

# Diseases of the Pancreas

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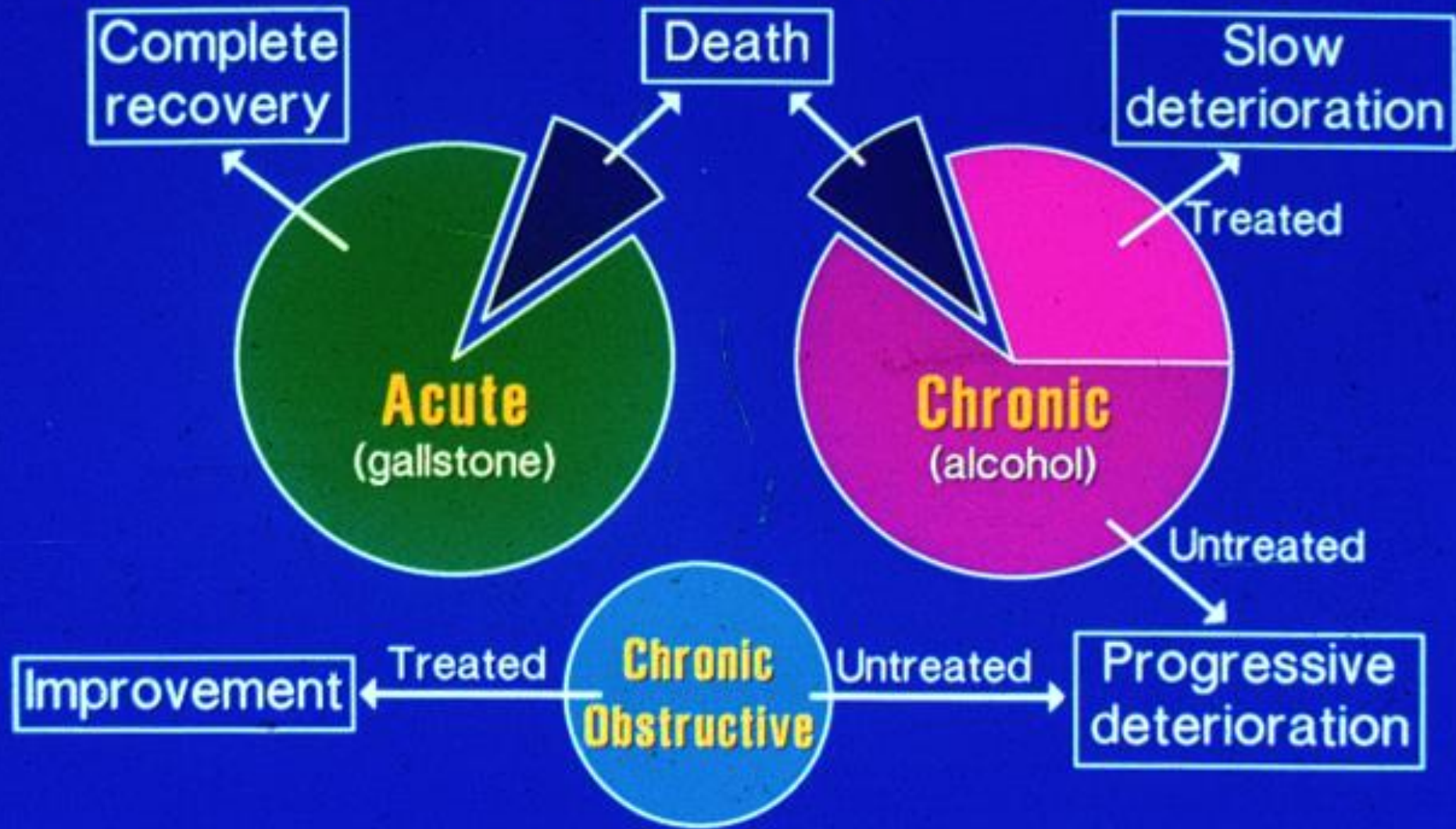


I have no disclosures

I work for the Curators of the University of  
Missouri



# Pancreatitis



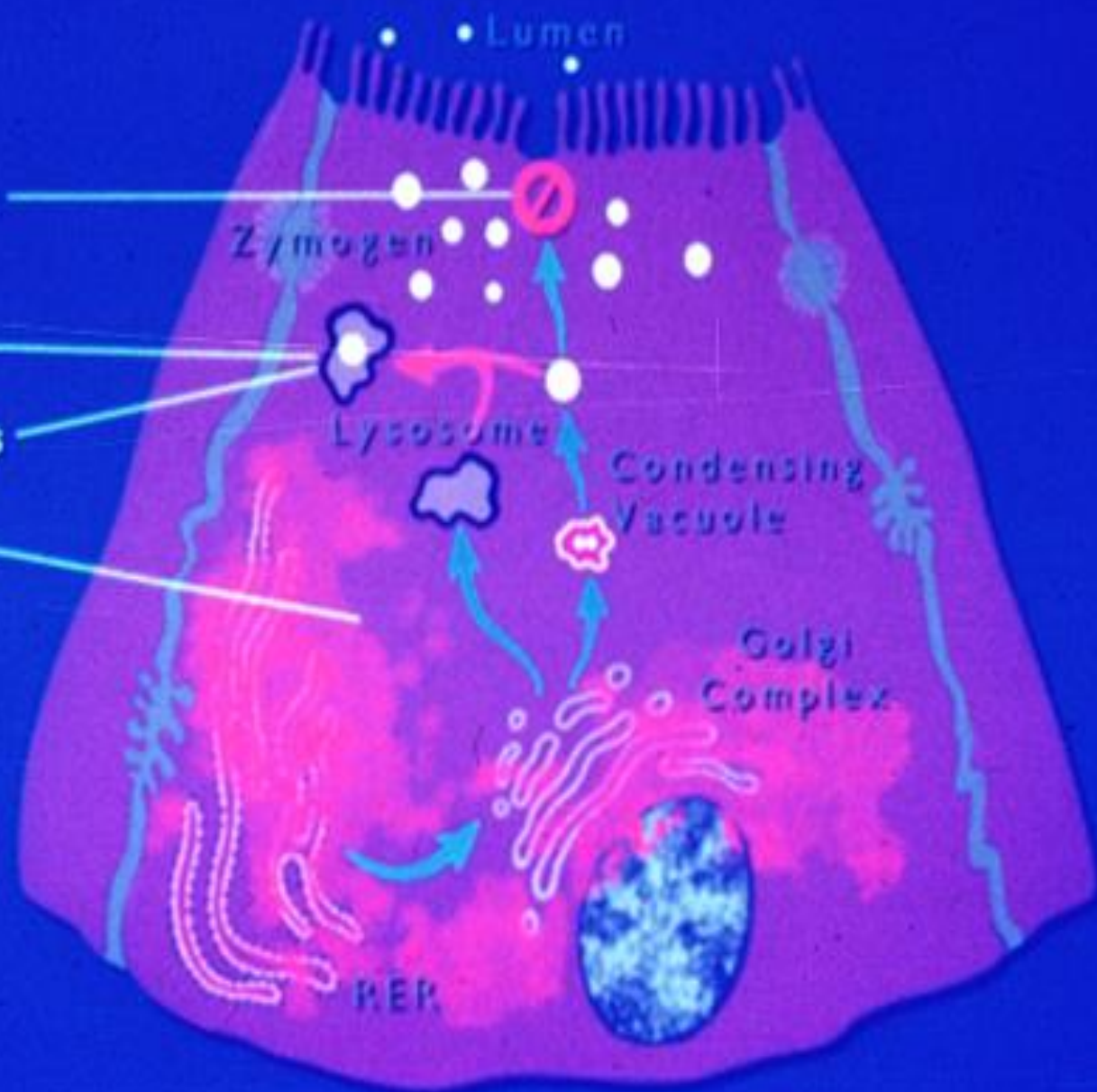
# Enzyme Synthesis





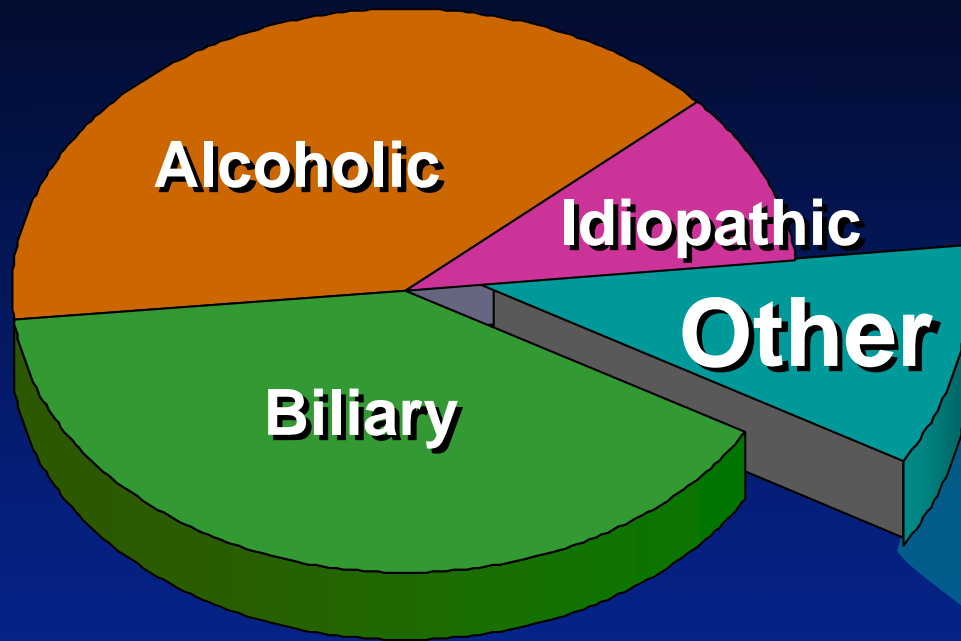
# Intracellular Injury

- Blockage of secretion
- Fusion of lysosomes and zymogens
- Activation of enzymes
- Intracellular injury



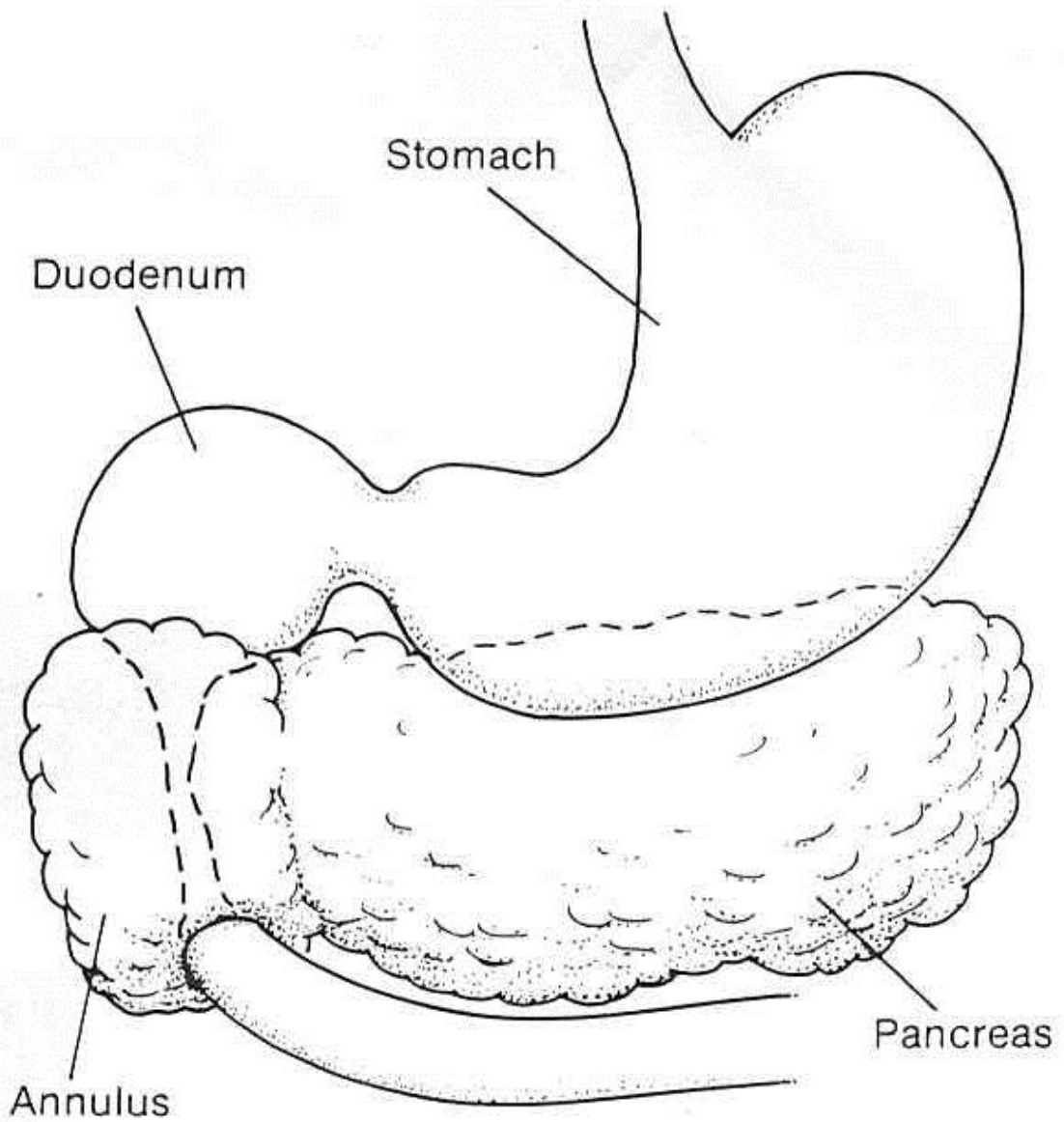
## Acute Pancreatitis

# Etiologies



- Autoimmune
- Drug-induced
- Iatrogenic
- IBD-related
- Infectious
- Inherited
- Metabolic
- Neoplastic
- Structural
- Toxic
- Traumatic
- Vascular





## **Modified Biliary Classification**

**A = Elevated liver tests on 1 or more occasions**

**B = Dilated Common Bile Duct**

**Biliary Type I – A+B**

**Biliary Type II – A or B**

**Biliary Type III – Pain only**



## Acute Pancreatitis

# Drug Induced Pancreatitis Sorted by Incidence

### Common

asparaginase

azathioprine

6-mercaptopurine

didanosine (DDI)

pentamidine

valproate

### Uncommon

ACE inhibitors

acetaminophen

5-amino ASA

furosemide

sulfasalazine

thiazides

### Rare

carbamazepine

corticosteroids

estrogens

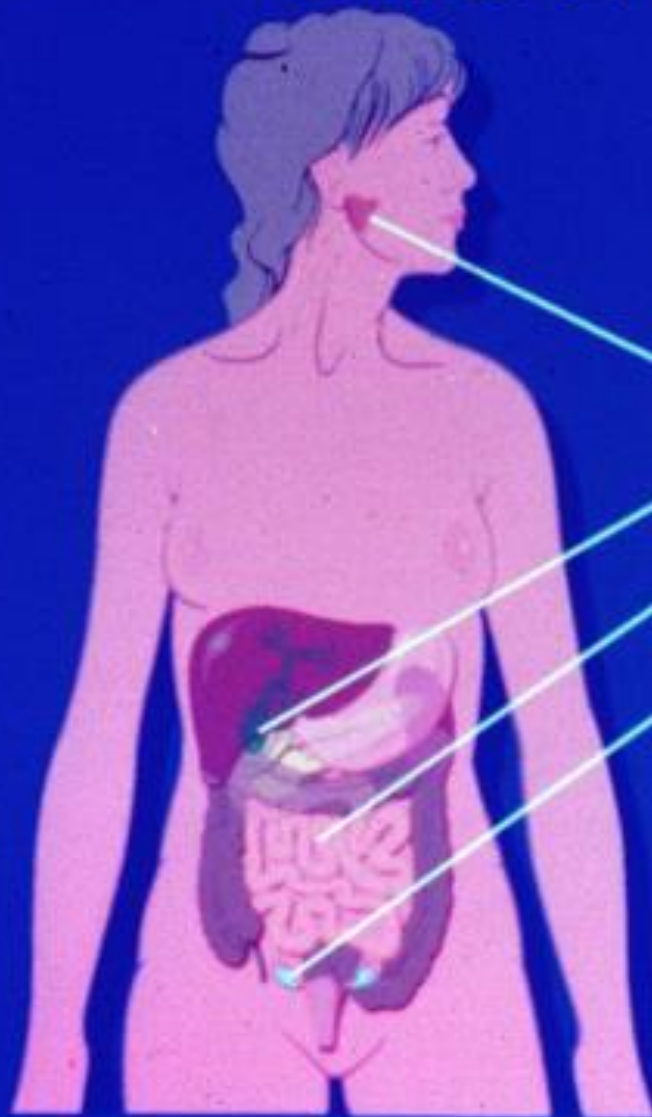
minocycline

nitrofurantoin

tetracycline



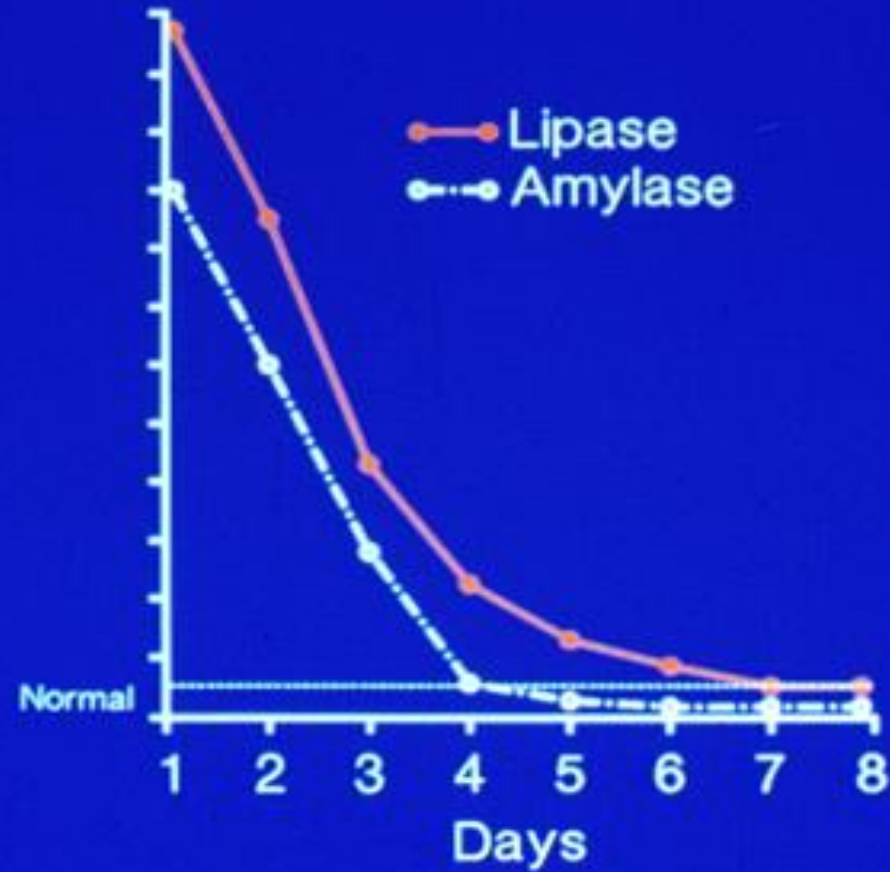
## Causes of Increased Serum Enzymes



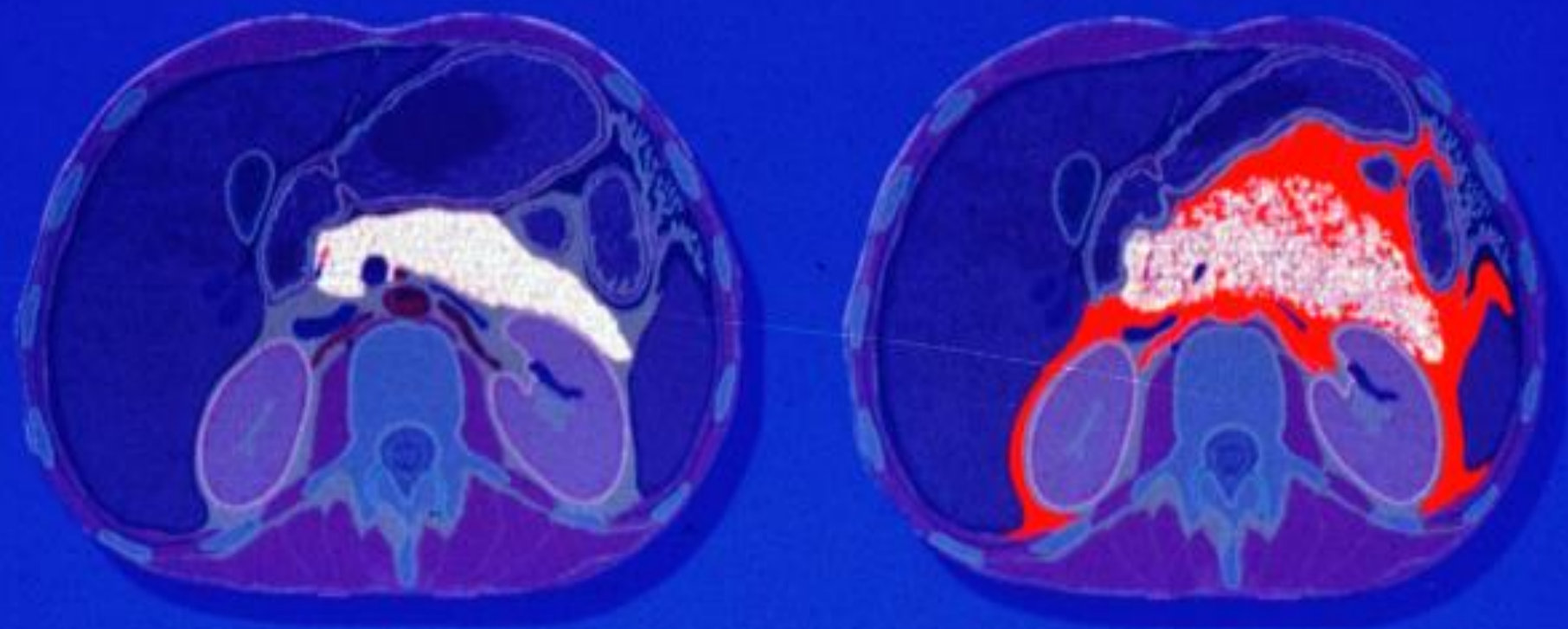
	Amylase	Lipase
Pancreatitis	↑	↑
Parotitis	↑	Normal
Biliary stone	↑	↑
Intestinal injury	↑	↑
Tubo-ovarian disease	↑	Normal
Renal failure	↑	↑
Macroamylasemia	↑	Normal

**ACUTE PANCREATITIS**

# Time Course of Serum Enzymes



## Local Effects of Enzymes



- Inflammation
- Third space losses
- Fat necrosis
- Pancreatic and peripancreatic necrosis



## Danger Signals: First Few Hours



- Encephalopathy
- Hypoxemia
- Tachycardia  $>130/\text{min}$
- Hypotension  $<90 \text{ mmHg}$
- Hct  $>50$
- Oliguria  $<50 \text{ ml/hr}$
- Azotemia





**Figure 1.**  
(A) Periumbilical ecchymosis (Cullen sign) and  
(B) flank ecchymosis (Grey Turner sign). Published  
with permission from Chung and Chuang.<sup>1</sup>

**ACUTE PANCREATITIS**

**Grey-Turner Sign**





## Ranson's Criteria of Severity

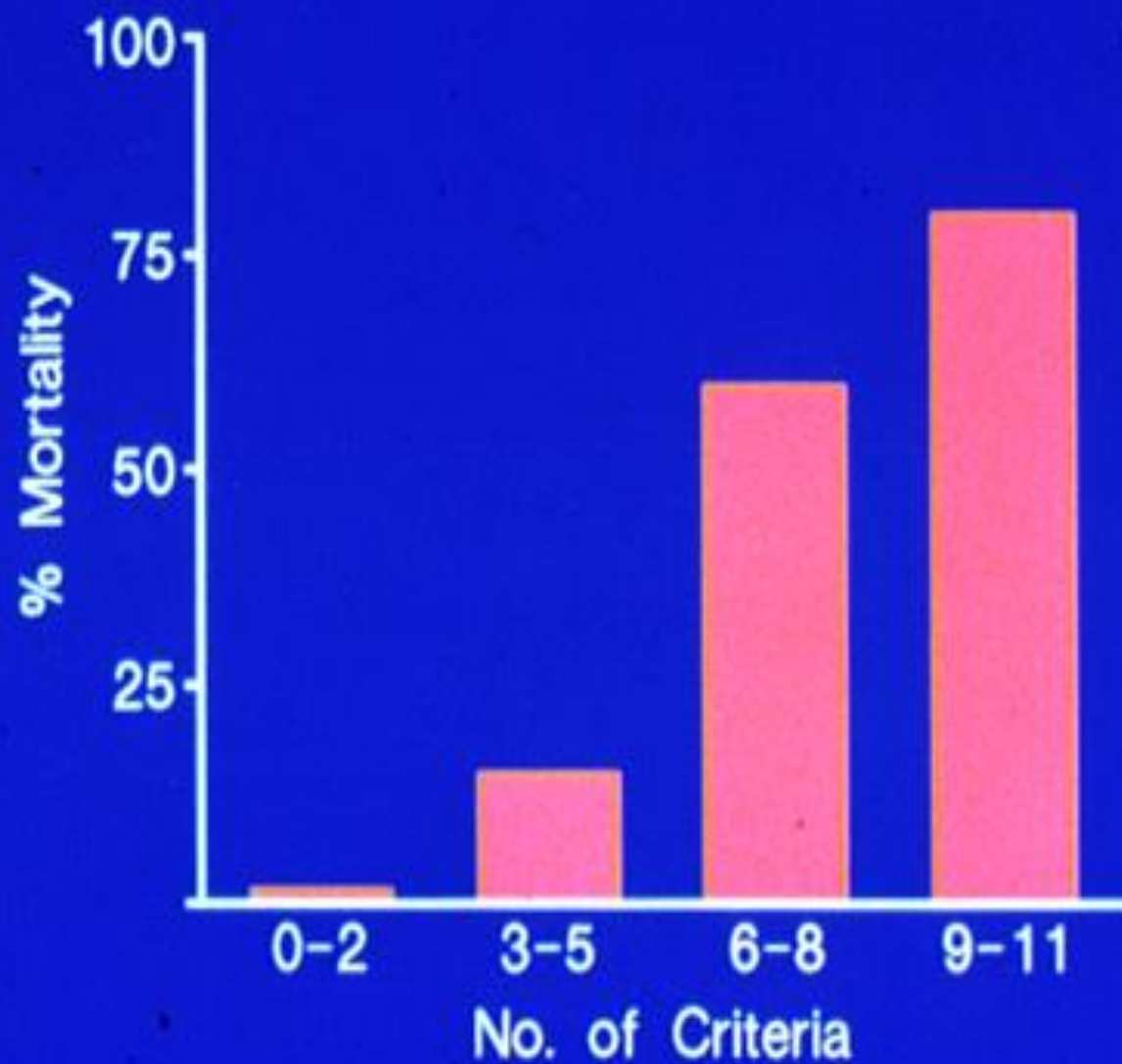
### At admission

- Age  $>55$  years
- WBC  $>16,000/\text{mm}^3$
- Glucose  $>200$  mg/dl
- LDH  $>350$  IU/L
- AST  $>250$  U/L

### During initial 48 hours

- Hct decrease of  $>10$
- BUN increase of  $>5$  mg/dl
- $\text{Ca}^{++}$   $<8$  mg/dl
- $\text{PaO}_2$   $<60$  mm Hg
- Base deficit  $>4$  mEq/L
- Fluid sequestration  $>6$  L

## Mortality Related to Ranson's Criteria



# Treatment

## Supportive care

- **Aggressive fluid and electrolyte replacement**
- **Monitoring**
  - Vital signs
  - Urine output
  - O<sub>2</sub> saturation
  - Pain
- **Analgesia, anti-emetics**

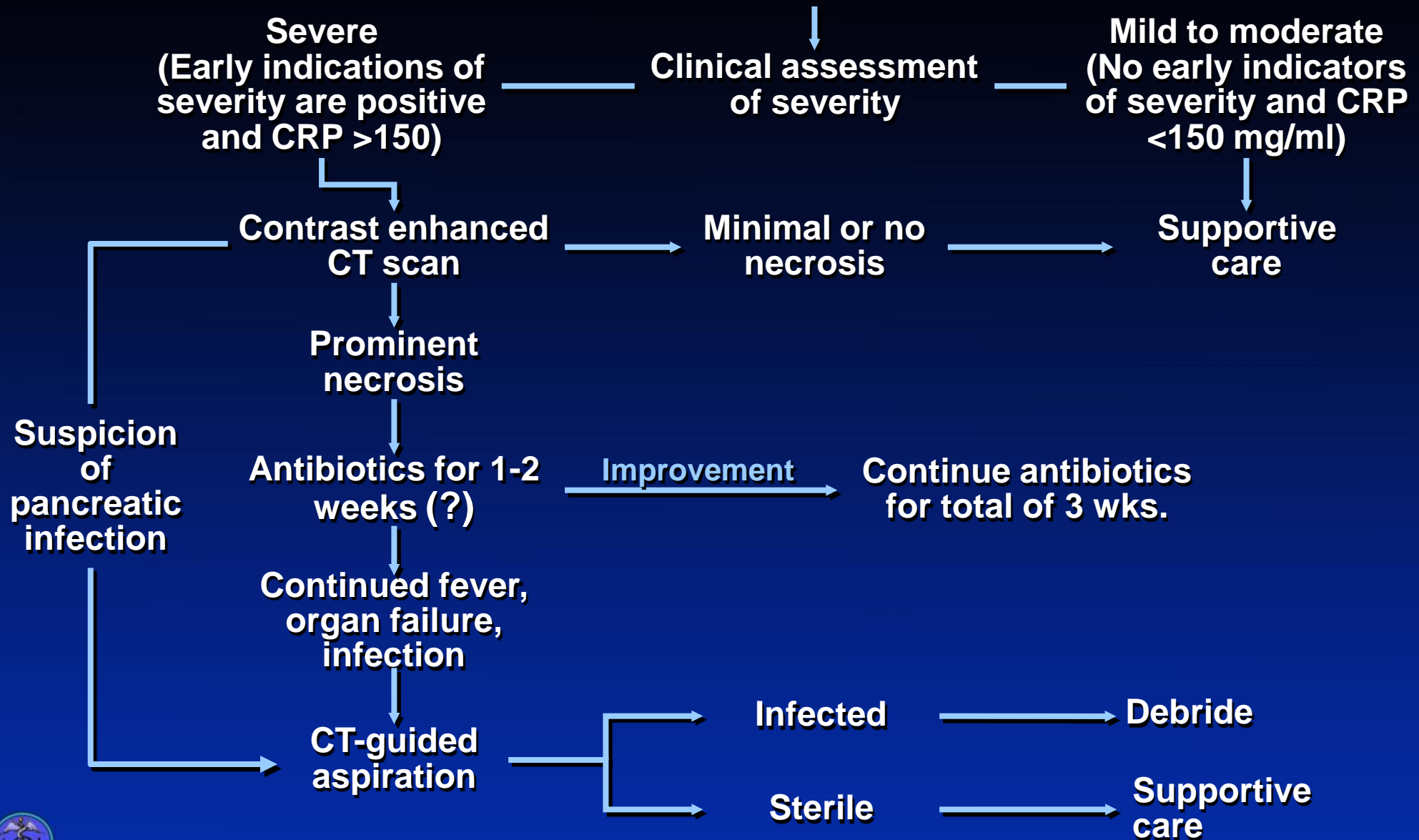
## Other treatments

- **Acid suppression**
- **Antibiotics**
- **NG tube**
- **Nutritional support**
- **Urgent ERCP**



# Acute Pancreatitis: Management

## Resuscitation



# **Nutritional Support**

- **Consider when protracted course is likely**
- **Enteral vs parenteral**  
**Safety**  
? Effect on outcome
- **Monitor calcium and triglycerides**



# Major Complications

## Local

- Fluid collections
- Necrosis
- Infection
- Ascites
- Erosion into adjacent structures
- GI obstruction
- Hemorrhage

## Systemic

- Pulmonary
- Renal
- CNS
- Multiorgan failure

## Metabolic

- Hypocalcemia
- Hyperglycemia

# Acute Pancreatitis

## Causes of mortality

DEATH

Early (< one week)

- Systemic inflammatory response syndrome (SIRS)
- Multiorgan failure

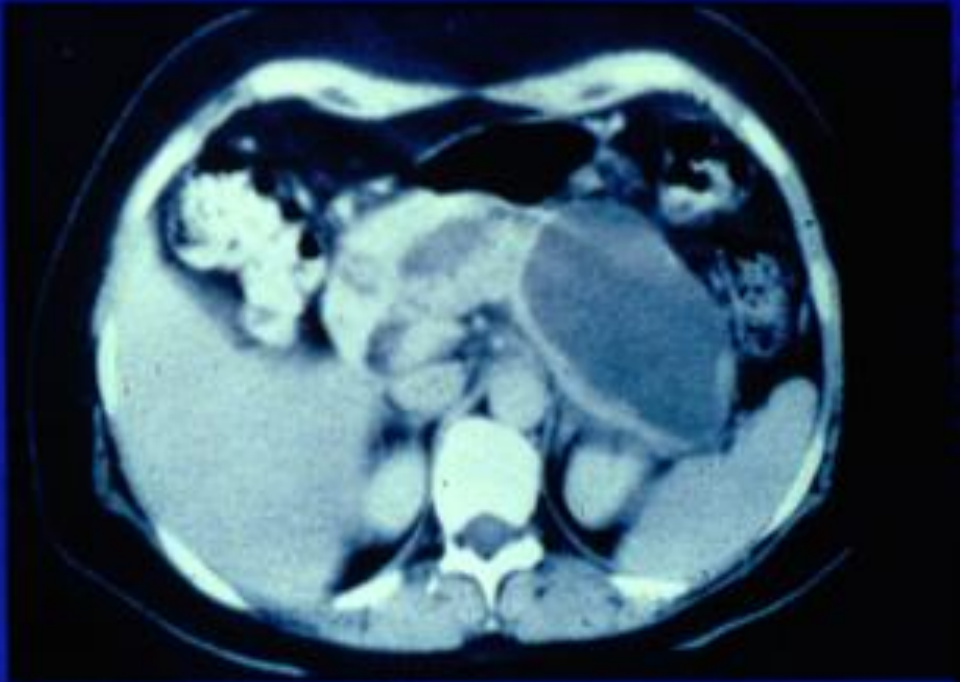
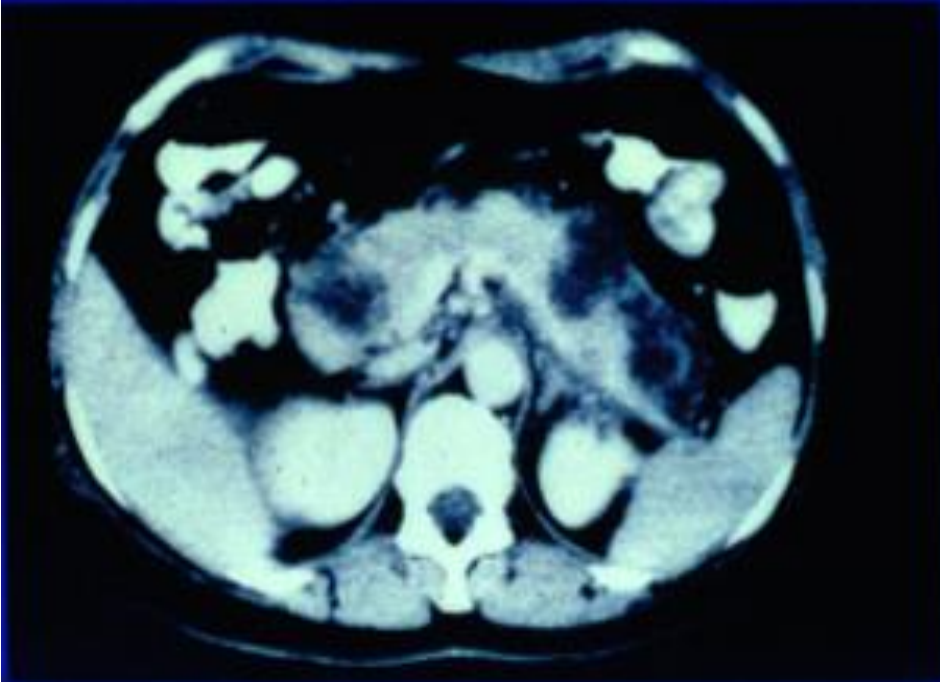
Late (> one week)

- Multiorgan failure
- Pancreatic infections/sepsis



**ACUTE PANCREATITIS**

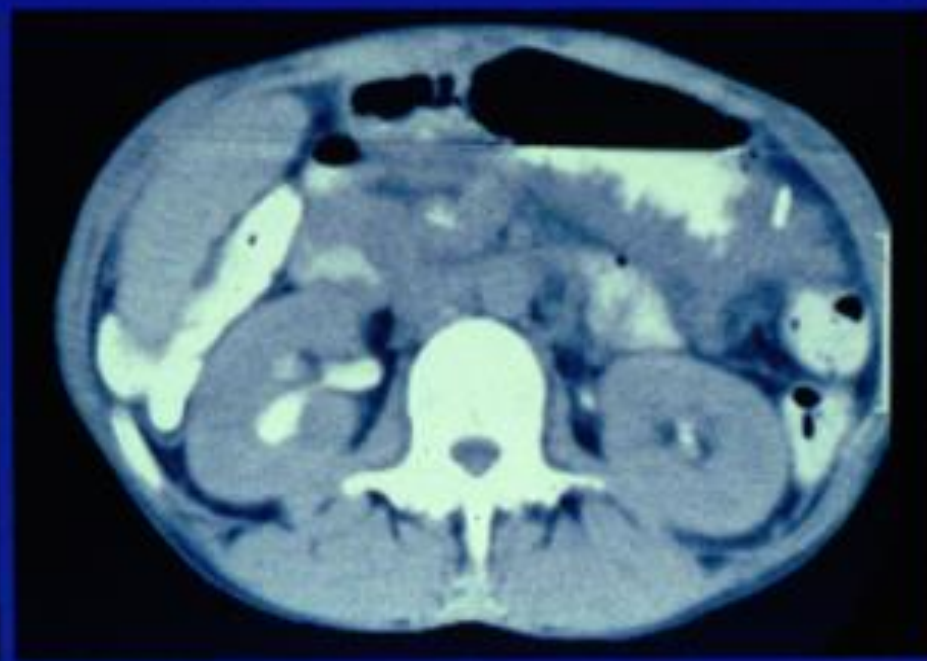
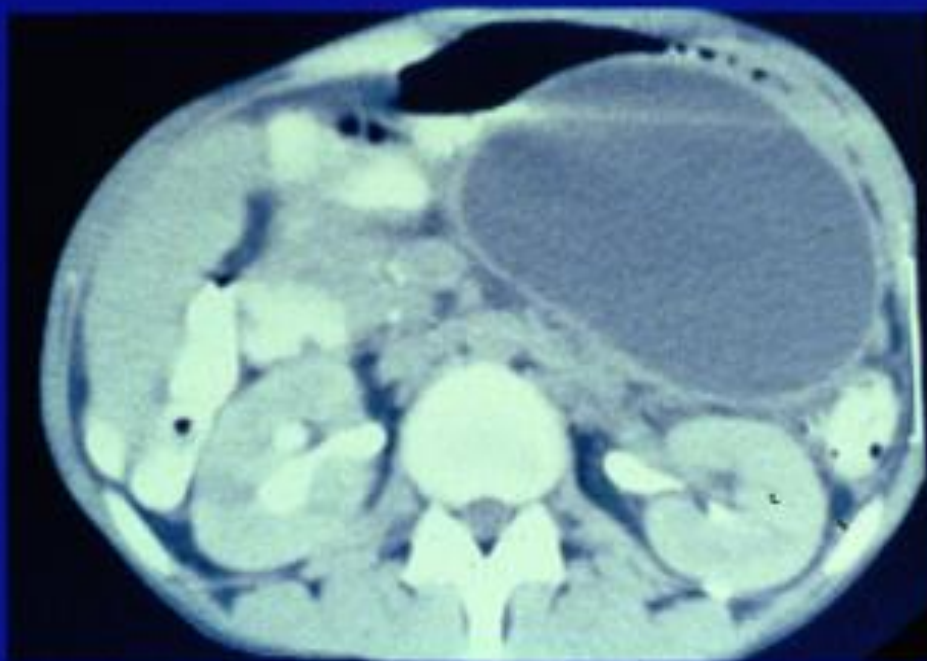
**Progression to Pseudocyst**





**PSEUDOCYST**

## Needle Aspiration

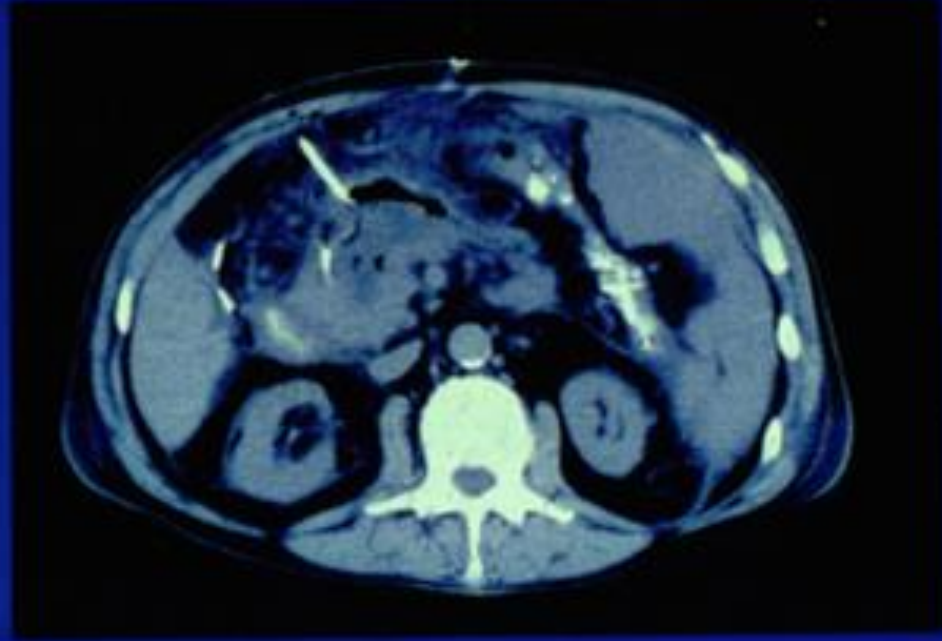
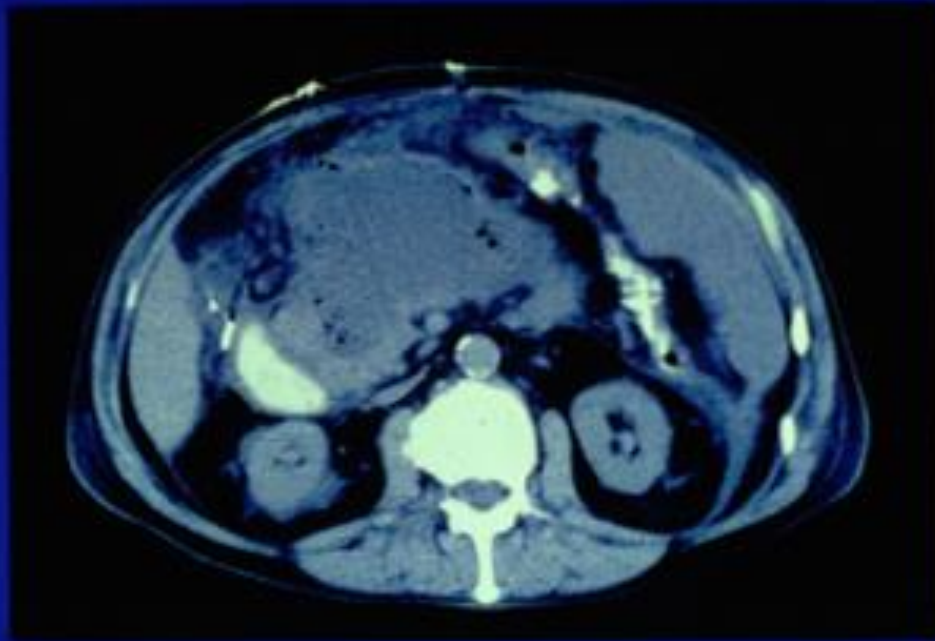


## Complications

- Severe pain
- Obstruction (CBD, duodenum)
- Dissection
- Bleeding
- Infection
- Leakage (ascites, pleural effusion)
- Rupture

**ACUTE PANCREATITIS: COMPLICATIONS**

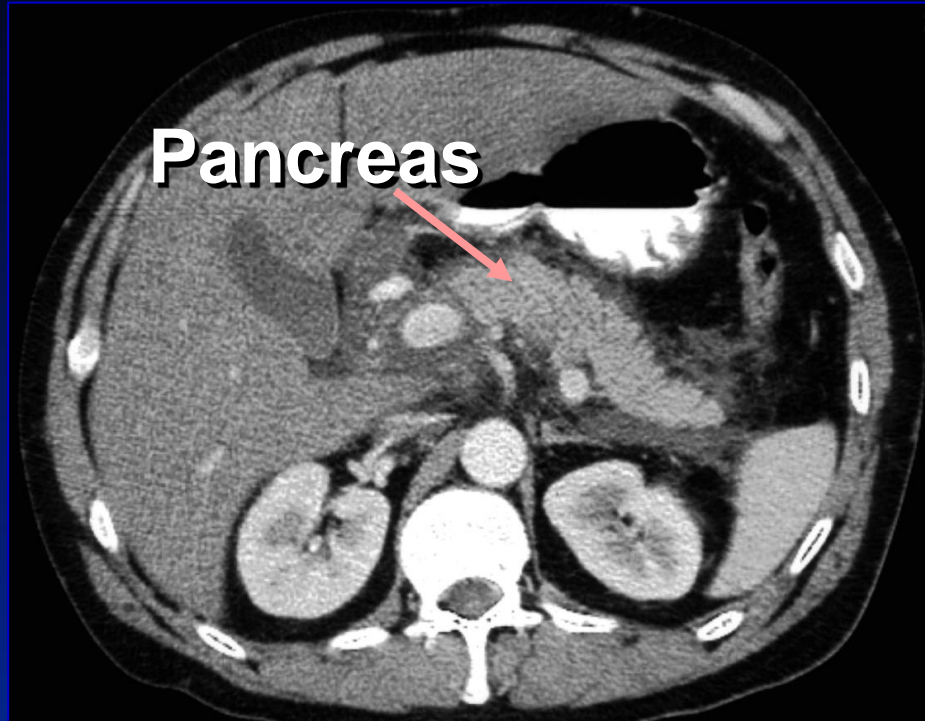
**Abscess Drainage**



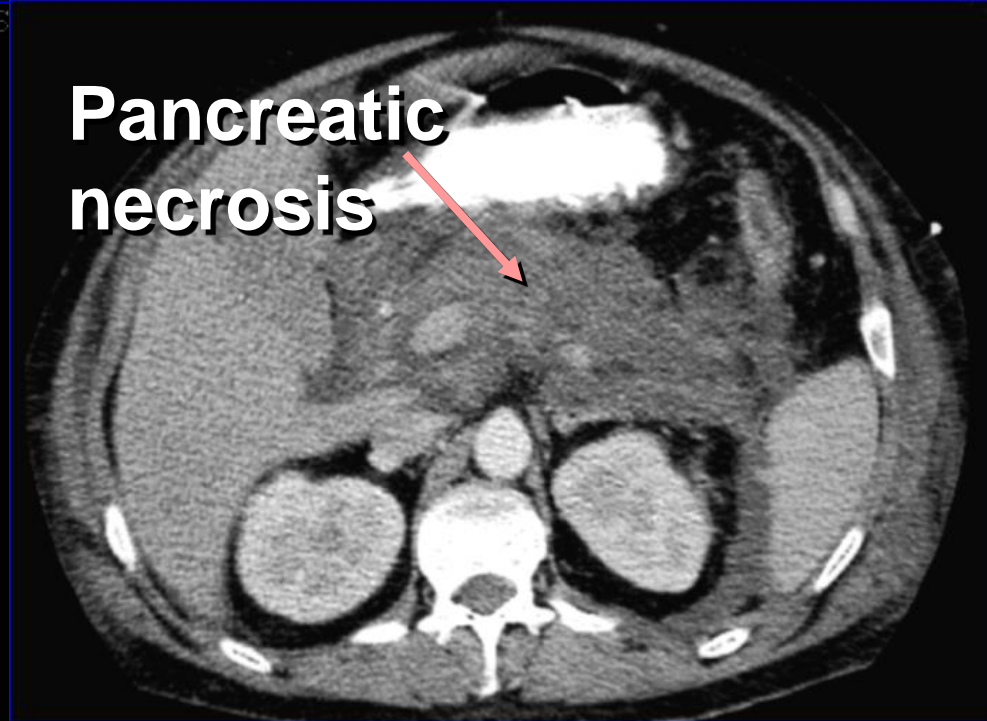


## Acute Pancreatitis: Necrosis

# Progression

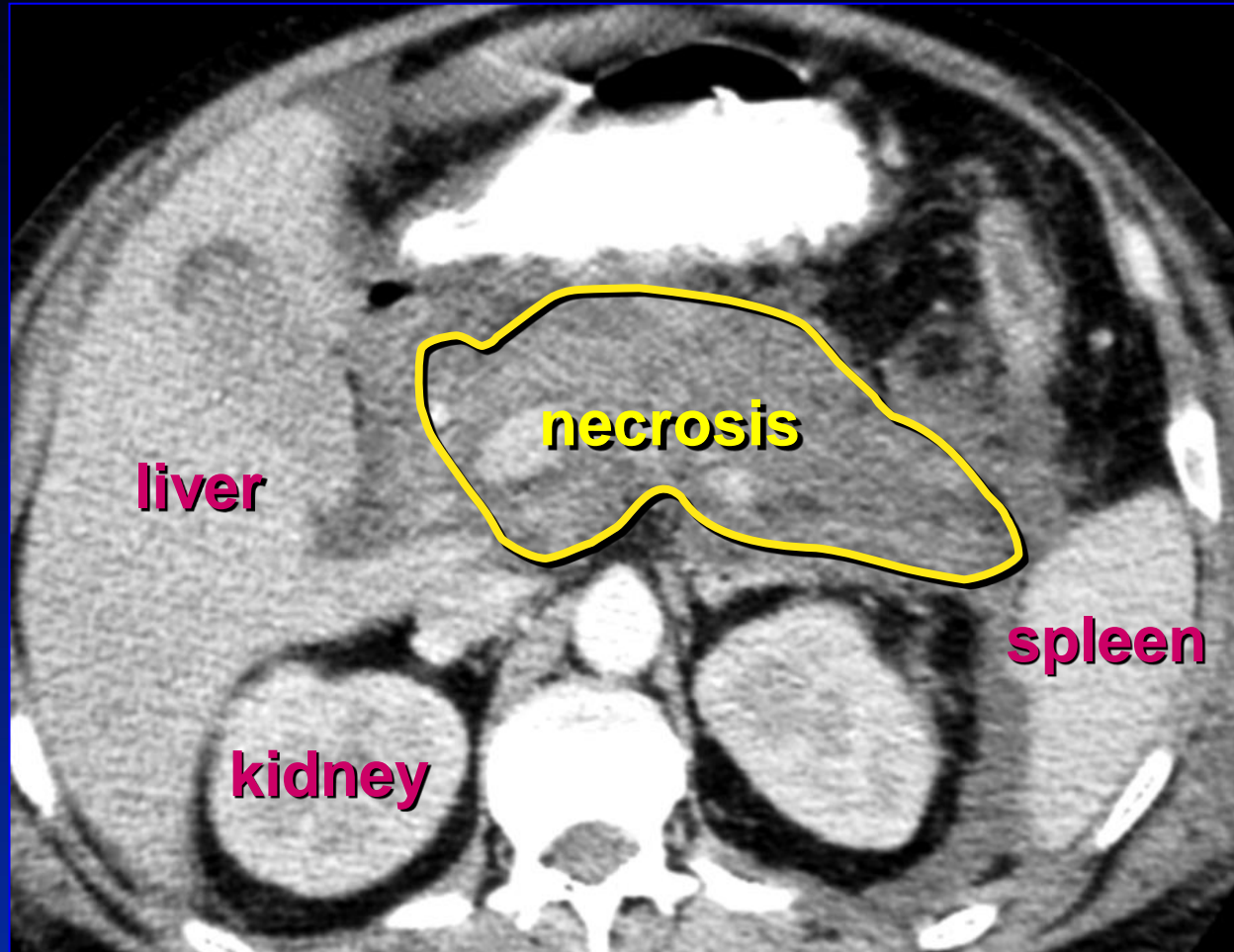


Day 1



Day 3

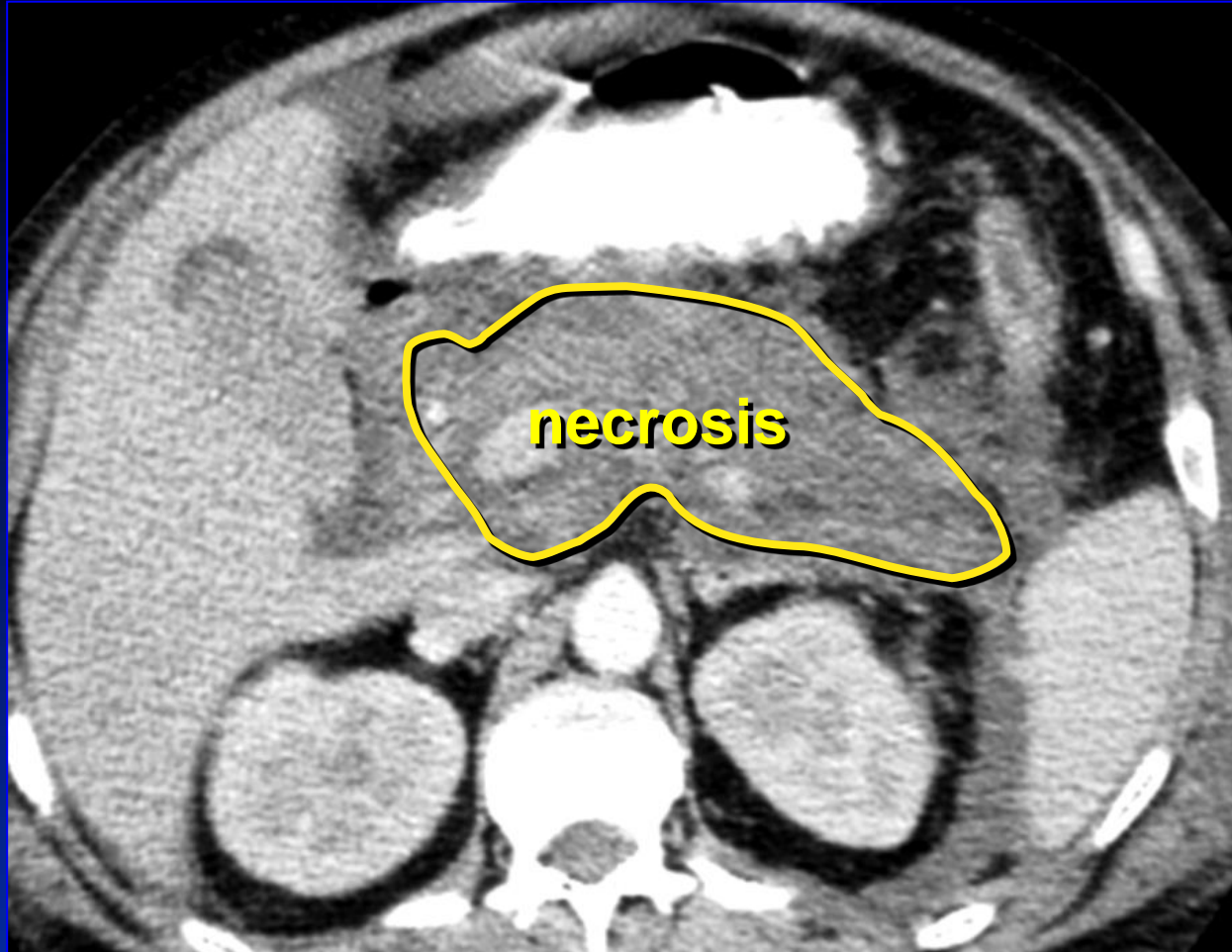
## Pancreatic Necrosis



- **Non-perfusion**
- **Systemic complications**
- **Local complications**
  - Hemorrhage
  - Infection



## Pancreatic Necrosis



Debridement

VS

Observation

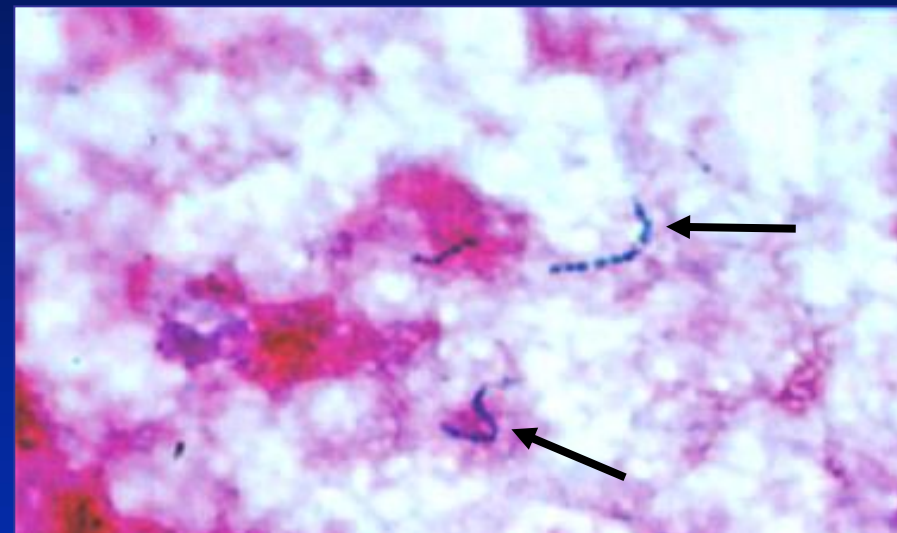
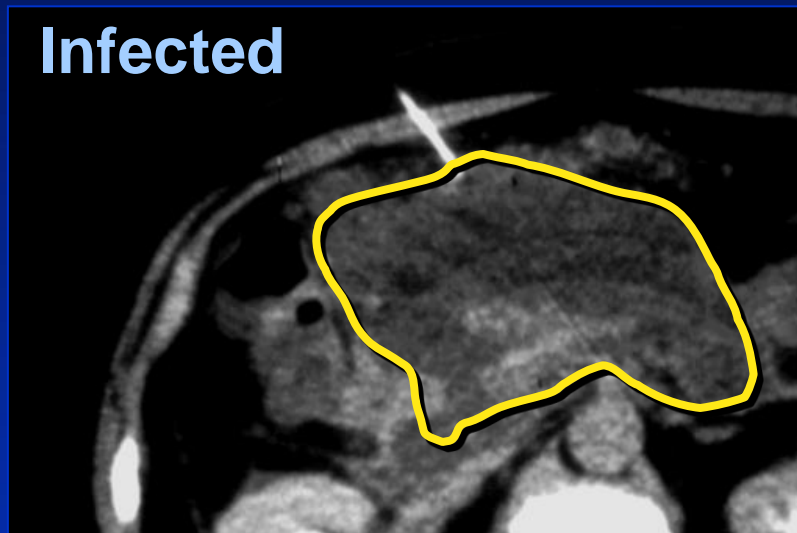
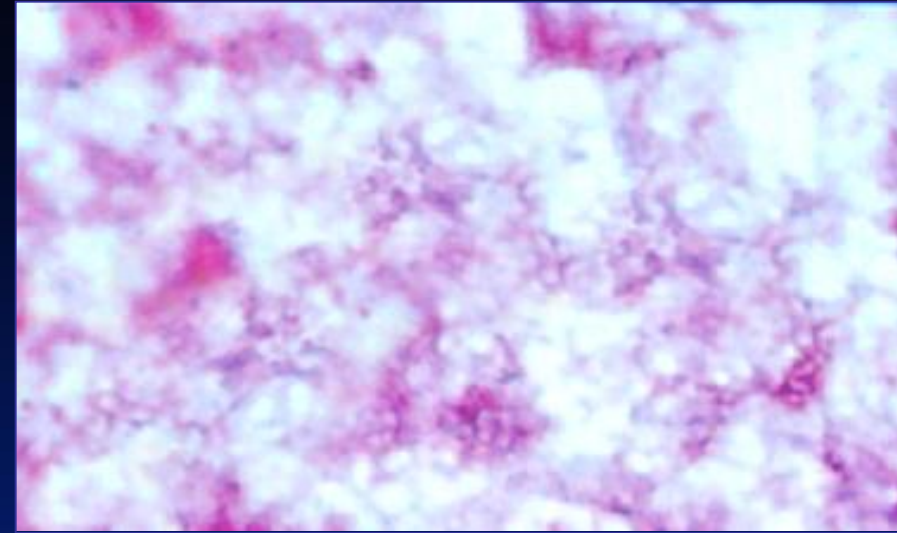
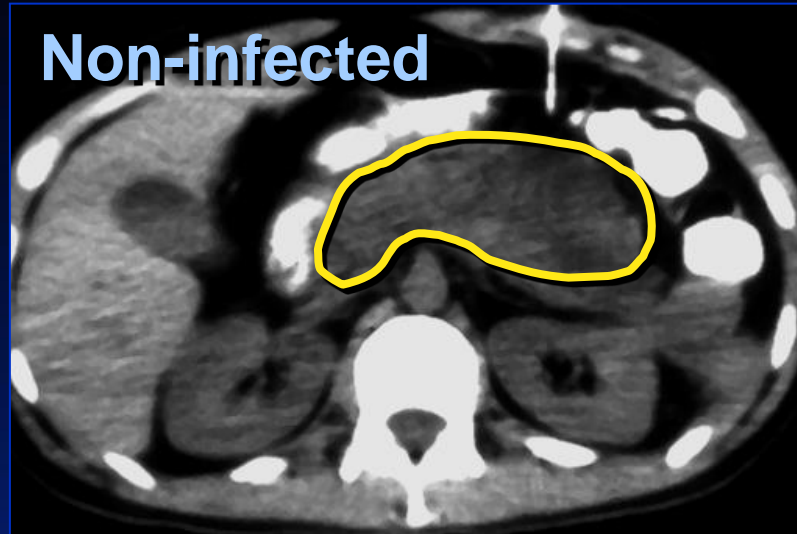
# Signs of Infected Pancreatic Necrosis

- Increasing markers of inflammation  
(serum CRP, white blood cell count)
- Newly developed fever without extra pancreatic infection
- Signs of infection on CT  
(gas collection within areas of necrosis)



# Acute Pancreatitis

## Necrosis



## Pancreatic Necrosis

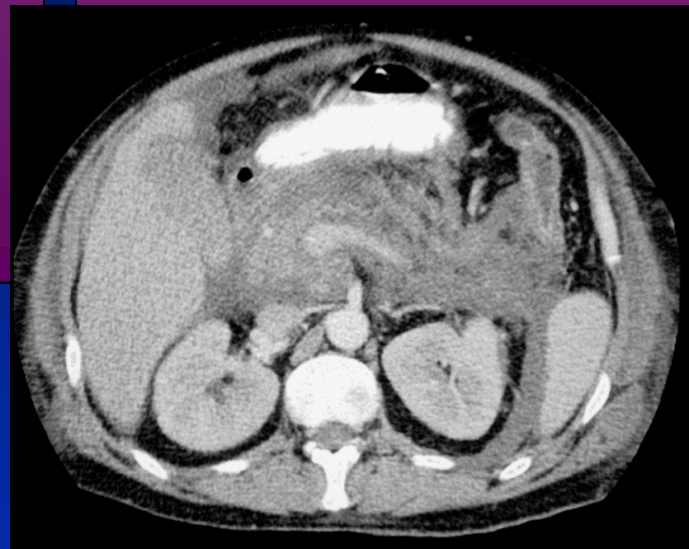
### Treatment Strategies

#### Sterile

- Medical therapy
- Debridement for persistent organ failure?

#### Infected

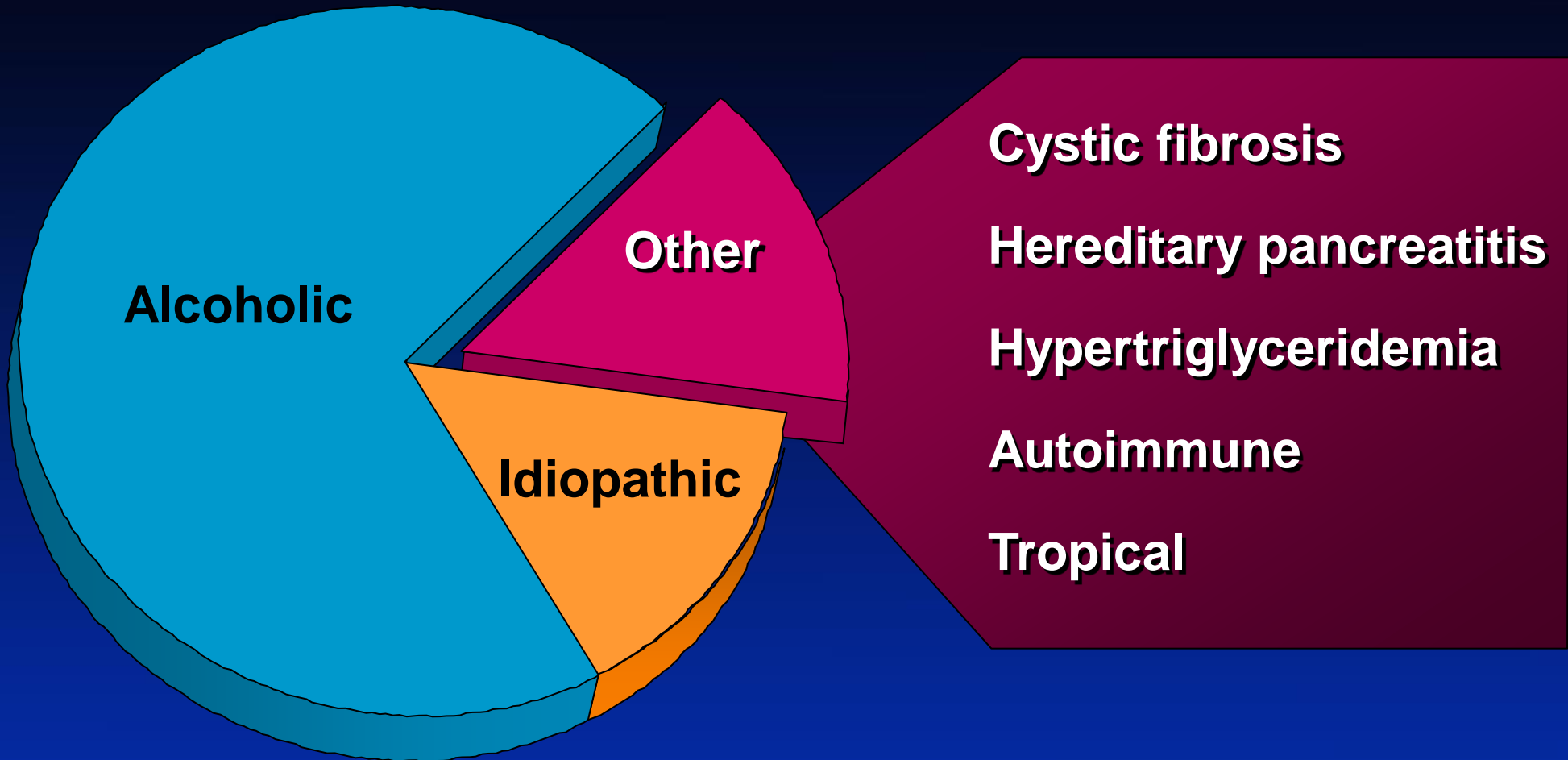
- Antibiotics
- Debridement



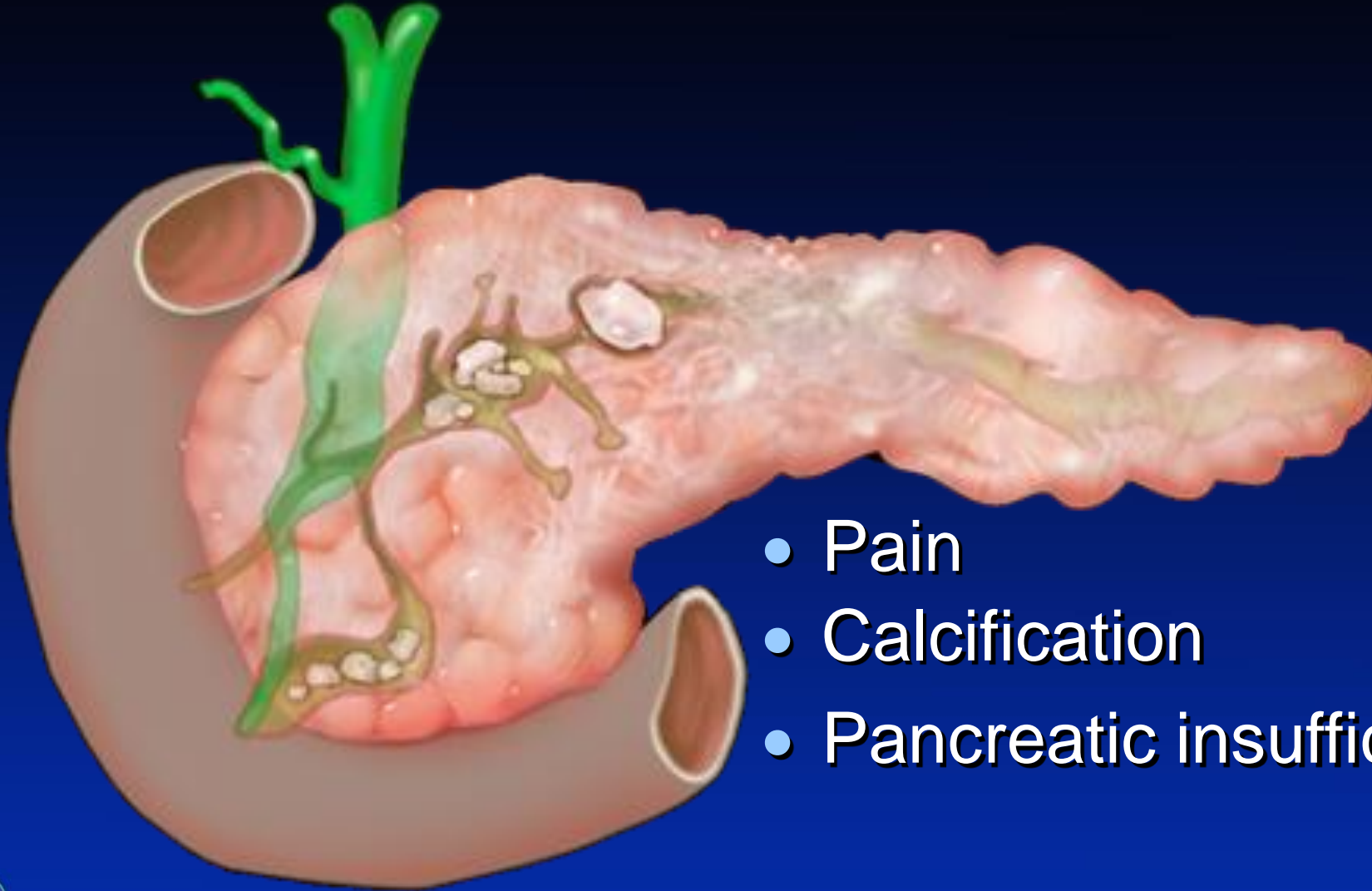


# Chronic Pancreatitis

## Etiologies



# Chronic Pancreatitis



- Pain
- Calcification
- Pancreatic insufficiency

## Diagnostic Tests

### Structure

ERCP

CT scan  
Ultrasonogram

Abdominal x-ray

Most  
sensitive

Less  
sensitive

Least  
sensitive

### Function

Secretin test

Bentiromide (PABA)  
Serum trypsinogen  
Fecal chymotrypsin

Fecal fat  
Blood glucose

# Chronic Pancreatitis

## Clinical Assessment

Presentation

Pain

Order of evaluation

Imaging

Malabsorption

Imaging

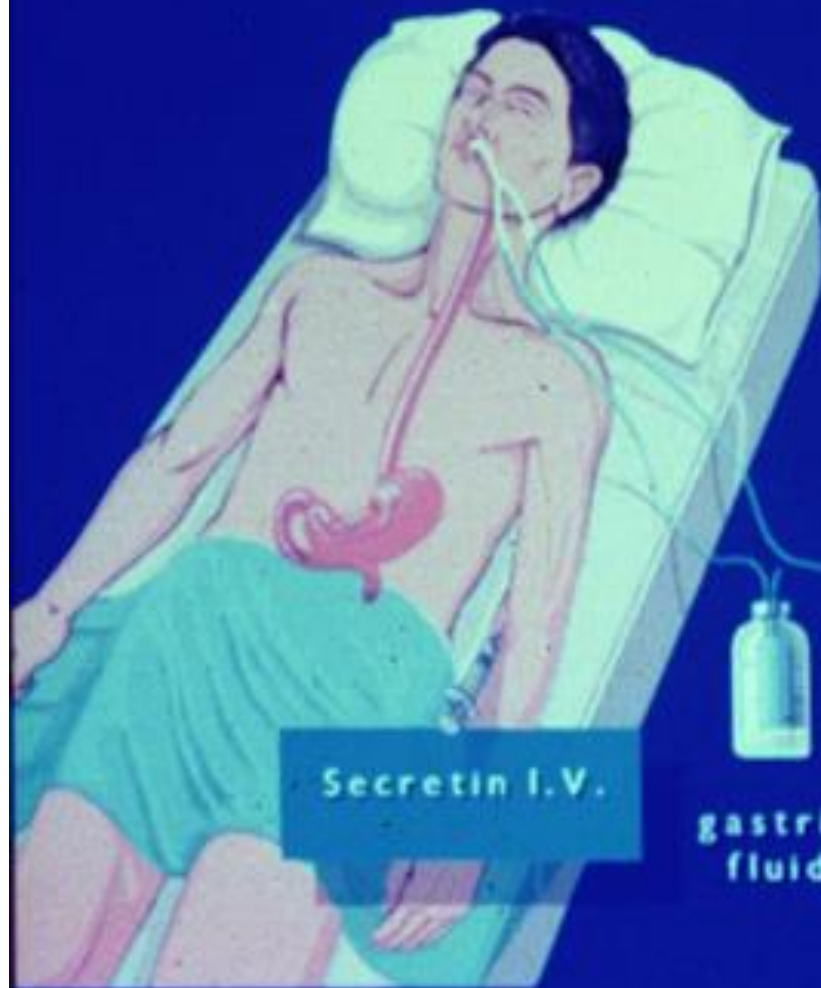
Trial of pancreatic  
enzymes

Tests of pancreatic  
insufficiency





# Secretin Test



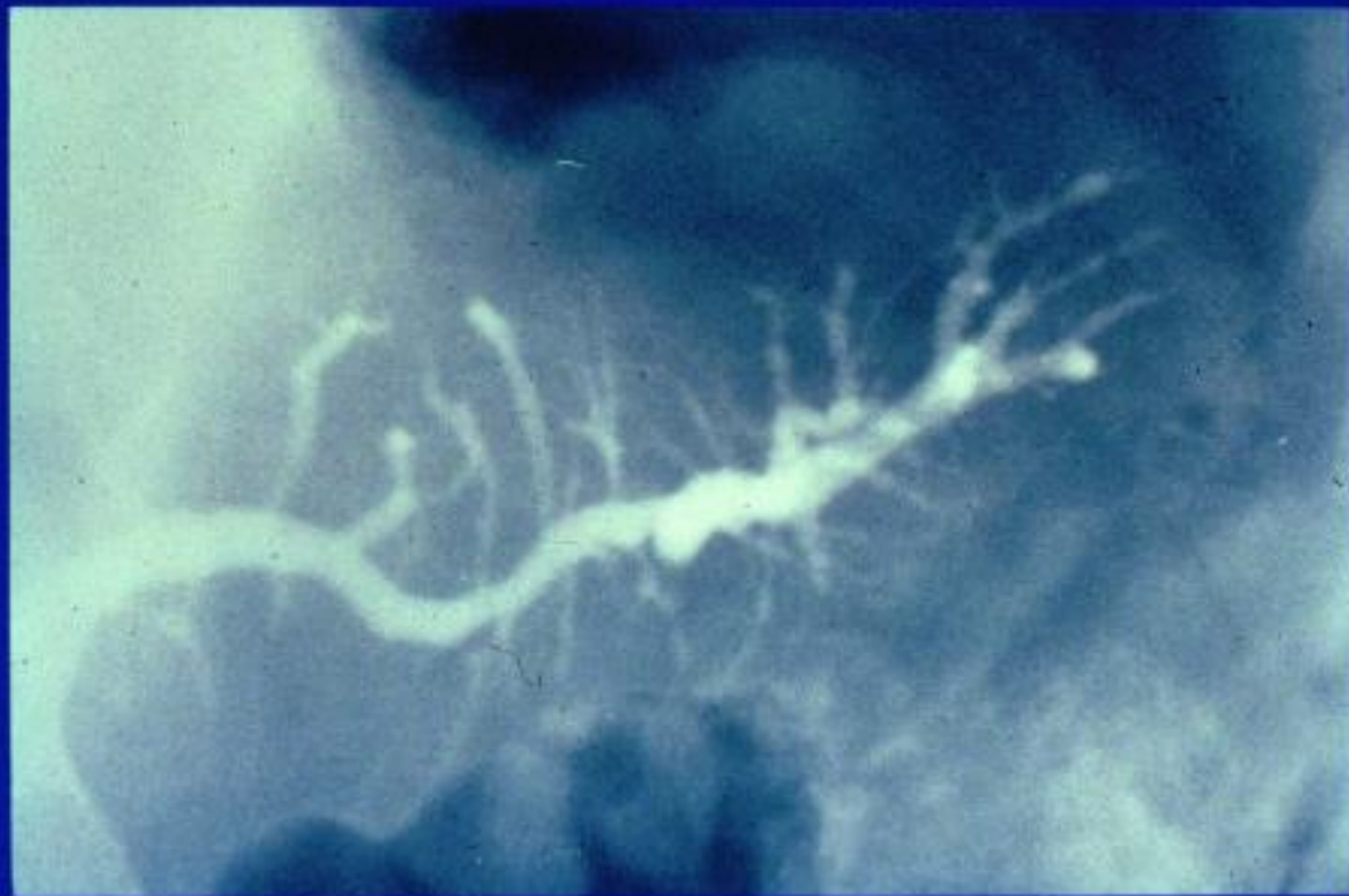
Normal Pancreatitis  
Volume

Normal Pancreatitis  
Max [HCO<sub>3</sub><sup>-</sup>]



- Sensitive and specific
- Unpleasant
- Time consuming
- Requires x-rays
- Not readily available

**CHRONIC PANCREATITIS**



**CHRONIC PANCREATITIS**





**CHRONIC PANCREATITIS**



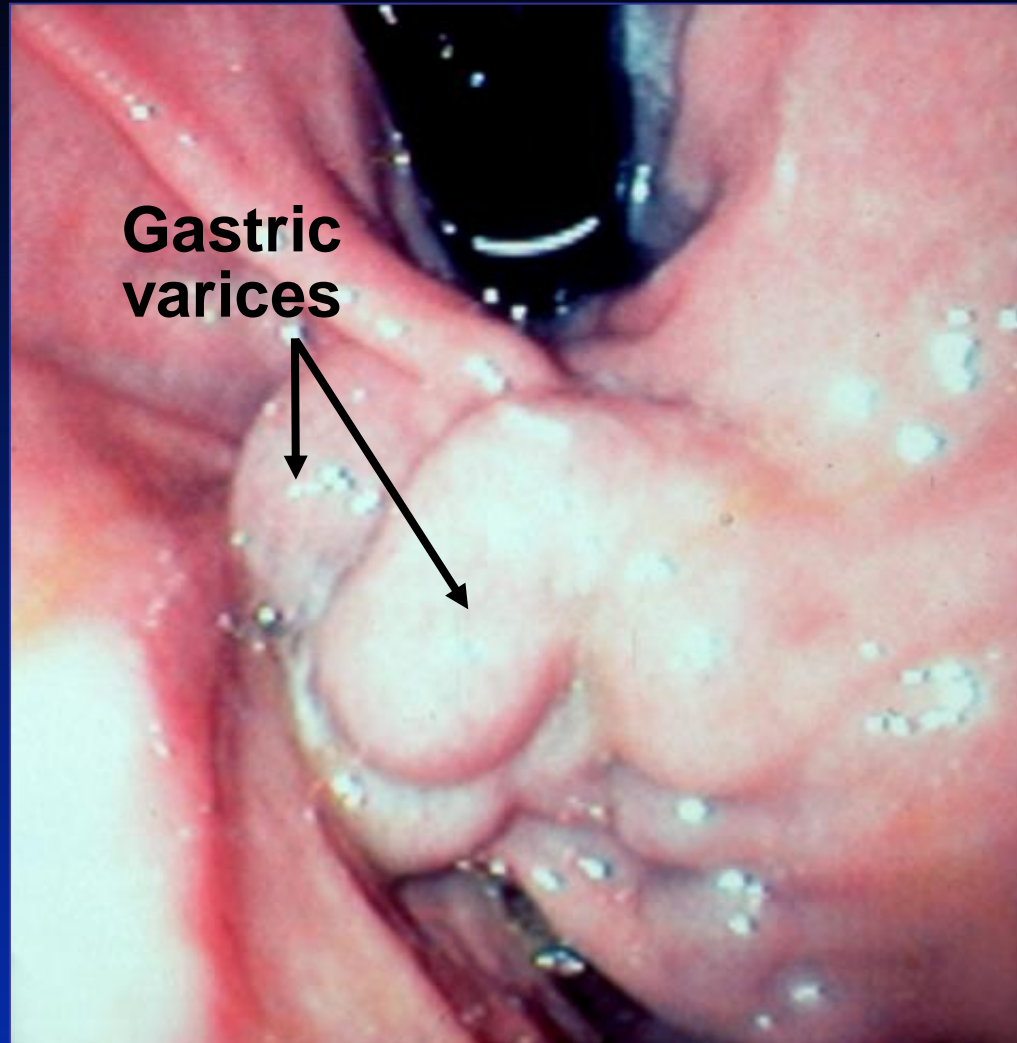


**CHRONIC PANCREATITIS**



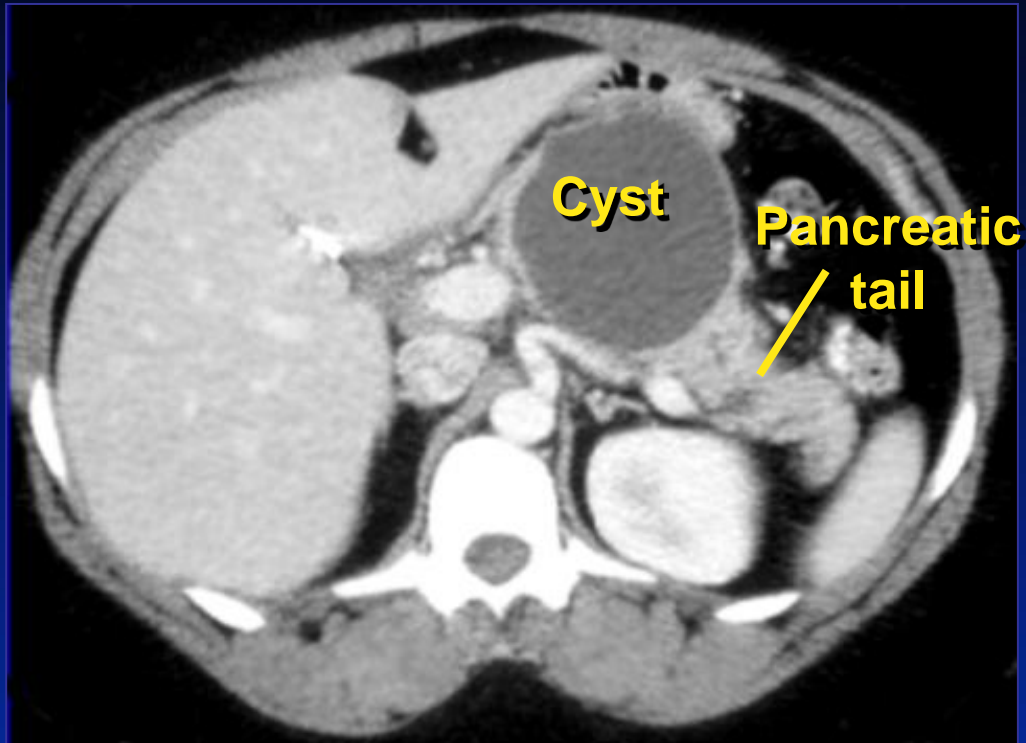
## Chronic Pancreatitis

# Splenic Vein Thrombosis



- Associated with chronic disease
- Splenomegaly
- Large gastric varices without esophageal varices
- Splenectomy for bleeding

# Cystic Neoplasm



## Clinical clues

- No prior pancreatitis
- Unexplained pancreatitis
- Cyst present on 1<sup>st</sup> CT

## Diagnosis

- Fluid analysis
- EUS, ERCP
- Resection

## Cystic Pancreatic Lesions

Type	Features	Cancer risk
Pseudocyst	Macrocytic Thick wall	None
Serous cystadenoma	Micro- or macrocytic	Low
Mucinous cystadenoma	Macrocytic	High
Mucinous cystadenocarcinoma	Macrocytic Thick wall Intracystic mass	Cancer present





# Chronic Pancreatitis

## Nutritional Management of Exocrine Insufficiency

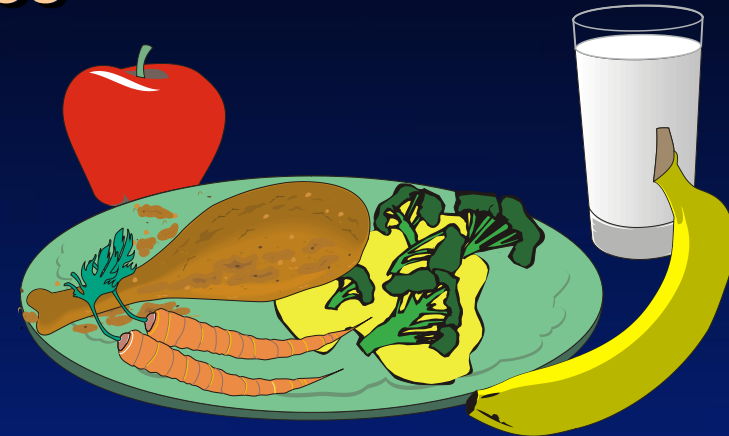
### Diet and exogenous enzymes

Modify fat intake

Medium chain triglycerides

Enzyme replacement

- Coated vs uncoated
- Acid suppression



### Vitamins, supplements

Fat soluble

Calcium

Cyanocobalamin (B<sub>12</sub>)

## Chronic Pancreatitis

# Pain Management

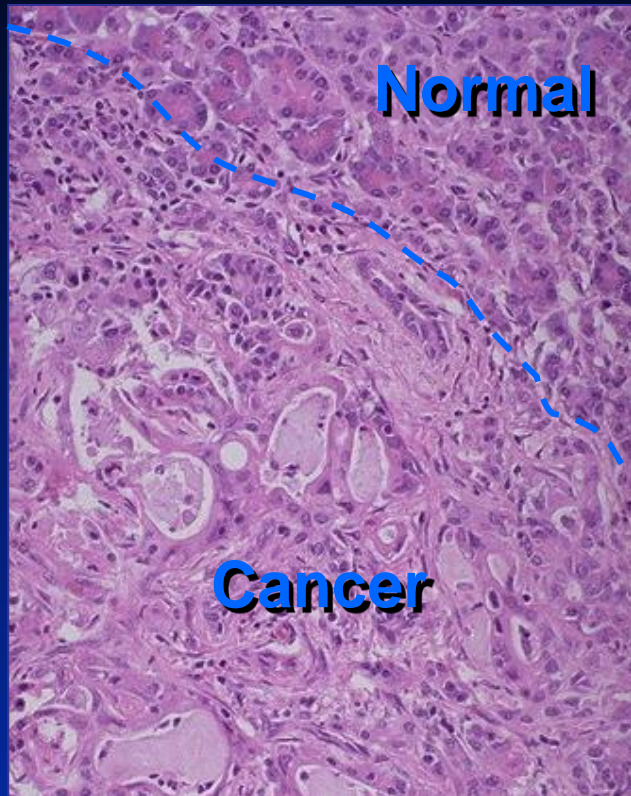
Treatment	Effectiveness
No alcohol	Low to moderate
Analgesia	Moderate
Enzyme replacement	Low
Neurolytic therapy	Moderate short term
Pseudocyst drainage	High
Duct decompression	Moderate
Stone removal	Moderate



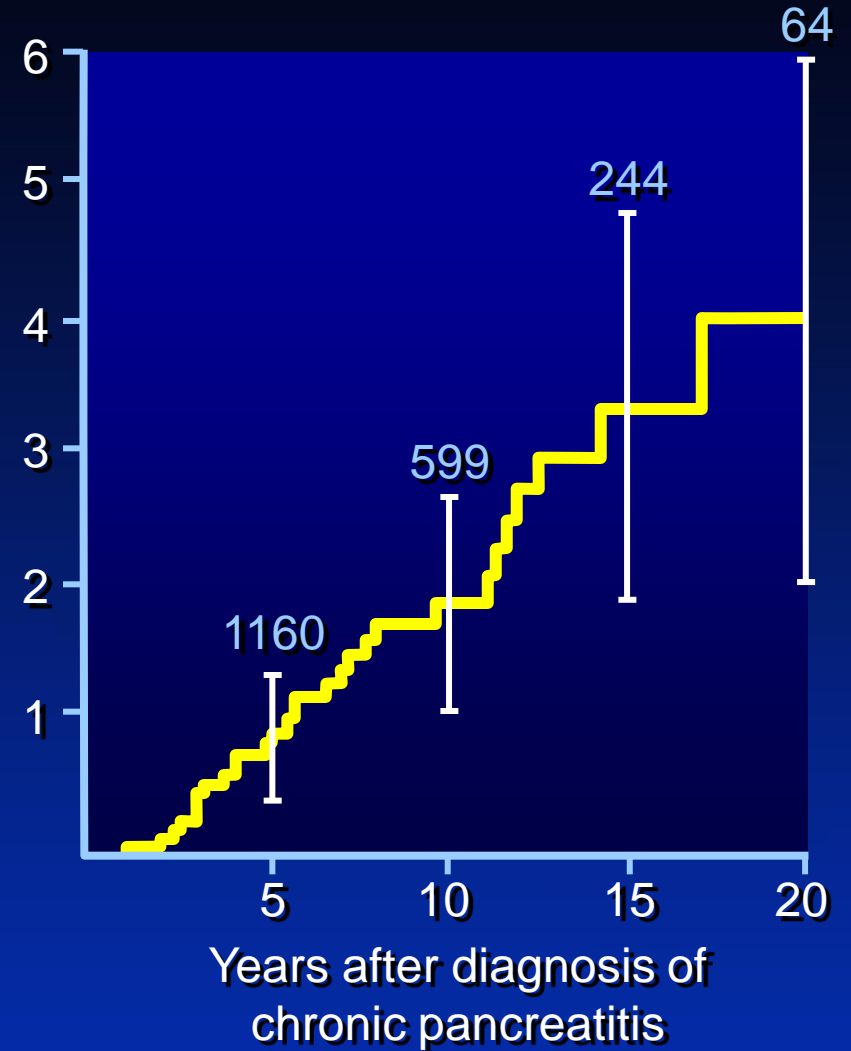
# Chronic Pancreatitis

## Pancreatic Cancer Risk

3-15 fold increase



%  
Cumulative  
incidence



# Pancreatic Insufficiency Without Pancreatitis

## Non-pancreatic

- Mucosal disease
  - ↓ CCK release
  - Enterokinase deficiency \*
- Gastrinoma
- Bilroth II reconstruction

## Pancreatic

- Cystic fibrosis \*
- Pancreatic tumors
- Shwachman-Diamond syndrome \*
- Childhood pancreatic atrophy \*
- Johanson-Blizzard syndrome\*
- Adult lipomatosis or atrophy
- Protein-calorie malnutrition



\* inherited





## Autoimmune Pancreatitis

# Diagnostic Criteria: I

### Imaging

- Diffuse pancreatic duct narrowing
- Diffuse pancreatic enlargement

### Immunity

- Autoantibodies
- Elevated gammaglobulins or IgG4

### Histology

- Periductular lymphoblastic infiltrate
- Phlebitis
- Fibrosis



## Autoimmune Pancreatitis

# Presentation

### Symptoms

- Asymptomatic or mild pain
- Acute pancreatitis, rare
- Obstructive jaundice

### Imaging

- Incidental pancreatic mass

