



Acute Pancreatitis: What's New?

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Disclosure

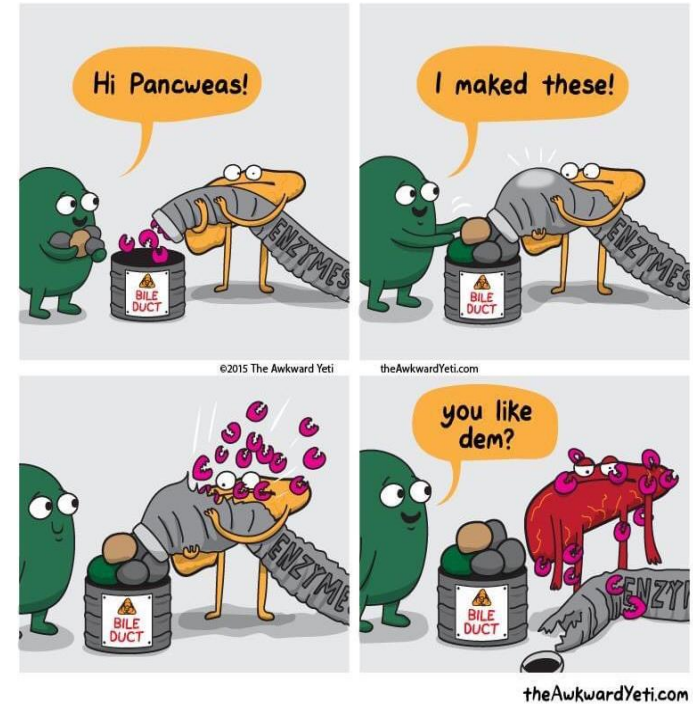
- I have nothing to disclose

Objectives

- At the conclusion of this activity, participants should be able to:
 1. Understand the role of non-operative management
 2. Address recent evidence-based practice changes in the management of complicated acute pancreatitis
 3. Understand the role of early versus delayed surgical intervention

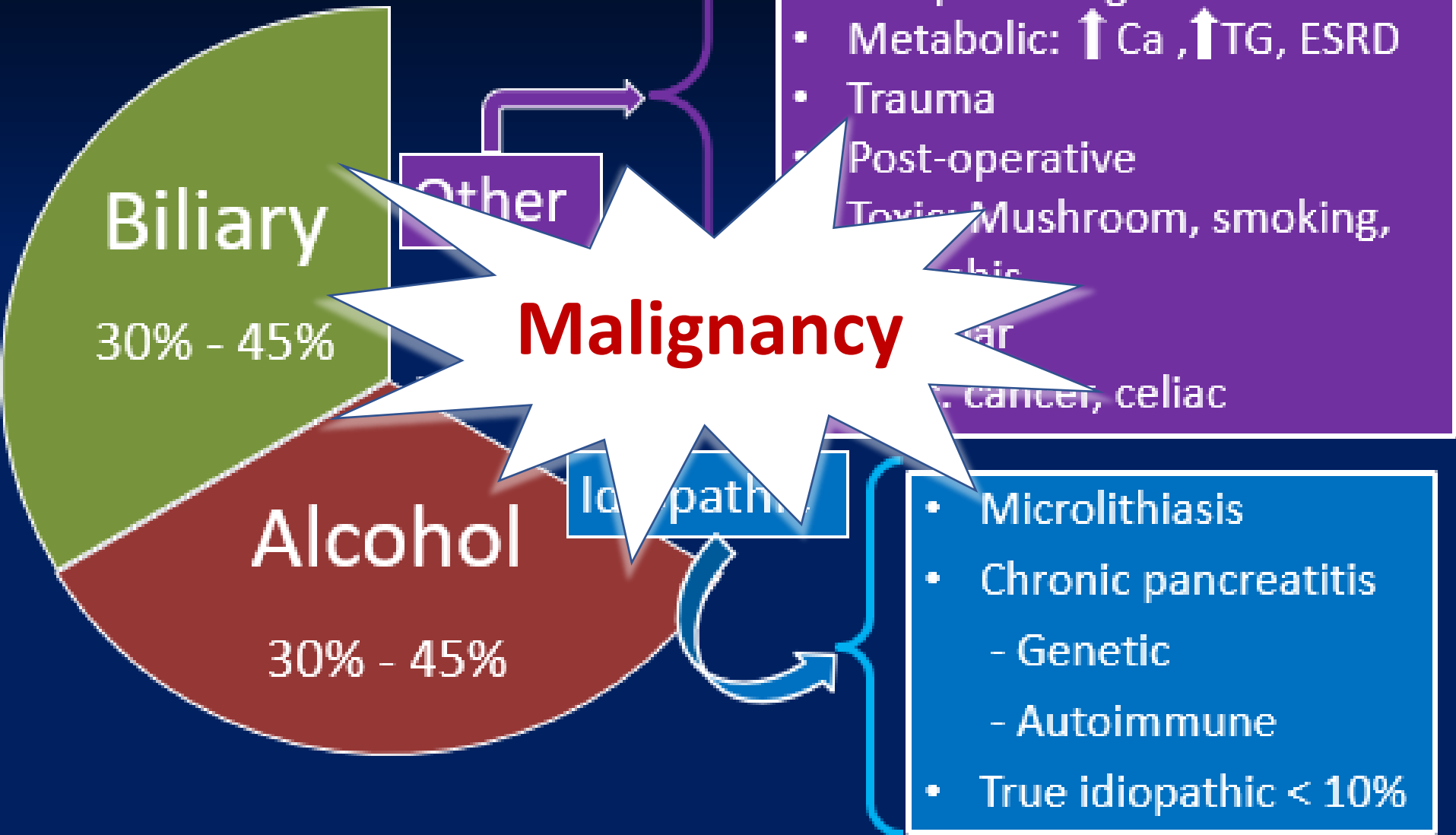
Why acute pancreatitis?

- One of the most common GI condition requiring acute hospital admission in U.S.
- Significant mortality (Severe: 10-30%)
- Studies show important areas of noncompliance with evidence-based recommendations (fluid, Abx, nutrition, etc.)



IAP/APA evidence-based guidelines for the management of acute pancreatitis. Pancreatology 2013

Etiologies of Acute Pancreatitis



Optimal Management of Acute Pancreatitis

- Assessment of Severity
- Fluid Resuscitation & Supportive Care
- Pain Control
- Antibiotics
- Nutrition
- Management of Local Complications
- Endoscopic Interventions
- Role of Surgery

Clinical Phases of Acute Pancreatitis

- **Phase 1:**

- Acute phase 1-4 weeks
- SIRS and organ failure

- **Phase 2:**

- Subacute phase 4-8 weeks
- Organ failure, infections, and local complications

- **Phase 3:**

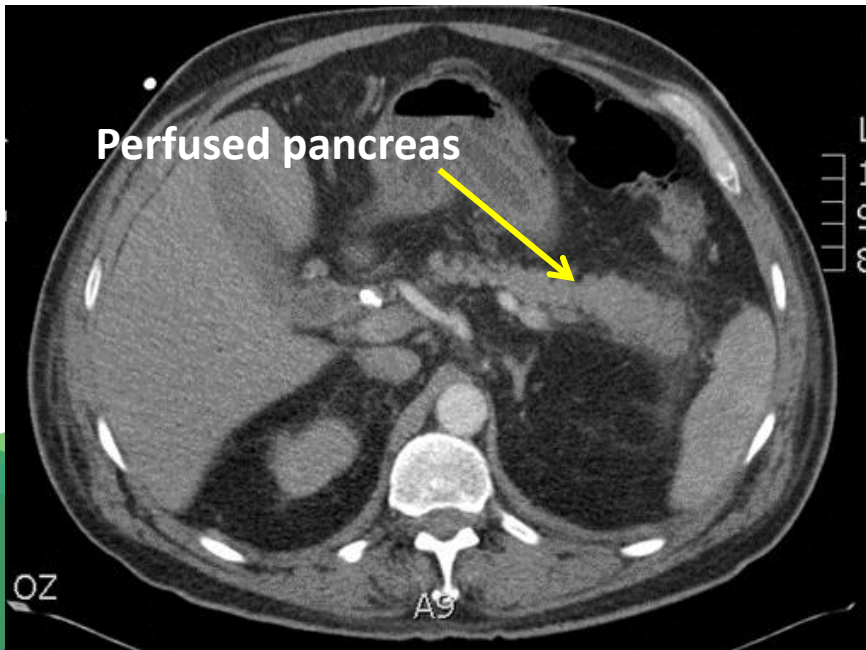
- Delayed phase
- Local complications

Important Definitions and Terminology

Interstitial Pancreatitis (90%)



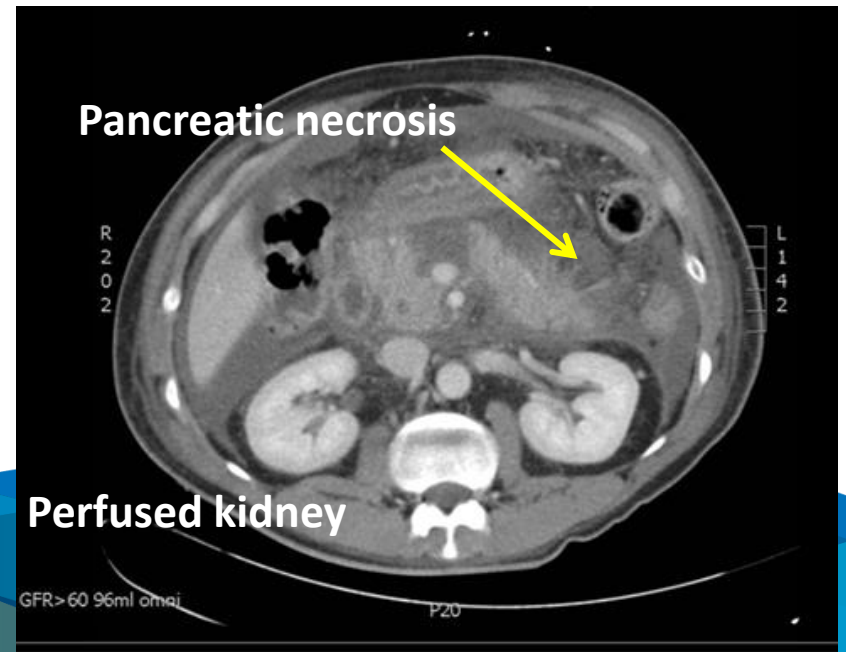
Pancreas & surrounding fat
(resolves in < 4 weeks)



Necrotizing Pancreatitis



Pancreatic/
peripancreatic
necrosis



Important Definitions and Terminology

Pancreatic/peripanc Fluid Collections

Interstitial Pancreatitis

<4 weeks

Acute
Peripancreatic
Fluid
Collection
(APFC)

>4 weeks

Pancreatic
Pseudocyst

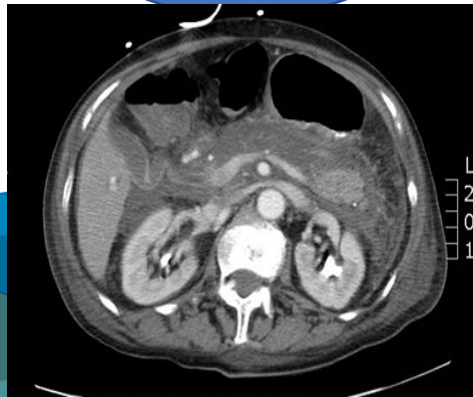
Necrotizing Pancreatitis

<4 weeks

Acute Necrotic
Collection
(ANC)

>4 weeks

Walled-off
Pancreatic
Necrosis
(WOPN)



Phase I

Qualitative Assessment of Severity

- Severity of the acute pancreatitis
 1. Mild
 2. Moderately severe
 3. Severe
- levels of severity are based on the presence and/or absence of persistent organ failure and local/systemic complications

Phase I

Qualitative Assessment of Severity (Atlanta Revision 2013)

Mild

- No organ failure
- No local complication
- **Mortality:** almost nil

Moderate

- Local complication, and/or
- Transient organ failure < 48 h
- **Mortality:** 2%

Severe

- Persistent organ failure > 48 h
- **Mortality:** up to 36-50%

Local complication: Acute peri-pancreatic fluid collection, Pseudocyst, Necrosis, Pleural effusion.

Organ Failure: Failure of respiratory, cardiac, renal or other (liver, hematology, neurology).

Phase I

Quantitative Assessment of Severity

- Ranson's criteria
- APACHE criteria
- Glasgow criteria
- Atlanta revision

Ranson (alcoholic or other)	Ranson (biliary)
At admission	At admission
Age > 55 y	Age > 70 y
GB > 16 000/mm ³	GB > 18 000/mm ³
LDH > 350 U/l	LDH > 250 U/l

CLASSIFICATION OF ACUTE PANCREATITIS

Atlanta* criteria (1992)

Mild acute pancreatitis (80% cases)

(Acute Interstitial/edematous pancreatitis)

- Acute Absence of organ failure
- Absence of

Severe acute

(Acute Hemorrhagic pancreatitis)

- Local comp
- Organ failure
 - SBP < 90
 - PaO₂ ≤ 60
 - GI bleed
 - Cret ≥ 2
- Ranson sco

*defined as a

Revised Atlanta criteria (2012)

• Mild acute pancreatitis

- Absence of organ failure
- Absence of local complications

APACHE II score = (acute physiology score)

1. Rectal temperature (°C)
2. Mean arterial pressure (mmHg)
3. Heart rate (bpm)
4. Respiratory rate (bpm)
5. Oxygen delivery (mL/min)
6. PO₂ mmHg
7. Arterial pH
8. Serum sodium (mmol/L)
9. Serum potassium (mmol/L)
10. Serum creatinine (mg/dL)
11. Hematocrit (%)
12. White cell count (10⁹/mL)
13. History of severe organ insufficiency

Note : Do Not include
" Serum Calcium conc."

APACHE II

- Acute Physiology and Chronic Health Evaluation
- as good as the Ranson or Glasgow at 24 and 48 hours of the admission
- APACHE II score > 8 = Severe acute pancreatitis
- Cumbersome to use if one does not use a pc or palm - where the formula is easily downloaded

BISAP Score

The Bedside Index of Severity in Acute Pancreatitis Wu et al: GUT 2008

BUN	<ul style="list-style-type: none">• BUN >25 mg/dL (8.9 mmol/L) (1 point)
Impaired mental status	<ul style="list-style-type: none">• Abnormal mental status with a Glasgow coma score <15 (1 point)
SIRS	<ul style="list-style-type: none">• Evidence of SIRS (systemic inflammatory response syndrome) (1 point)
Age	<ul style="list-style-type: none">• age >60 years old (1 point)
Pleural effusion	<ul style="list-style-type: none">• Imaging study reveals pleural effusion (1 point)

0-2 Points: Lower mortality (<2 percent)

3-5 Points: Higher mortality (>15 percent)

Phase I

Assessment of Severity

- Mild acute pancreatitis has expected complete recovery within 1 week with $< 1\%$ mortality
- Severe pancreatitis had mortality of 10-30%
- Assessment of the severity of the attack is important for:
 1. Predicting the course of the disease
 2. Allocating resources and multidisciplinary care for these patients
 3. Determining the need for transfer to higher level care early in the disease process.

Management: Phase I

Aggressive IV resuscitation

- The most important intervention in the first 6-24 hours
- The intervention most likely to improve outcome
- 250-500 ml/hr (5-10 ml/kg/hr) of isolated crystalloid solution.
- Goal is to decrease BUN and increase pancreatic perfusion.
- May not be beneficial after 24-48 hours
- Lactated Ringer's is the preferred solution (HCO_3 , Stable pH), may reduces SIRS.
- $\uparrow\text{Ca} \rightarrow \text{NS}$
- Monitor vitals and urine output

Trikudanathan et al. Current controversies in fluid resuscitation in acute pancreatitis: a systematic review. Pancreas. 2012

Management: Phase I

Supportive Care

- Hypotension: vasopressors
- AKI: CVVHD
- Hypoxia, ARDS: ventilation support
- Pain control:
 - PCA: Fentanyl (esp. AKI) or Hydromorphone, avoid Morphine
 - Thoracic epidural can be considered
 - Gabapentin
 - IV NSAID if renal fx allows

Management: Phase I

Antibiotics

- **Not recommended:** Routine use of prophylactic antibiotics in acute pancreatitis (including severe necrotizing pancreatitis)
- ↑C. diff infection → ↑ morbidity
- Indications for antibiotics:
 - Infected necrosis, proven either on CT scan or percutaneous/intraop cultures
 - Cholangitis
 - Bacteremia
 - UTI
 - Pneumonia
- Carbapenems are preferred for infected pancreatic necrosis

Management: Phase I Antibiotics

THE LANCET
Gastroenterology & Hepatology

NHS
Manchester University
NHS Foundation Trust

A procalcitonin-based algorithm to guide antibiotic use in patients with acute pancreatitis (PROCAP): a single-centre, patient-blinded, randomised controlled trial

Ajith K Siriwardena, Santhalingam Jegatheeswaran, James M Mason, on behalf of the PROCAP investigators

Design: single-centre, patient-blinded, randomised controlled trial

Patients with acute pancreatitis ≥ 18 years old

132

128

PROCALCITONIN-GUIDED
Procalcitonin testing was conducted on days 0, 4, 7, and weekly thereafter

< 1 ng/ml: stop or not start antibiotics
 ≥ 1 ng/ml: start or continue antibiotics

PHYSICIAN-GUIDED (usual care)

45% Antibiotic prescription 63%

Similar number of infections

Similar mortality and adverse events

Procalcitonin-guided care can reduce antibiotic use without increasing infection or harm

Management: Phase I Nutrition

- Early enteral feeding:
 - Maintains gut integrity and immune system
 - Prevents bacterial and endotoxin translocation
 - Facilitates gut motility
- Prolonged parenteral feeding:
 - Worsens hypomotility of the gut
 - Causes atrophy and increased permeability of the gut mucosa
 - Induces significant changes in the intestinal microflora
 - Promotes cholestasis
 - Is associated with line-related complications



Petrov et al. Enteral nutrition and the risk of mortality and infectious complications in patients with severe acute pancreatitis: a meta-analysis of randomized trials. Arch Surg 2008

Management: Phase I

Nutrition

- Early enteral feeding has:
 1. ↓ hospital stay
 2. ↓ infectious complications
 3. ↓ morbidity
 4. ↓ mortality
- Early enteral nutrition within 72 hours of hospital admission after adequate resuscitation is recommended
- PYTHON trial: no difference between 24 hr vs. 72hr feeding
- Oral feeding is preferred but no difference in nasogastric vs nasojejunal feeding

Eckerwall et al. Immediate oral feeding in patients with acute pancreatitis is safe and may accelerate recovery- a randomized clinical study . Clin Nutr 2007

Bakker et al. Early versus On-Demand Nasoenteric Tube Feeding in Acute Pancreatitis. N Engl J Med 2014 ₂₀

Management: Phase I

Local Complications

- **Acute fluid collection/necrosis:**
 - Wait as much as you can if no infection – most of the time resolves
 - <10% convert to pseudocysts or WOPN (phase 2/3)
- **Abdominal compartment syndrome:**
 - Dialysis, luminal decompression, neuromuscular blockade
 - Role of decompression laparotomy – last resort and rarely needed
 - Should not be a reason to prophylactically defer aggressive resuscitation



Management: Phase I

Local Complications

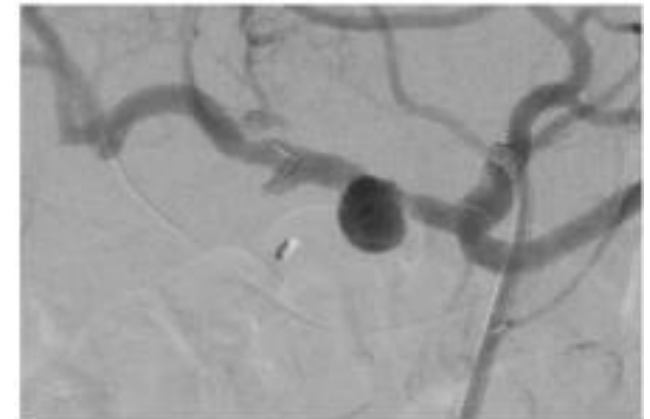
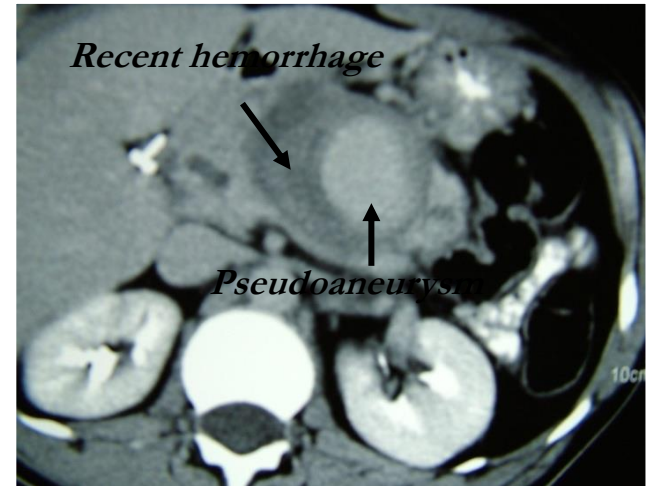
- **Pancreato-enteric Fistula:**
 - Gas or contrast extravasation on CT scan
 - Surgery if sepsis or infected pancreatic ascites
- **Splanchnic venous thrombosis:**
 - Most common vascular complication
 - Splenic vein thrombosis is the most common
 - No need for anticoagulation unless extending into the PV or SMV causing liver injury or bowel ischemia



Management: Phase I

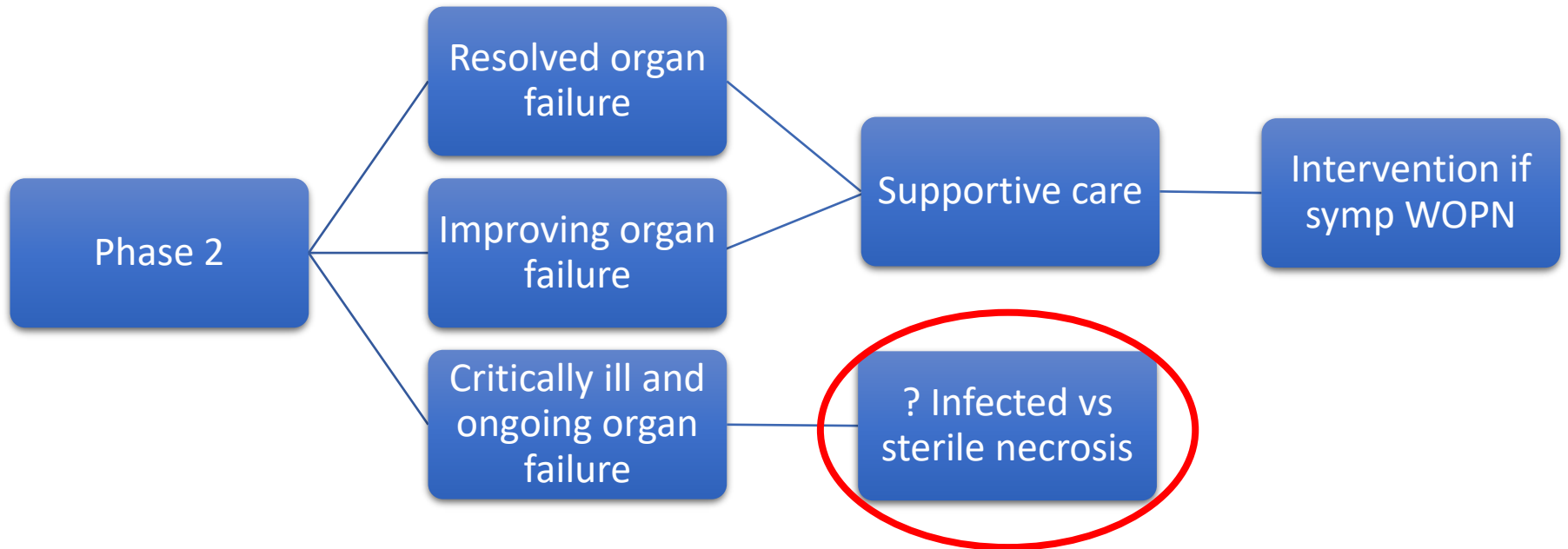
Local Complications

- **Hemorrhage: (emergency)**
- Pseudoaneurysms are a rare but serious complication
- Suspect when unexplained GI bleeding, an unexplained drop in hematocrit, or sudden expansion of a pancreatic fluid collection
- CTA
- The main arteries affected are the splenic, gastroduodenal & pancreatoduodenal
- IR angioembolization/stent placement
- Surgery does not help, fragile vessels



Management: Phase 2

Local Complications



Management: Phase 2

Local Complications

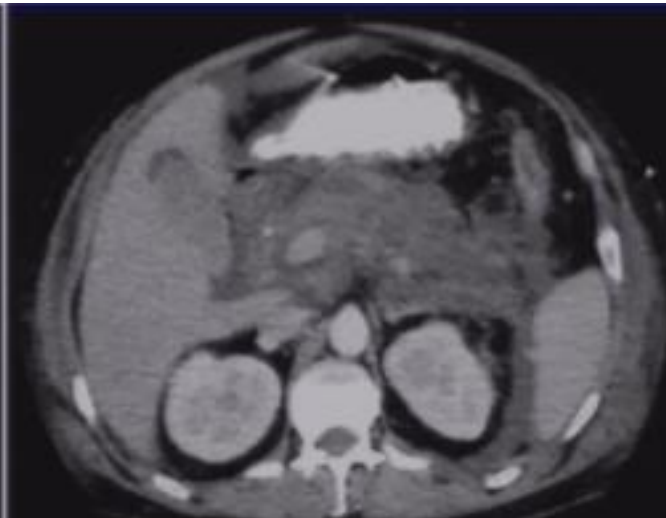
- **Infected Severe Necrotizing Pancreatitis:**
- Presence of gas in the fluid collection on contrast-enhanced CT
- ~~Positive culture of pancreatic or peripancreatic necrotic tissue~~
- Secondary event after instrumentation (increased mortality and morbidity)
- Suspected infected necrosis if persistent sepsis or progressive clinical deterioration despite maximal support
- Start antibiotics: Meropenem +/- antifungals
- Use Procalcitonin

Management: Phase 2

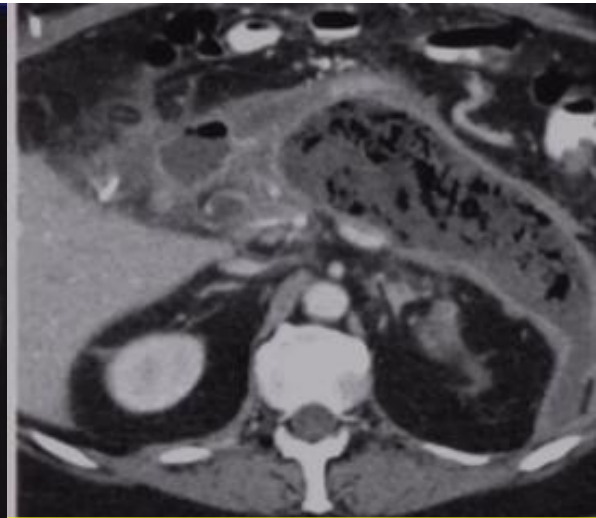
Local Complications



Day 1
Interstitial pancreatitis



Day 3
Necrotizing pancreatitis



About ≥ 7 days
Infected necrosis

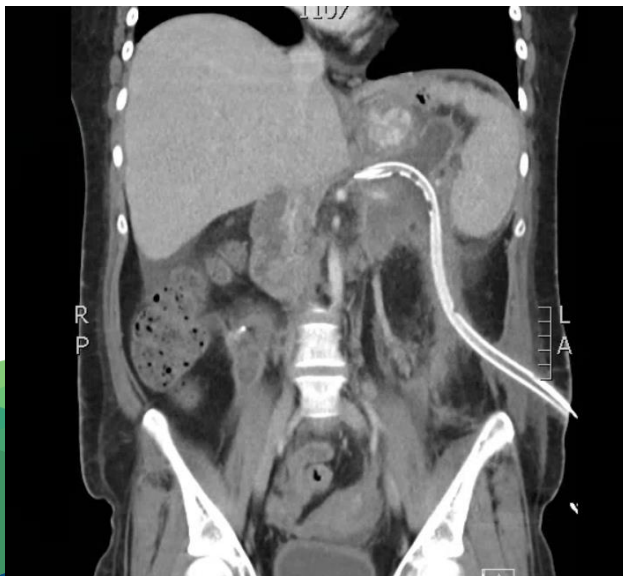


- Clinical deterioration
- Gas in collection

Management: Phase 2

Management of Infected Necrotizing Pancreatitis

- Multi-disciplinary team approach
- **Step-up percutaneous imaging-guided drainage:**
 - Require adequate and safe radiographic window
 - Needs multiple upsizing and exchanging, adequate in 35%
 - Can be followed by minimal invasive surgical debridement through drain track (VARD)



van Santvoort et al. A step-up approach or open necrosectomy for necrotizing pancreatitis. N Engl J Med. 2010

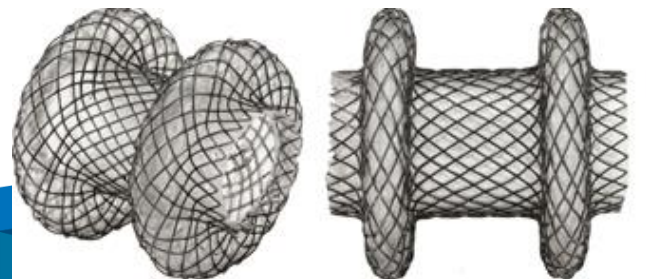
Management: Phase 2

Management of Infected Necrotizing Pancreatitis

- **Endoscopic drainage:**
- EUS-guided transduodenal or transgastric drainage
- A plastic stents or Lumen-apposing metal stents (LAMS) or both are placed
- Necrosectomy can be performed through LAMS, but requires multiple endoscopic interventions
- Surgical necrosectomy is needed in 12% of patients

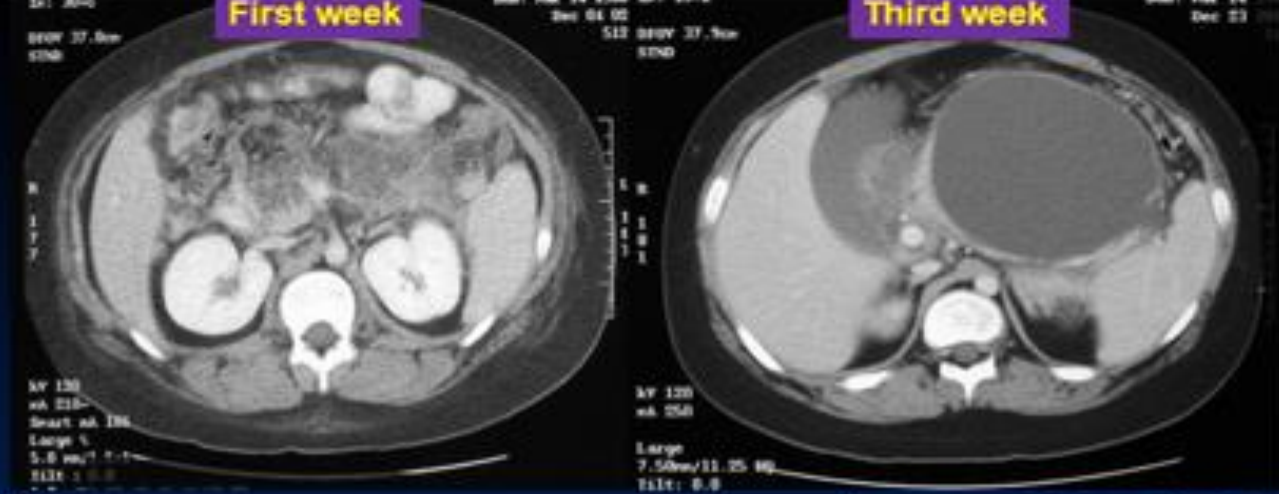


LAMS



EUS-guided transgastric drainage with necrosectomy through a LAMS





8 weeks later



Management: Phase 2

Management of Infected Necrotizing Pancreatitis

- **Surgical necrosectomy:**

- Progressive MOF despite apparently adequate drainage
- Inadequate drainage - multi-field necrosis or high-volume of solid necrosis, particularly in biliary pancreatitis
- Gastric wall varices precluding endoscopic necrosectomy
- No radiological window for step-up approach
- Infected pancreatic ascites - peritonitis
- Concern for other missed pathology - specifically ischemic bowel or bowel perforation

Case 1:

Protracted course

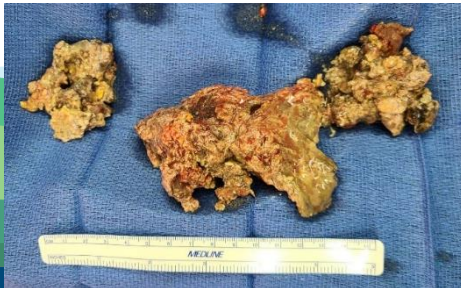
- 37 yo M with hairy cell ALL summer of 2020 s/p chemotherapy awaiting BMT
- Presented with nec panc failed endoscopic cystgastrostomy and step-up approach c/b colonic fistula treated with endoscopic clipping
- 08/2021: pancreatic necrosectomy, cholecystectomy, J tube placement
- Three months later: good recovery and relisted for BMT



Case 2:

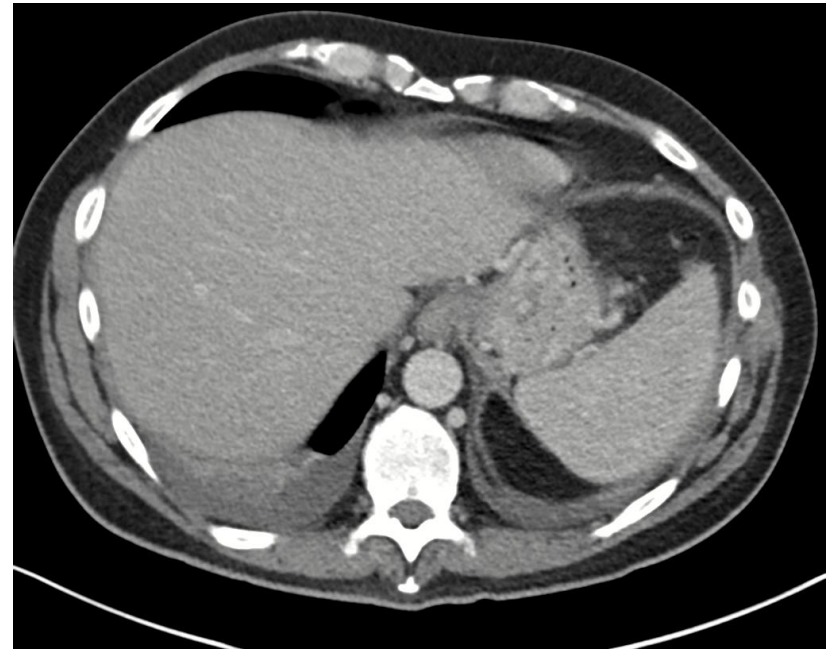
Pancreatic Ascites and Peritonitis

- 48 yo M lawyer with biliary colic s/p chole followed by ERCP x2 in Nov 2021 c/b pancreatitis at OSH
- Discharged home → nec panc
- Admitted for non-op management/step-up approach
- 2 days later: acidotic, peritoneal
- CT scan with pancreatic ascites
- OR: pancreatic necrosectomy



Case 2: Pancreatic Ascites and Peritonitis

- 6 weeks later
- Drains removed

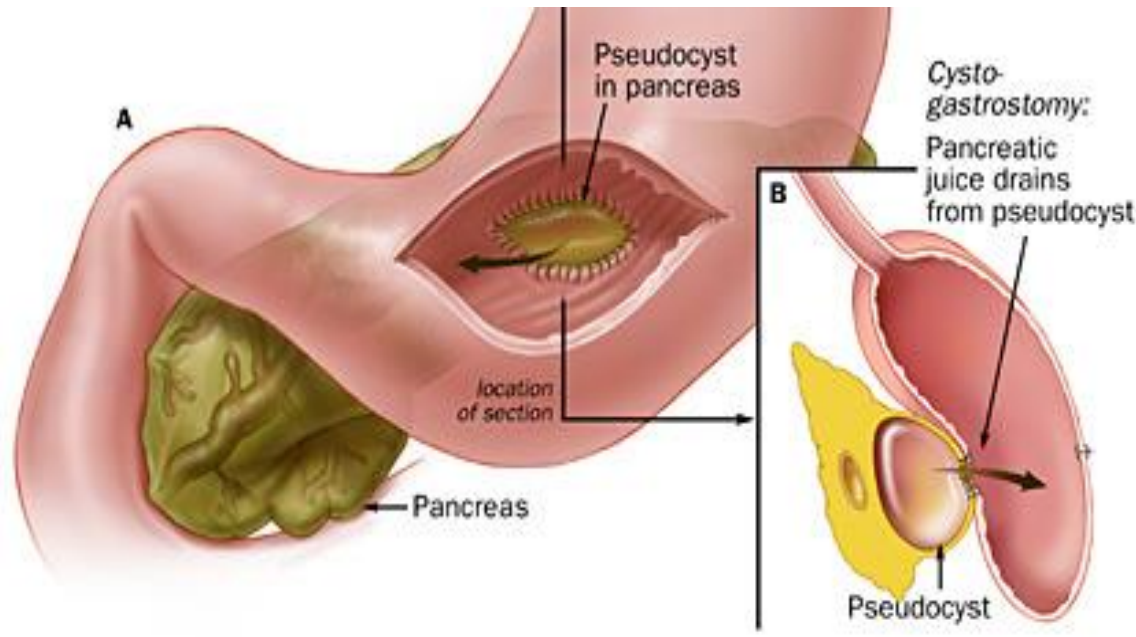


Management: Phase 3

Management of Pseudocyst or WOPN

- **Surgical Cystgastrostomy:**

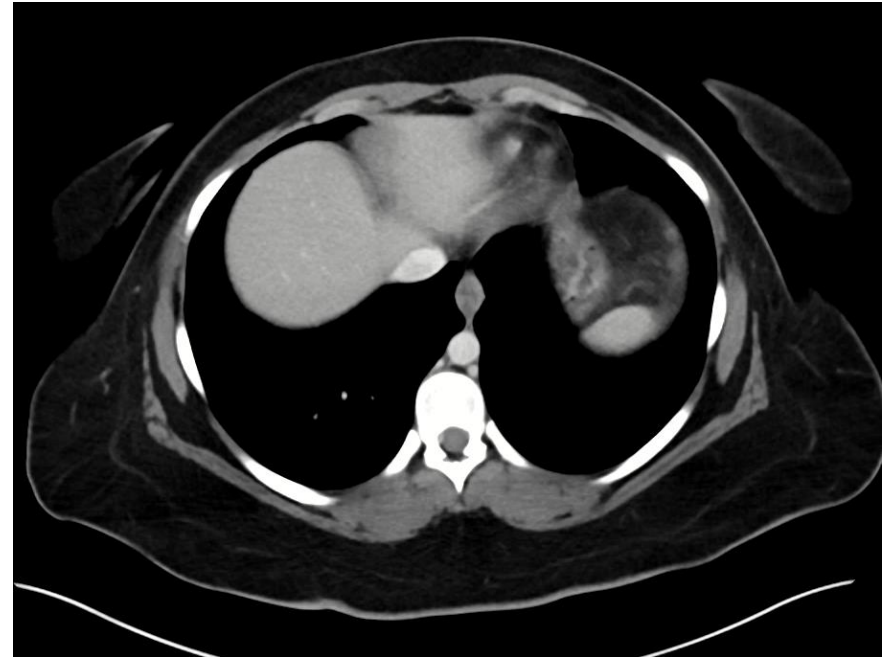
- Persistent walled-off collections despite multiple endoscopic/percutaneous drainage
- Has higher patency rate, open>robotic

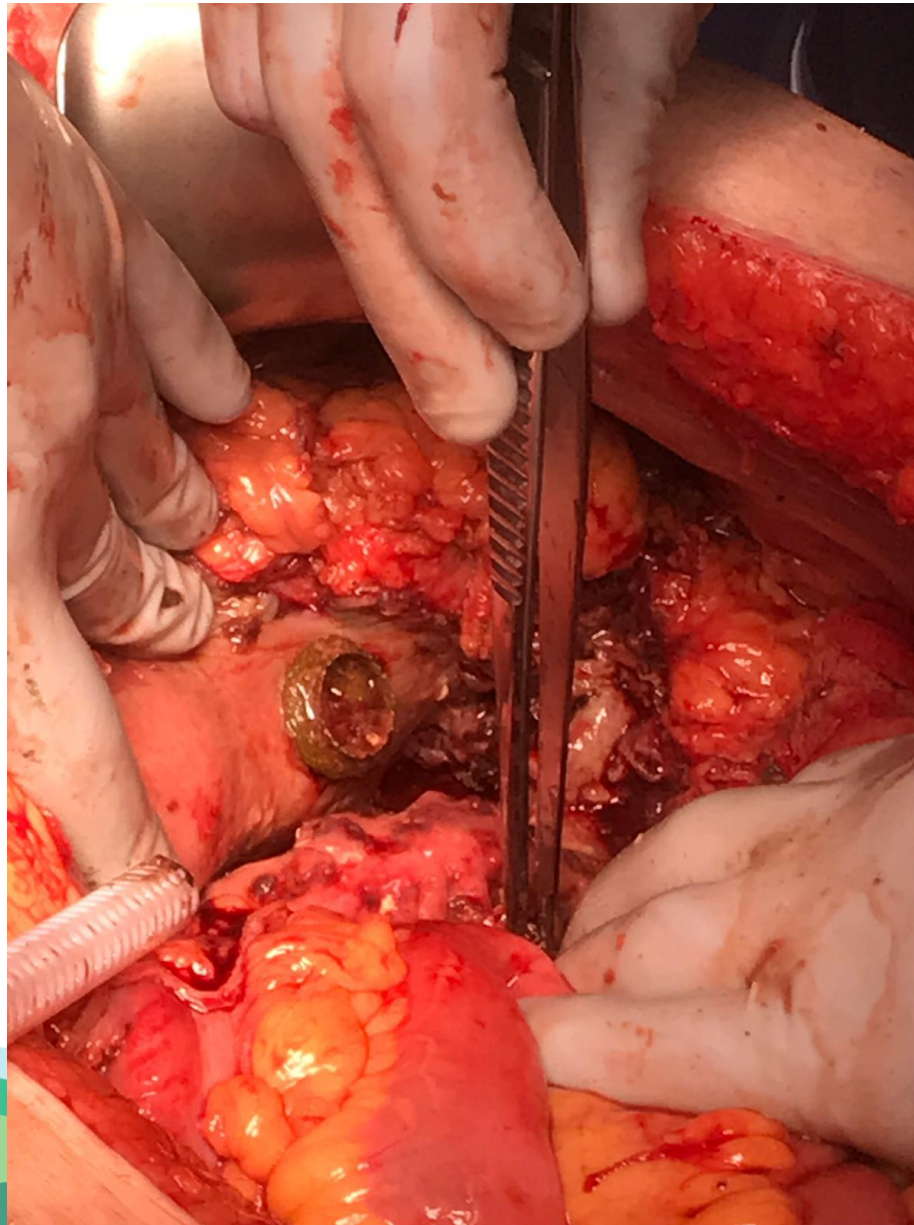


Case

Surgical Cystgastrostomy after failed endoscopy

- 22 yo F with biliary nec panc
- WOPN failed endoscopic cystgastrostomy
- 11x7 cm WOPN
- PO intolerance
- Aspiration pneumonia
- 2/2022: surgical cystgastrostomy and chole





Case

Surgical Cystgastrostomy after failed endoscopy

- Postop CT scan
- Resolution of WOPN



Management: Phase 3

Local Complications

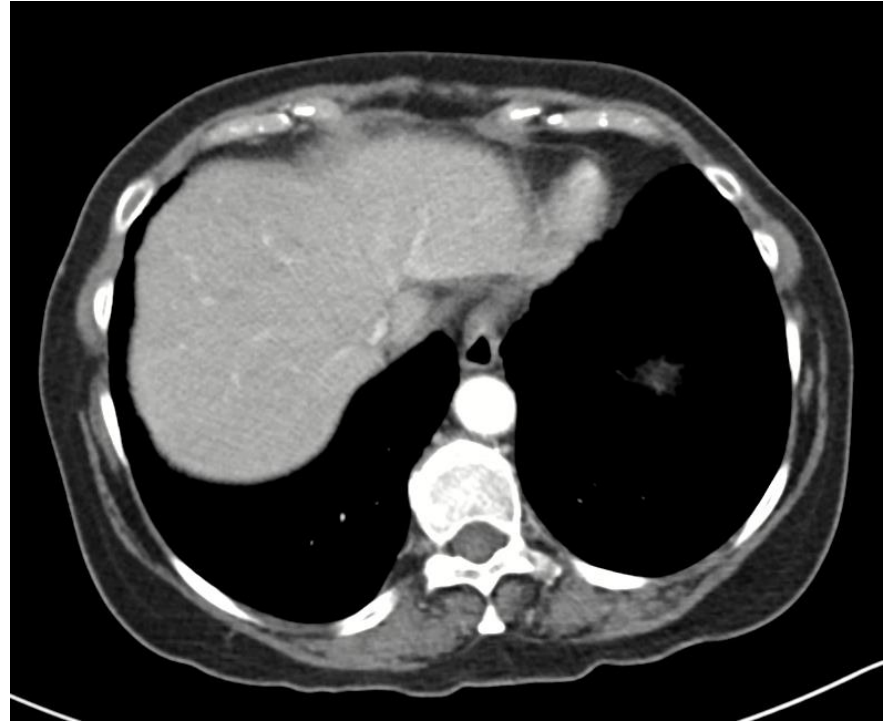
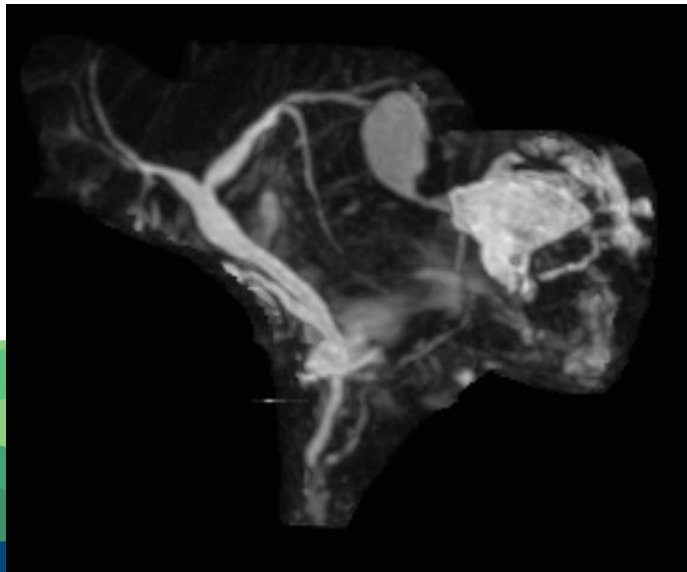
- **Disconnected Duct Syndrome:**
- Following necrotizing pancreatitis >8 weeks
- Transection of the pancreatic duct with persistent symptoms
- Evaluate splenic vein and portal vein
- Consideration of ERCP and pancreatic sphincterotomy +/- pancreatic stenting but 2/3 eventually requires operation
- For distal PD transection: distal pancreatectomy with splenectomy
- If severe varices from sinistral portal hypertension → preop splenic artery embolization



Case 1:

Disconnected Duct with Recurrent Attacks

- 64 yo F
- Idiopathic recurrent pancreatitis
- Proximal disconnected PD
- 08/2021: distal pancreatectomy, splenectomy, chole



Case 2:

Severe Sinistral portal HTN and varices

- 36 yo M, ETOH
- Recurrent pancreatitis
- SV thrombosis
- Severe variceal disease, multiple EGDs
- PO intolerance, severe pain
- 07/2022: SA embo followed by distal pancreatectomy and splenectomy, modified Sugiura procedure



Management: Phase 3

Local Complications

- **Gastric Outlet Obstruction:**
 - Long-term complication despite adequate drainage
 - ?duodenal stricture, r/o malignancy
 - If persistent → gastrojejunostomy
- **Biliary Stricture:**
 - Risk factors: pancreatic head necrosis, splanchnic vein thrombosis
 - Fails endoscopic treatment in 17%
 - Operative intervention in 20%, especially after 6 months

Cholecystectomy after Biliary Pancreatitis

- Cholecystectomy:
 - During surgical necrosectomy
 - After recovery
 - During same admission for mild pancreatitis
 - After inflammation resolves in necrotizing pancreatitis
- Delay of cholecystectomy is associated with 30% risk of recurrent pancreatitis, cholecystitis, or cholangitis within 6-18 weeks

Take Home Points

- Aggressive IV Fluids: Early (24-48 hrs), LR vs. NS, Rate (5-10 ml/kg/hr)
- Pain control: Avoid Morphine
- Antibiotics: for sepsis, NO PROPHYLAXIS
- Nutrition: early, oral or enteral feeding (NJ=NG), ? TPN
- Biliary pancreatitis:
 - Urgent ERCP for cholangitis
 - Lap chole for stones & sludge during same admission
- Treatment of local complication:
 - IR embolization for hemorrhage (fatal)
 - Infected necrosis: the longer you can wait before OR the better
 1. Step-up approach is preferred
 2. Endoscopic drainage can be performed alone or combined with IR
 3. Surgical necrosectomy is indicated in severe non-responsive disease

Take Home Points

- Early care by multidisciplinary team improves outcomes in severe acute pancreatitis
- Collaboration between:
 - Gastroenterology
 - Interventional radiology
 - Nutrition
 - Infectious disease
 - Endocrinology
 - Intensive Care Unit
 - HPB Surgery



Typical Characteristics	IPMN	MCN	SC	PSEUDO **	SPN	LEC	cNET	cPDAC
Age Group	Elderly	Middle	Middle-Elderly	Any	Young	Elderly	Middle-Elderly	Elderly
Gender	70% male	95% female	>50% female	>50% male	80%-90% female	80% male	50% each	>50% male
History	Asx; Pain; +/- Jaundice	Asx; Pain; Nausea	Asx; VHL	Pancreatitis **	Asx; Pain; Nausea	Asx	Asx; FxnI; MEN	Asx; Pain; +/- Jaundice
Location in Pancreas	Head in 70%; Multi-focal	Body/Tail in 95%	Anywhere	Anywhere	Anywhere	Peripheral	Anywhere	Anywhere
Shape	Ovoid	Spherical	Ovoid	Spherical	Ovoid	Ovoid	Spherical	Variable
Locularity	Any	Uni or Oligo	Oligo or Multi	Uni	Oligo or Multi	Uni or Oligo	Uni	Any
Duct Communication	Common	No	No	Common	No	No	No	Some
Calcification	No	No	Central sunburst	No	Some	No	Some	No
Cyst Fluid Appearance	Viscous, clear, muc	Viscous, clear, muc	Thin, clear, nonmuc	Opaque, bloody/ Necrotic debris	Opaque, bloody/ Necrotic debris	Nonmuc, pasty, debris	Nonmuc	Thin
High CEA/Mucin*	+	+	-	-	-	-	-	+/-
High Ca 19-9	+/-	+/-	-	+	-	-	-	+/-
Amylase	+	-	-	+	-	-	-	+/-



Q&A Thank you

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