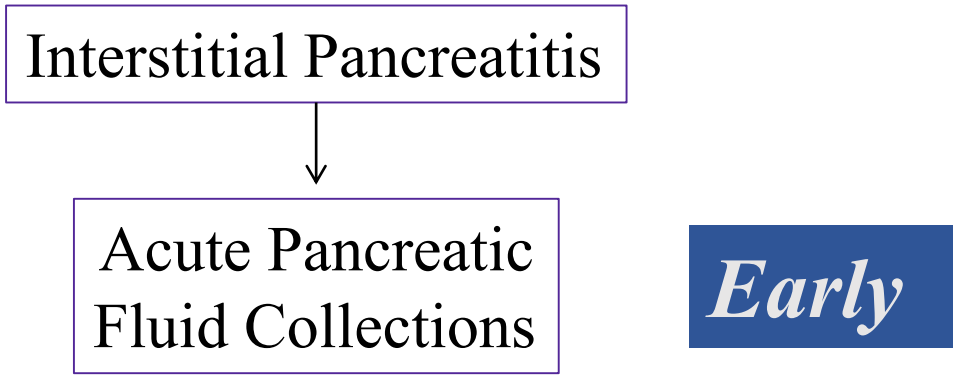
- All patients with biliary pancreatitis should have a surgical consultation for cholecystectomy during the index hospital stay

Complications of Pancreatitis

Acute Pancreatitis
Defining the Complications



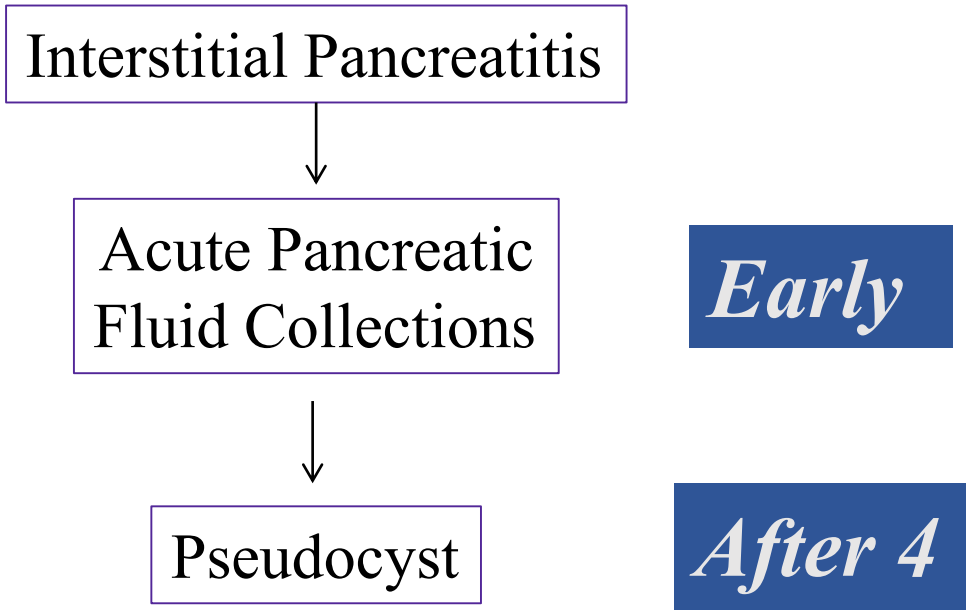
Acute Pancreatitis
Acute Fluid Collections



- These are due to inflammation and/or duct disruption leading to accumulation of pancreas juice.

- Do nothing; the majority of these resolve. For those needing intervention (large size and symptomatic), should wait until fluid collection matures.

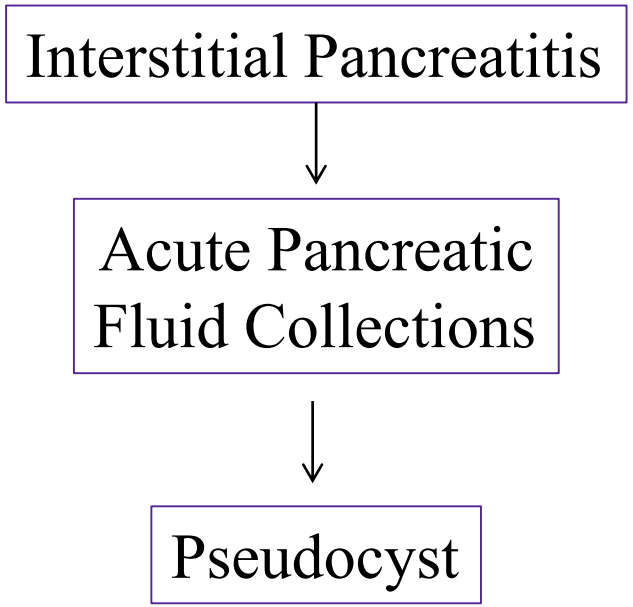
Acute Pancreatitis
Pseudocysts



- These are mature collections of pancreas juice, possibly associated with a persistent disruption in the pancreas duct.

- Larger pseudocysts, especially those with persistent disruption may need drainage.

Acute Pancreatitis
Pseudocysts



Early

After 4 weeks

- Three main options for drainage
1. Percutaneous (radiology)
2. Surgical
3. Endoscopic

Acute Pancreatitis
Pseudocyst Management

- Considerations in choice of drainage procedure
  - Percutaneous drainage may result in a pancreaticocutaneous fistula; these can be difficult to manage once they are established
  - Endoscopic (transmural) drainage may not be possible if there is a large distance between stomach/duodenum and pseudocyst
  - Patients may not be a surgical candidate

Acute Pancreatitis
Managing the Complications

- Does not require any therapy in acute period.

- If there are signs of sepsis, aspiration can be performed to guide therapy.

- Surgery should certainly be **avoided** early in necrosis if at all possible.

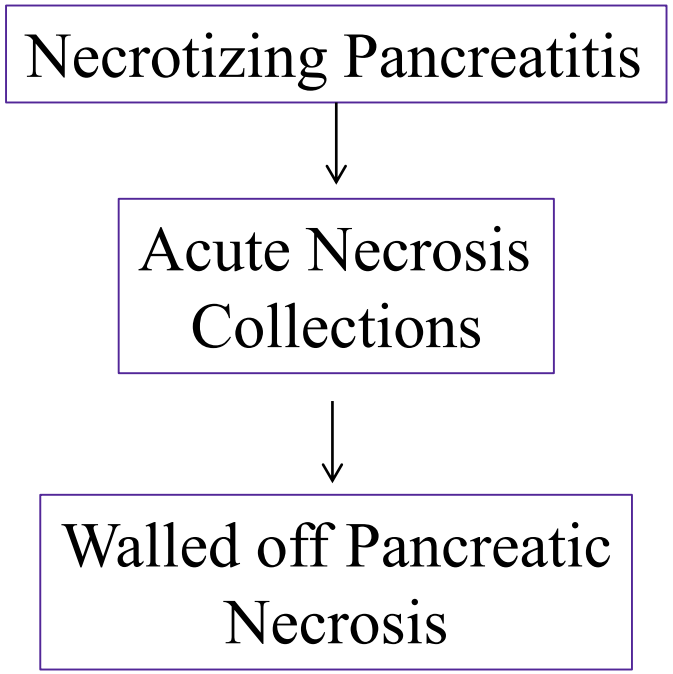
Early

Necrotizing Pancreatitis

↓

Acute Necrosis Collections

Acute Pancreatitis
Defining the Complications



- Requires treatment if infected or if symptomatic.

- Will require debridement in addition to drainage.

Acute Pancreatitis
Defining the Complications

- Three main options for drainage

1. Percutaneous (radiology)
2. Surgical
3. Endoscopic

Early

After 4 weeks

Necrotizing Pancreatitis

↓

Acute Necrosis Collections

↓

Walled off Pancreatic Necrosis

Acute Pancreatitis
Endoscopic Management of WOPN

Acute Pancreatitis

Overall Trends in Management of Necrosis

- Open surgical debridement is no longer the standard of care and should be avoided as outcomes are worse[1]
- Delay intervention for at least 3-4 weeks[1]
- Step-up approach may be most effective – retroperitoneal or endoscopic drainage followed by retroperitoneal surgical access for debridement (PANTER trial)[2]
- A majority of patients will never require any therapy with medical therapy alone effective[3]
- Endoscopic necrosectomy may be preferable to surgical[4]

[1] Windsor J, HPB, 2011

[2] Santvoort HC, NEJM, 2010

[3] Santvoort HC, Gastroenterology, 2011

[4] Bakker OJ, JAMA, 2012

Acute Pancreatitis - Management

A 48 y/o M is evaluated in the ED for flank pain and dysuria. Six months earlier he was hospitalized for severe acute gallstone pancreatitis. Contrast-enhanced CT of the pancreas showed lack of perfusion in the body of the pancreas. He recovered with supportive care and was discharged 2 weeks later. He had an uncomplicated lap chole 4 weeks after discharge. He reports he felt well until the sudden onset of left flank pain today.

On physical examination BP is 130/80, HR 90 and other vitals normal. Abdominal pain notable for LLQ pain on palpation. UA with hematuria.

A CT scan is obtained which shows nephrolithiasis and a small stone in the left ureter. The CT scan also notes a 6 cm fluid collection with solid debris in the body of the pancreas with a well-defined wall.

Acute Pancreatitis - Management

What kind of fluid collection is this?

a. Acute peripancreatic fluid collection

b. Acute necrotic collection

c. Pseudocyst

d. Walled off pancreatic necrosis

Acute Pancreatitis - Management

What kind of fluid collection is this?

a. Acute peripancreatic fluid collection

b. Acute necrotic collection

c. Pseudocyst

d. Walled off pancreatic necrosis

Acute Pancreatitis - Management

Which of the following is the most appropriate management of the fluid collection?

A. Antibiotics

B. CT-guided fine-needle aspiration

C. Endoscopic ultrasound guided drainage

D. Observation

Acute Pancreatitis - Management

Which of the following is the most appropriate management of the fluid collection?

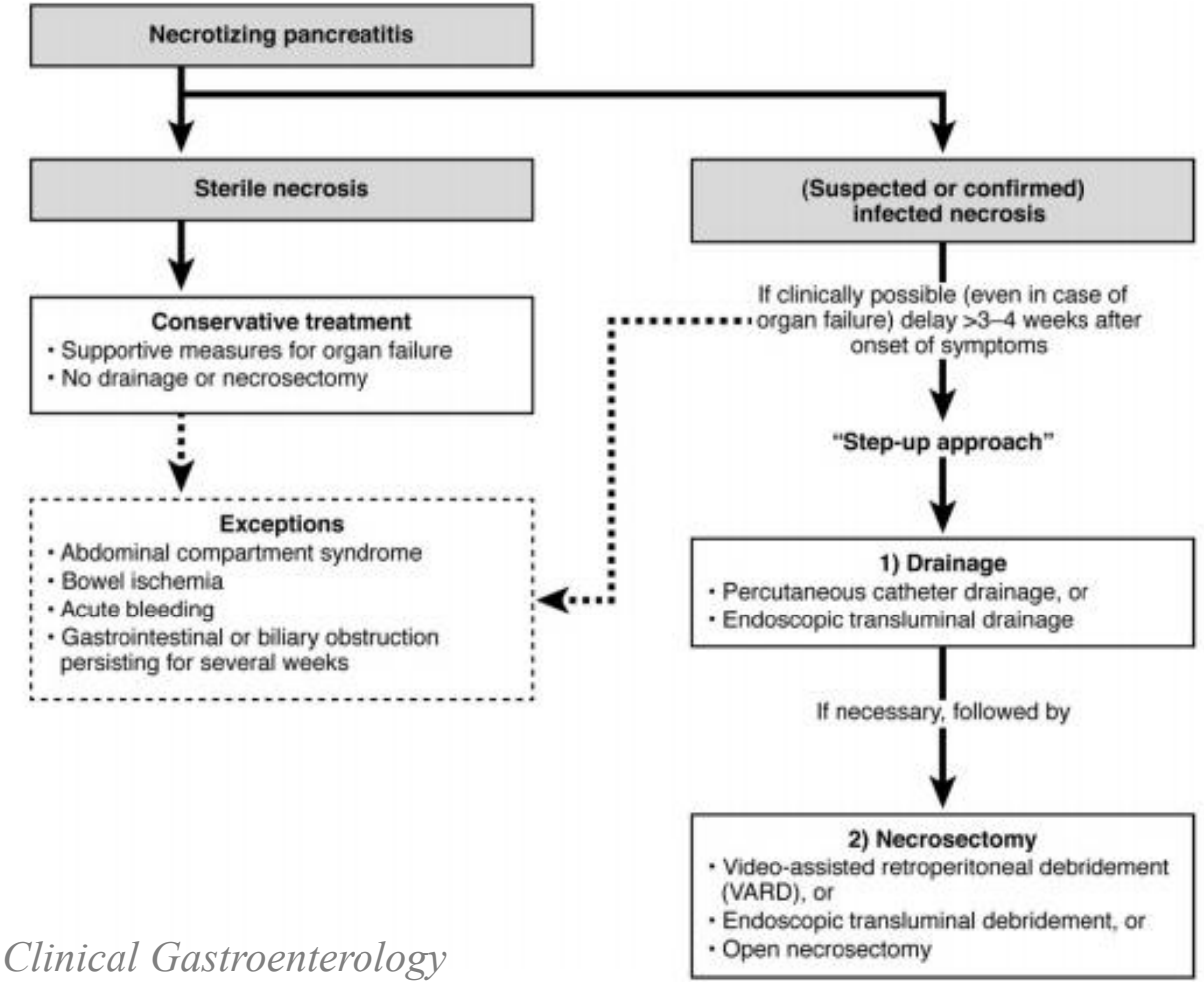
A. Antibiotics

B. CT-guided fine-needle aspiration

C. Endoscopic ultrasound guided drainage

D. **Observation**

Acute Pancreatitis
Management of Necrosis



van Brunschot S et al, *Clinical Gastroenterology and Hepatology*, 2012

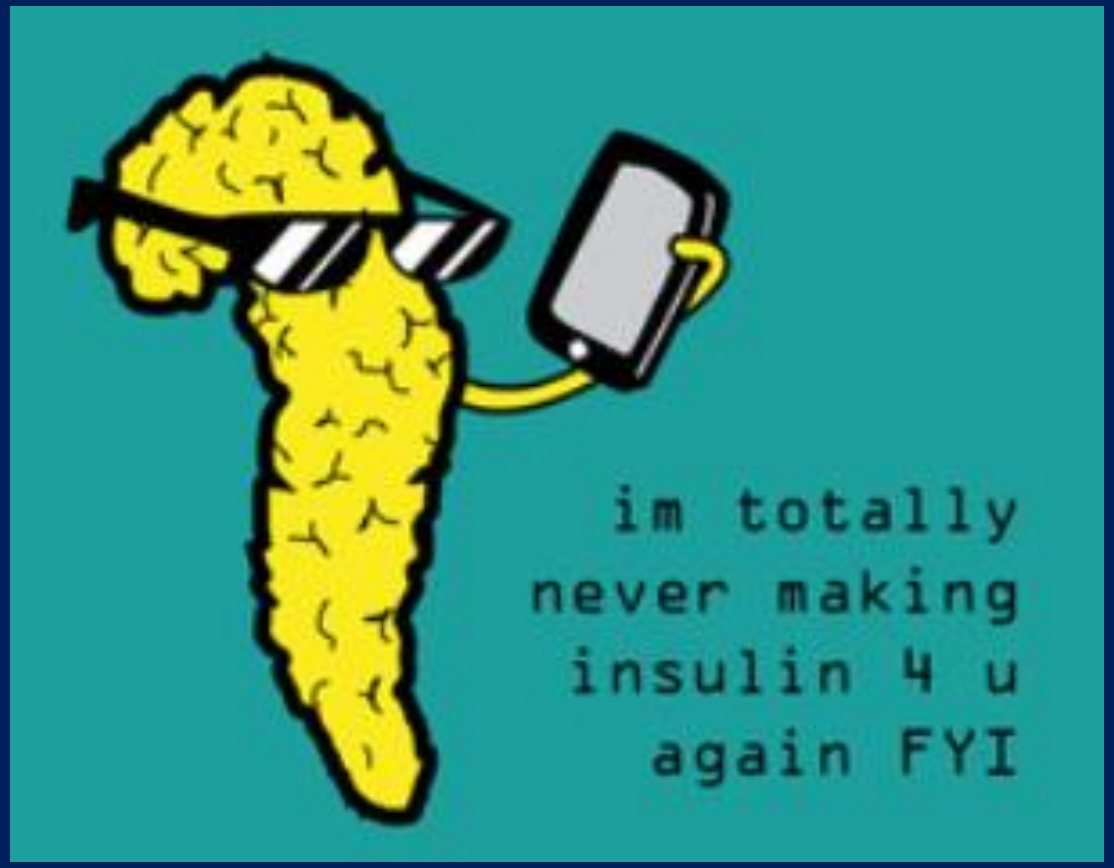
Conclusions – Everything You Need to Know in Two Slides

- Avoid pancreatitis diagnosis for equivocal lipase elevations
- Consider a broad pancreatitis differential (don't just say "alcohol")
- Within 24 hours
  - Goal-directed LR
  - Avoid CTs unless diagnosis not known
- Nutrition
  - **AVOID TPN!**

Conclusions – Everything You Need to Know in Two Slides

- Fluid Collections
  - Wait as long as possible
  - IR or Endoscopy first – avoid surgery if possible

Thank you



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