Diseases of the Pancreas

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I have no disclosures

I work for the Curators of the University of Missouri
Pancreatitis

Complete recovery

Death

Slow deterioration

Treated

Untreated

Progressive deterioration

Acute (gallstone)

Chronic (alcohol)

Improvement

Chronic Obstructive

Treated

Untreated
ACUTE PANCREATITIS

Intracellular Injury

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

Etiologies

- Alcohol
- Biliary
- Idiopathic
- Other
- 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

<table>
<thead>
<tr>
<th>Common</th>
<th>Uncommon</th>
<th>Rare</th>
</tr>
</thead>
<tbody>
<tr>
<td>asparaginase</td>
<td>ACE inhibitors</td>
<td>carbamazepine</td>
</tr>
<tr>
<td>azathioprine</td>
<td>acetaminophen</td>
<td>corticosteroids</td>
</tr>
<tr>
<td>6-mercaptopurine</td>
<td>5-amino ASA</td>
<td>estrogens</td>
</tr>
<tr>
<td>didanosine (DDI)</td>
<td>furosemide</td>
<td>minocycline</td>
</tr>
<tr>
<td>pentamidine</td>
<td>sulfasalazine</td>
<td>nitrofurantoin</td>
</tr>
<tr>
<td>valproate</td>
<td>thiazides</td>
<td>tetracycline</td>
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</table>
Causes of Increased Serum Enzymes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Amylase</th>
<th>Lipase</th>
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</thead>
<tbody>
<tr>
<td>Pancreatitis</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Parotitis</td>
<td>↑</td>
<td>Normal</td>
</tr>
<tr>
<td>Biliary stone</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Intestinal injury</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Tubo-ovarian disease</td>
<td>↑</td>
<td>Normal</td>
</tr>
<tr>
<td>Renal failure</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Macroamylasemia</td>
<td>↑</td>
<td>Normal</td>
</tr>
</tbody>
</table>
ACUTE PANCREATITIS

Time Course of Serum Enzymes

- Lipase
- Amylase

Days

1 2 3 4 5 6 7 8

Normal
Local Effects of Enzymes

- Inflammation
- Third space losses
- Fat necrosis
- Pancreatic and peripancreatic necrosis
Danger Signals: First Few Hours

- Encephalopathy
- Hypoxemia
- Tachycardia >130/min
- Hypotension <90 mmHg
- Hct >50
- Oliguria <50 ml/hr
- Azotemia
Figure 1.
(A) Periumbilical ecchymosis (Cullen sign) and
(B) flank ecchymosis (Grey Turner sign). Published
with permission from Chung and Chuang.¹
Grey-Turner Sign
ACUTE PANCREATITIS

Ranson’s Criteria of Severity

At admission
- Age >55 years
- WBC >16,000/mm³
- 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
- Ca²⁺ <8 mg/dl
- PaO₂ <60 mm Hg
- Base deficit >4 mEq/L
- Fluid sequestration >6 L
Mortality Related to Ranson’s Criteria

% Mortality

No. of Criteria

0-2

3-5

6-8

9-11
Treatment

Supportive care

- Aggressive fluid and electrolyte replacement
- Monitoring
  - Vital signs
  - Urine output
  - \( O_2 \) saturation
  - Pain
- Analgesia, anti-emetics

Other treatments

- Acid suppression
- Antibiotics
- NG tube
- Nutritional support
- Urgent ERCP
Acute Pancreatitis: Management

**Resuscitation**

- **Severe** (Early indications of severity are positive and CRP >150)
  - Contrast enhanced CT scan
  - Prominent necrosis

- **Clinical assessment of severity**
  - Minimal or no necrosis
  - Supportive care

- **Mild to moderate** (No early indicators of severity and CRP <150 mg/ml)

**Clinical assessment of severity**

- **Supportive care**

- **Suspicion of pancreatic infection**
  - Antibiotics for 1-2 weeks (?)
  - Continued fever, organ failure, infection
  - CT-guided aspiration

- **Improvement**
  - Continue antibiotics for total of 3 wks.

- **Infected**
  - Debride

- **Sterile**
  - Supportive care
Nutritional Support in Acute Pancreatitis

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

Major Complications

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

Systemic
- Pulmonary
- Renal
- CNS
- Multiorgan failure

Metabolic
- Hypocalcemia
- Hyperglycemia
Causes of mortality

Acute Pancreatitis

DEATH

Early (< one week)
- Systemic inflammatory response syndrome (SIRS)
- Multiorgan failure

Late (> one week)
- Multiorgan failure
- Pancreatic infections/sepsis
ACUTE PANCREATITIS

Progression to Pseudocyst
Needle Aspiration
Complications

- Severe pain
- Obstruction (CBD, duodenum)
- Dissection
- Bleeding
- Infection
- Leakage (ascites, pleural effusion)
- Rupture
Abscess Drainage
Acute Pancreatitis: Necrosis

Progression

Pancreas

Pancreatic necrosis

Day 1
Day 3
Pancreatic Necrosis

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

Liver, Spleen, Kidney, Necrosis
Pancreatic Necrosis - treatment options

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

Non-infected vs infected necrosis diagnosed by needle aspiration and Gram stain.
Pancreatic Necrosis

Treatment Strategies

**Sterile**
- Medical therapy
- Debridement for persistent organ failure?

**Infected**
- Antibiotics
- Debridement
Etiologies of chronic pancreatitis

- Cystic fibrosis
- Hereditary pancreatitis
- Hypertriglyceridemia
- Autoimmune
- Tropical
- Idiopathic
- Other

Chronic Pancreatitis

Alcoholic

Idiopathic

Other

Cystic fibrosis
Hereditary pancreatitis
Hypertriglyceridemia
Autoimmune
Tropical
Chronic Pancreatitis

- Pain
- Calcification
- Pancreatic insufficiency
CHRONIC PANCREATITIS

Diagnostic Tests

Structure
- ERCP
- CT scan
- Ultrasonogram
- Abdominal x-ray

Function
- Most sensitive
  - Secretin test
- Less sensitive
  - Bentiromide (PABA)
  - Serum trypsinogen
  - Fecal chymotrypsin
- Least sensitive
  - Fecal fat
  - Blood glucose
## Clinical Assessment

### Chronic Pancreatitis

#### Clinical assessment in chronic pancreatitis

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Order of evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Imaging</td>
</tr>
<tr>
<td>Malabsorption</td>
<td>Imaging</td>
</tr>
<tr>
<td></td>
<td>Trial of pancreatic enzymes</td>
</tr>
<tr>
<td></td>
<td>Tests of pancreatic insufficiency</td>
</tr>
</tbody>
</table>
Secretin Test

Normal Pancreatitis
Volume

Normal Pancreatitis
Max $[\text{HCO}_3^-]$%

Sensitive and specific
Unpleasant
Time consuming
Requires x-rays
Not readily available
CHRONIC PANCREATITIS
Splenic Vein Thrombosis

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

Gastric varices
Cystic Neoplasm

Clinical clues
- No prior pancreatitis
- Unexplained pancreatitis
- Cyst present on 1st CT

Diagnosis
- Fluid analysis
- EUS, ERCP
- Resection
## Cystic Pancreatic Lesions

<table>
<thead>
<tr>
<th>Type</th>
<th>Features</th>
<th>Cancer risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudocyst</td>
<td>Macrocystic Thick wall</td>
<td>None</td>
</tr>
<tr>
<td>Serous cystadenoma</td>
<td>Micro- or macrocystic</td>
<td>Low</td>
</tr>
<tr>
<td>Mucinous cystadenoma</td>
<td>Macrocystic</td>
<td>High</td>
</tr>
<tr>
<td>Mucinous cystadenocarcinoma</td>
<td>Macrocystic Thick wall</td>
<td>Cancer present</td>
</tr>
<tr>
<td></td>
<td>Intracystic mass</td>
<td></td>
</tr>
</tbody>
</table>
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 (B₁₂)
### Pain Management

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alcohol</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Analgesia</td>
<td>Moderate</td>
</tr>
<tr>
<td>Enzyme replacement</td>
<td>Low</td>
</tr>
<tr>
<td>Neurolytic therapy</td>
<td>Moderate short term</td>
</tr>
<tr>
<td>Pseudocyst drainage</td>
<td>High</td>
</tr>
<tr>
<td>Duct decompression</td>
<td>Moderate</td>
</tr>
<tr>
<td>Stone removal</td>
<td>Moderate</td>
</tr>
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Chronic Pancreatitis

Pancreatic Cancer Risk

3-15 fold increase


Cumulative incidence

Pancreatic cancer risks in chronic pancreatitis

Normal

Cancer

Years after diagnosis of chronic pancreatitis
Causes of pancreatic insufficiency without pancreatitis

**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
Symptoms

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

Imaging

- Incidental pancreatic mass