Acute Pancreatitis

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JUSOM
Outline

- Introduction
- Epidemiology
- Pathophysiology
- Etiology
- Clinical Presentation
- Workup
- Severity Scoring System
- Treatment
- Prognosis
- Complications
PANCREATITIS

Inflammation in pancreas associated with injury to exocrine parenchyma
ACUTE PANCREATITIS

• **CLINICAL DEFINITION**
  - Abdominal Pain-Typical
  - Elevated Pancreatic Enzymes
  - Imaging studies

• **PATHOLOGICAL DEFINITION**
  - Reversible* pancreatic parenchymal injury associated with inflammation

*if underlying cause of pancreatitis is removed, heal without any impairment of function or morphologic loss of gland

*Recurrent attacks with irreversible parenchymal injury leading to impairment of function and morphologic loss is chronic pancreatitis
Considered a phase of chronic pancreatitis
**resulting from fibrosis within pancreas**
Acute Pancreatitis

Two phases:
- **Early**: 1st week
- **Late**: After 1st week

Severity:
- **Mild**: No organ failure
- **Moderate**: Organ failure less than 48 h
- **Severe**: Organ failure longer than 48 h

Two types:
- **Oedematous**
  - < 4 wk: acute peripancreatic collection
  - > 4 wk: pseudocyst
- **Necrotizing**
  - < 4 wk: acute necrotic collection
  - > 4 wk: walled-off necrosis
CLASSIFICATION OF ACUTE PANCREATITIS

- **Mild acute pancreatitis (80% cases)**
  - (Acute Interstitial/edematous pancreatitis)
  - Absence of organ failure
  - Absence of local complications

- **Severe acute pancreatitis (20% cases)**
  - (Acute Hemorrhagic Necrotizing (fulminant) pancreatitis)
  - Local complications +/-
  - Organ failure defined as:
    - SBP < 90 mm Hg
    - PaO₂ ≤ 60 mm Hg
    - GI bleed ≥ 500 ml/24 hrs
    - Cret ≥ 2 mg/dL after rehydration
  - Ranson score ≥ 3
  - or APACHE ≥ 8
Acute Pancreatitis - Fluid Collections

Interstitial Pancreatitis

< 4 weeks

Acute Peripancreatic Collection

> 4 weeks

Pseudocyst

< 4 weeks

Acute Necrotic Collection

> 4 weeks

Walled off Necrosis

Necrotizing Pancreatitis
Acute Fluid Collection =
Acute peripancreatic fluid collection (APFC)

- Enzyme rich pancreatic juice
- Predominantly adjacent to gland
- Lacks wall, occurs within 48 hrs in 30-50%
- Majority remain sterile
- Resolves spontaneously within 2-4 weeks
Acute Fluid Collection + Gland Necrosis =

Acute Necrotic Collection (pancreatic)
Epidemiology

- Ranges between 1 and 80 per 100,000 of population

- The incidence in USA 73.3 per 100,000 per year

- In Jordan 1.6 per 100,000 of population per year

- In Saudia Arabia 7.5 per 100,000 of population per year

- In Egypt 19.1 per 100,000 of population per year

- In Turkey 22.4 per 100,000 of population per year

http://www.rightdiagnosis.com/a/acute_pancreatitis/stats-country.htm
# Epidemiology

## Median ages of onset for various etiologies

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Median Ages of onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol-related</td>
<td>39 years</td>
</tr>
<tr>
<td>Biliary tract–related</td>
<td>69 years</td>
</tr>
<tr>
<td>Trauma-related</td>
<td>66 years</td>
</tr>
<tr>
<td>Drug-induced etiology</td>
<td>42 years</td>
</tr>
<tr>
<td>ERCP-related</td>
<td>58 years</td>
</tr>
<tr>
<td>AIDS-related</td>
<td>31 years</td>
</tr>
<tr>
<td>Vasculitis-related</td>
<td>36 years</td>
</tr>
</tbody>
</table>
Epidemiology

Gender Predilection
Generally $\rightarrow$ M>F
In males $\rightarrow$ more often related to alcohol
In females $\rightarrow$ more often related to biliary tract disease

Race
$\rightarrow$ 3 times higher for blacks than whites
Autodigestion of pancreatic substance by inappropriately activated pancreatic enzymes (especially trypsinogen)
Activation of Zymogens

- Trypsinogen converted to trypsin by intestinal epithelium
- Trypsin converts other 2 as well as digests dietary protein
Premature enzymes
Trypsin inhibitor
Zymogen granules
ANATOMY AND PHYSIOLOGY

Protection

- **COMPARTMENTALIZATION** - Digestive enzymes are contained within zymogen granules in acinar cells
- **REMOTE ACTIVATION** - Digestive enzymes are secreted as inactive proenzymes within the pancreas
- **PROTEASE INHIBITORS** – Trypsin inhibitor is secreted along with the proenzymes to suppress any premature enzyme activation
- **AUTO "SHUT-OFF"** – Trypsin destroys trypsin in high concentrations
<table>
<thead>
<tr>
<th>Pathophysiology</th>
<th>TRYPSINOGEN → TRYPSIN</th>
<th>Activation of <strong>Hageman factor-XII</strong></th>
<th>Activation of clotting and complement systems → thrombosis → Splenic vein thrombosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipase</td>
<td>Lipase activation → Triglycerides → Glycerol + Fatty acids</td>
<td>Fatty acids + calcium → Saponification → <strong>Hypocalcemia</strong></td>
<td></td>
</tr>
<tr>
<td>Elastase</td>
<td>Elastase activation → Digestion of elastic fibers → Capillary leak/rupture Pseudoanurysm</td>
<td>3rd space Sequestration of blood/fluid → <strong>Hemorrhage + Hypovolemic shock</strong></td>
<td></td>
</tr>
<tr>
<td>Lysolecithinase</td>
<td>Activation of Lysolecithinase (derived from bile)</td>
<td>Membrane damage → Necrosis</td>
<td></td>
</tr>
<tr>
<td>Inflammatory mediators</td>
<td>Release of inflammatory mediators into circulation</td>
<td>Systemic complications</td>
<td></td>
</tr>
</tbody>
</table>
Etiology of Pancreatitis

**Mechanical**
- Gall Stone
- Ampullary tumor
- Pancreatic Ca
- Iatrogenic (ERCP)
- Trauma

**Metabolic**
- Alcoholism
- Hypercalcemia
- Hyperlipidimia
- Malnutrition
- Azotemia

**Infective**
- Mumps
- Cocksaki – B
- Ascaris
- Scorpion bite
- Snake bite

**Genetic**
- Pancreatic devisim
- Annular pancreas
- Cystic fibrosis
- Autoimmune

**Vascular**
- Shock
- Hypothermia
- Atheroembolism
- Vasculitis (Polyarteritis nodosa, SLE)

**Idiopathic**
- 70 % due to microlithiasis

**Drugs**
- Tetracycline
- Azathioprine
- Steriods
- Furosemide
- Valproic acid
Pathophysiology – acute biliary pancreatitis

Duct Obstruction → Interstitial edema → Impaired blood flow → Ischemia → Acinar cell Injury

Duct obstruction → Acinar cell injury → Defective intracellular transport

Trypsin → Trypsinogen

Ethanol can induce pancreatitis by several methods:

1- Ethanol is a metabolic toxin to pancreatic acinar cells, where it can interfere with enzyme synthesis and secretion also by Release of free radicals—superoxide, hydroxyl produced by ethanol metabolism.

2- The "secretion with blockage" mechanism is possible because ethanol causes spasm of the sphincter of Oddi,

3- Elevation of enzyme proteins that can precipitate within the pancreatic duct. Calcium then can precipitate within this protein matrix, causing multiple ductal obstructions by protein bulges.

4- Ethanol also increases ductal permeability, making it possible for improperly activated enzymes to leak out of the activated enzymes into the surrounding tissue.
Hyperlipidemia induced AP

- In the absence of gallstones and/or history of significant history of alcohol use, a serum triglyceride should be obtained and **considered the etiology if > 1,000 mg/dl**

- **May ↑↑ Lipase without increase of serum amylase**
Post-ERCP Pancreatitis

- 3rd Most common cause of AP (after gallstone and alcohol) i.e. 4-6 %
- Most common complication of ERCP

**INCIDENCE**
- 4-6 % patients undergoing ERCP develop acute pancreatitis
- Risk of severe AP < 1/500.

**CAUSE**
- Duct disruption, enzyme extravasation

**PREDISPOSING FACTORS:**
- Young, female
- Sphincter of Oddi dysfunction (risk increases to 30 %)
- H/o recurrent pancreatitis
- Sphincterotomy
- Balloon dilation of sphincter
- Inexperienced endoscopist
- Multiple injection into the PD with manometry
CLINICAL MANIFESTATION
ABDOMINAL PAIN - Cardinal Symptom

- **SITE**: usually experienced first in the epigastrium but may be localized to either upper quadrant or felt diffusely throughout the abdomen or lower chest.

- **ONSET**: characteristically develops quickly, generally following substantial meal.

- **SEVERITY**: frequently severe, reaching max. intensity within minutes rather than hours.

- **NATURE**: “boring through”, “knife like”

- **DURATION**: hours-days.

- **COURSE**: constant (refractory to usual doses of analgesics, not relieved by vomiting).

- **RADIATION**: directly to back (50%), chest or flanks.

- **RELEIVNG FACTOR**: sitting or leaning/stooping forward.
  - due to shifting forward of abdominal contents and taking pressure off from inflamed pancreas.

- **AGGRAVATING FACTOR**: food/alcohol intake, walking, lying supine.
OTHER MANIFESTATIONS

- Nausea, frequent and effortless vomiting, anorexia, diarrhea
  - Due to reflex pylorospasm
  - More intense in necrotizing than in edematous pancreatitis

- Persistent retching
  - despite empty stomach

- Hiccups
  - Due to gastric distension/diaphragmatic irritation

- Fever
  - Low grade, seen in infective pancreatitis

- Weakness, Anxiety, Sweating
  - Indicates severe attack.
General Physical Examination

- Appearance: well → gravely ill with profound shock, toxicity and confusion

- Vitals:
  - Tachypnea (and dyspnea-10%),
  - Tachycardia (65%).
  - Hypotension
  - Temp → high (76%/normal/low) (acute swinging pyrexia in cholangitis)

- Icterus (28%)
  - Gallstone pancreatitis or due to edema of pancreatic head

- Pallor, cold clammy skin, diaphoresis, dehydration
ABDOMEN EXAMINATION

- Tenderness + Rebound tenderness:
  - epigastrium/upper abdomen

- Distension:
  - Ileus (BS decreased or absent)
  - ascites with shifting dullness

- Mass in epigastrium (usually absent)
  - due to inflammation

- Guarding (also called “defense musculaire”) - upper abdomen
  - Tensing of the abdominal wall muscles to guard inflamed organs within the abdomen from the pain of pressure upon them (i.e. during palpation)

- Rigidity (involuntary stiffness) - unusual
  - Tensing of the abdominal wall muscles to guard inflamed organs even if patient not touched
SYSTEMIC COMPLICATIONS

- CARDIOVASCULAR
  - Shock - hypovolemic and septic
  - Arrhythmias/pericardial effusion/sudden death
  - ST-T nonspecific changes

- Pulmonary
  - Respiratory failure/pneumonia/atelectasis/pleural effusion
  - Acute Respiratory Distress Syndrome (ARDS)

- Renal Failure
  - Oliguria
  - Azotemia
  - Renal artery/vein thrombosis

- Hematological
  - Hemoconcentration
  - Disseminated Intravascular Coagulopathy (DIC)
SYSTEMIC COMPLICATIONS

- **Metabolic**
  - Hypocalcemia
  - Hyperglycemia
  - Hyperlipidemia

- **Gastrointestinal**
  - Peptic Ulcer/Erosive gastritis
  - Ileus
  - Portal vein or splenic vein thrombosis with varices

- **Neurological**
  - Visual disturbances-Sudden blindness (Purtscher’s retinopathy)
  - Confusion, irritability, psychosis
  - Fat emboli
  - Alcohol withdrawal syndrome
  - Encephalopathy

- **Miscellaneous**
  - Subcutaneous fat necrosis
  - Intra-abdominal saponification
  - Arthralgia
RESPIRATORY EXAMINATION

Left sided* Pleural effusion (10-20%) - exudative

* Due to close approximation of body and tail of pancreas to the left sided diaphragm
MANIFESTAIONS OF COMPLICATIONS

- **Hypocalcaemia**
  - circumoral numbness or paresthesia (*1st symptom to develop*).
  - carpopedal spasm.
  - Laryngospasm.
  - generalized seizures
  - Chvostek sign:
    - Depending on calcium level, graded response occur: twitching first at angle of mouth, then by nose, the eye and the facial muscles
    - Positive in 10 % population in absence of hypocalcaemia
  - Trousseau sign:
    - BP cuff around arm and inflating to 20 mmHg above SBP for 3-5 minutes
    - Carpal spasm observed
    - More specific and sensitive than chvostek sign (positive even before tetany/hyperreflexia)
1. Named after British surgeon George Grey Turner (1877-1951)

2. Named for Thomas Stephen Cullen (1869-1953), Canadian gynecologist who first described the sign in ruptured ectopic pregnancy in 1916

3. Named after George Henry Fox (1846-1937), American dermatologist
Differential Diagnosis

Abdominal Conditions
- Perforated peptic ulcer/gastroentritis
- Biliary colic/acute cholecystitis/Cholangitis
- Mesentric Ischemia
- Ruptured Aortic Anuerysm
- Intestinal Obstruction
- Gastric/colon/pancreatic CA
- Viral Hepatitis
- IBS

Thorax Conditions
- Pneumonia/ARDS
- Pleuritic pain
- MI

Gynecological Conditions
- Ectopic pregnancy
- Salpingitis

Systemic Conditions
- DKA
Diagnostic criteria

- Most often established by the presence of two of the three following criteria:
  - (i) abdominal pain consistent with the disease,
  - (ii) serum amylase and/or lipase greater than three times the upper limit of normal, and/or
  - (iii) characteristic findings from abdominal imaging.

- CT and/or MRI of the pancreas should be reserved for patients
  - in whom the diagnosis is unclear (typical pain with normal enzymes)
  - who fail to improve clinically within the first 48–72 h after hospital admission (e.g., persistent pain, fever, nausea, unable to begin oral feeding)
  - to evaluate complications
WORKUP

- HEMATOLOGICAL investigations
- RADIOLOGICAL investigations
HEMATOLOGICAL

BASELINES

- **CBC:**
  - Low Hb: prolonged hematemesis/melena, internal hemorrhage
  - Leucocytosis (10,000-30,000/mcL)-infection, non infectious inflammation
  - Low platelets-DIC
  - Hct –raised in hemoconcentration

- **LFT’s:**
  - raised bilirubin, AST/ALT/LDH, ALP, GGTP- gall stone pancreatitis

- **RFT’s:**
  - raised BUN/cretainine- ATN→ ARF

- **Coagulation profile:**
  - increased INR-DIC

- **Blood sugar:**
  - > 180 mg/dl-diabetes as a sequelae or cause

- **Serum electrolytes:**
  - Low sodium/potassium: persistent vomiting
  - Hypocalcemia- saponification/fat necrosis

- **Serum Protein:**
  - low protein/ albumin
HEMATOLOGICAL

**ABG’s**

<table>
<thead>
<tr>
<th>Acid-Base Disturbance</th>
<th>Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metabolic (Lactic)acidosis</strong> with high anion gap</td>
<td>Hypovolemic shock</td>
</tr>
<tr>
<td><strong>Hypokalemic Hypochloremic metabolic alkalosis</strong></td>
<td>persistent vomiting</td>
</tr>
<tr>
<td><strong>Respiratory acidosis</strong></td>
<td>ARDS</td>
</tr>
</tbody>
</table>

**Etiology specific investigations**

- Serum fasting lipid profile
- Serum Calcium (Hypercalcemia → AP → Hypocalcemia)
- Autoimmune markers:
  - serum autoantibodies such as **anti-nuclear antibody (ANA), IgG4 level**, anti-lactoferrin antibody, anti-carbonic anhydrase II antibody, and rheumatoid factor (RF),
HEMATOLOGICAL

• Pancreatic Enzymes’ Assays
  
  ◦ Serum Amylase:
    - ONSET: almost immediately
    - PEAK: within several hours
      • 3-4 times upper limit of normal within 24 hrs (90%)
    - RETURN to normal in (3-5 days)
    - normal at time of admission in 20% cases
    - Compared with lipase, returns more quickly to normal values.

  ◦ Serum Lipase:
    - more sensitive/specifc than amylase
    - Remains elevated longer than amylase (12 days)
    - Useful in late presentation and if the cause is High TG
Pancreatic Enzymes’ Assays

- **Urine Amylase**
  - More sensitive than serum levels
  - Remain elevated for several days after serum levels returned to normal

- **Pancreatic-specific amylase (p-amylase)**
  - Measuring p-amylase instead to total amylase(also includes salivary amylase) makes diagnosis more specific(88-93%)
CONDITIONS ASSOCIATED WITH RAISED SERUM AMYLASE

**ABDOMEN**

- Small bowel obstruction
  - strangulation ileus
  - mesenteric ischemia
- Acute appendicitis
- Cholecystitis
- Perforated Duodenal Ulcer
- Gastroenteritis
- Biliary peritonitis
- Spasm of sphincter of Oddi

**GYNE**

- Ruptured Ectopic pregnancy
- Torsion of an ovarian cyst

**OTHERS**

- Parotitis (Mumps)
- Macroamylasaemia
- Opioids administration
- Low GFR
- Brain injury (CVA) - hyperstimulation of pancreas
**Plain X-ray abdomen erect AP view**

- **Sentinel* loop sign**
  - Localized isolated Distended gut loop (Ileus) seen near the site of injured viscus or inflamed organ

- **RATIONALE**: body's effort to localize the traumatic or inflamed lesions

- **ETIOLOGY**: Localized paralysis followed by accumulation of gas

- **SITE**:
  - Acute Pancreatitis → Left hypochondrium (PROXIMAL JEJUNUM)
  - Acute Appendicitis → Right iliac fossa
  - Acute Cholecystitis → Right Hypochondrium
  - Diverticulitis → Left iliac fossa
SENTINEL LOOP SIGN
Plain X-ray abdomen erect AP view

- **Colon cut-off sign**
  - Gas filled (Distended) segment of proximal(mainly transverse) colon associated with narrowing of the splenic flexure
  - with collapse of descending colon
  - **RATIONALE**: Extension of inflammatory process from the pancreas into the phrenicocolic ligament via the transverse mesocolon
    - resulting in functional spasm and/or mechanical narrowing of the splenic flexure at the level where the colon returns to the retroperitoneum.
  - **Differential DIAGNOSIS**:
    - IBD
    - Carcinoma of colon
    - Mesenteric Ischemia
COLON CUT-OFF SIGN
Transcutaneous Abdominal Ultrasonography

- Not diagnostic
- Should be performed within 24 hours in all patients to
  - detect gall stones* as a potential cause
  - Rule out acute cholecystitis as differential diagnosis
  - Detect dilated CBD.

* Identification of gallstones as the etiology should prompt referral for cholecystectomy to prevent recurrent attacks and potential biliary sepsis.

Gallstone pancreatitis is usually an acute event and resolves when the stone is removed or passes spontaneously.
IV Contrast enhanced Computed Tomography Scan

- Provides over 90% sensitivity and specificity for the diagnosis of AP..... BUT

- Routine use in patients with AP is unwarranted, as the diagnosis is apparent in many patients and most have a mild, uncomplicated course.
**IV Contrast enhanced Computed Tomography Scan**

- **INDICATIONS-DIAGNOSTIC**
  - Diagnostic uncertainty (differentiating pancreatitis from other possible intra-abdominal catastrophes)
  - Severe acute pancreatitis - distinguish interstitial from necrotizing pancreatitis
    - Necrosis (non enhancement area > 30% or 3 cm) done at 72 hrs
  - Systemic complications:
    - Progressive deterioration, MOF, sepsis
  - Localized complications:
    - Altered fat and fascial planes, Fluid collection, pseudocyst, pseudoaneurysm,
    - Bowel distension, mesenteric edema, hemorrhage
Magnetic Resonant Cholangiopancreatography

**INDICATION:**

- diagnosis of suspected biliary and pancreatic duct obstruction in the setting of pancreatitis.
- Repeated attacks of idiopathic acute pancreatitis (Microlithiasis)
**Endoscopic Ultrasonography**

**INDICATIONS**

- **Repeated idiopathic acute pancreatitis**
  - occult biliary disease- small stones/sludge
  - *secretin-stimulated EUS* study may reveal resistance to ductal outflow at the level of the papilla,
    - as evidenced by dilatation of the pancreatic duct to a greater extent and longer duration than in a healthy population

- **Age >40 to exclude malignancy**
  - especially those with prolong or recurrent course
  - RATIONALE: 5 % CA pancreas present as AP
**Endoscopic Retrograde Cholangiopancreatography**

**INDICATION**
- Severe gallstone AP or AP with concurrent acute cholangitis/biliary obstruction/ biliary sepsis/jaundice (due to persistent stone)
- ERCP within 24(-72) h of admission
- Sphincterotomy/stent and bile duct clearance
- It reduces infective complications/mortality

**NOT INDICATED**
- Not needed early in most patients with gallstone pancreatitis who **lack laboratory or clinical evidence** of ongoing biliary obstruction
  - MRCP or EUS recommended if CBD stone still suspected
    - as risk of post-ERCP pancreatitis is greater with normal caliber bile duct and normal bilirubin
    - MRCP/EUS as accurate as diagnostic ERCP
SEVERITY SCORING SYSTEMS

ACUTE PANCREATITIS SPECIFIC SCORING SYSTEMS

- Ranson score
- Glagsow score
- Bedside Index for Severity in Acute Pancreatitis (BISAP) score
- Harmless Acute Pancreatitis Score (HAPS)
- Hong Kong Criteria

ACUTE PANCREATITIS NON-SPECIFIC SCORING SYSTEMS (ICU SCORING SYSTEMS)

- Acute Physiology And Chronic Health Evaluation (APACHE) II score
- Sequential Organ Failure Assessment (SOFA) score
Although *amylase/lipase* are used in diagnosing pancreatitis, they are **NOT** use for predicting severity of disease.

- i.e. patient with normal amylase(raised in 90% cases) levels may still have severe acute pancreatitis.
## Ranson Score 1974
(for alcohol pancreatitis)

<table>
<thead>
<tr>
<th>ON ADMISSION</th>
<th>AFTER 48 HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Age &gt; 55 yrs</td>
<td>- BUN rise &gt;5 mg/dL</td>
</tr>
<tr>
<td>- WBC &gt; 16,000/mm³</td>
<td>- PaO₂ &lt; 60 mmHg ( 8 KPa)</td>
</tr>
<tr>
<td>- BSR &gt; 200 mg/dL</td>
<td>- Serum Calcium &lt; 8 mg/dL</td>
</tr>
<tr>
<td>- AST &gt; 250 IU/L</td>
<td>- Base deficit &gt; 4 meq/L</td>
</tr>
<tr>
<td>- LDH &gt; 350 IU/L</td>
<td>- Fluid Sequestration &gt; 6000 mL</td>
</tr>
<tr>
<td>- Fluid Sequestration &gt; 6000 mL</td>
<td>- Hct fall &gt; 10 %</td>
</tr>
</tbody>
</table>

**NOTE:** Disease classified as SEVERE when 3 or more factors are present.
### Revised RANSON SCORE 1979
(for Gallstone pancreatitis)

<table>
<thead>
<tr>
<th>ON ADMISSION</th>
<th>AFTER 48 HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Age &gt; 70 years</td>
<td>- BUN rise &gt;5 mg/dL</td>
</tr>
<tr>
<td>- WBC &gt; 18,000/mm³</td>
<td>- PaO₂ &lt; 60 mmHg (8 KPa)</td>
</tr>
<tr>
<td>- BSR &gt; 220 mg/dL</td>
<td>- Serum Calcium &lt; 8 mg/dL</td>
</tr>
<tr>
<td>- AST &gt; 250 IU/L</td>
<td>- Base deficit &gt; 5 meq/L</td>
</tr>
<tr>
<td>- LDH &gt; 400 IU/L</td>
<td>- Fluid Sequestration &gt; 4000 ml</td>
</tr>
<tr>
<td></td>
<td>- Hct fall &gt; 10 %</td>
</tr>
</tbody>
</table>

**NOTE:** Disease classified as SEVERE when 3 or more factors are present.
# Ranson Score

<table>
<thead>
<tr>
<th>Ranson score</th>
<th>Mortality rate</th>
<th>SEVERITY</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>0-2 %</td>
<td>Mild</td>
<td>Admit in regular ward</td>
</tr>
<tr>
<td>3-5</td>
<td>10-20 %</td>
<td>Moderate</td>
<td>Admit in ICU/HDU</td>
</tr>
<tr>
<td>6-7</td>
<td>40 %</td>
<td>Severe</td>
<td>Associated with more systemic complications</td>
</tr>
<tr>
<td>&gt;7</td>
<td>&gt;50 %</td>
<td></td>
<td>Same as above</td>
</tr>
</tbody>
</table>
**BALTHAZAR CT severity index (CTSI) - 1994**

Mild (0-3)  
moderate (4-6)  
severe (7-10)

<table>
<thead>
<tr>
<th>CT Severity Index</th>
<th>Inflammation score + Necrosis score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prognostic Indicator</td>
<td>Points</td>
</tr>
<tr>
<td>Pancreatic inflammation</td>
<td></td>
</tr>
<tr>
<td>Normal pancreas</td>
<td>0</td>
</tr>
<tr>
<td>Focal or diffuse enlargement of the pancreas</td>
<td>1</td>
</tr>
<tr>
<td>Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat</td>
<td>2</td>
</tr>
<tr>
<td>Single, ill-defined fluid collection or phlegmon</td>
<td>3</td>
</tr>
<tr>
<td>Two or more poorly defined collections or presence of gas in or adjacent to the pancreas</td>
<td>4</td>
</tr>
<tr>
<td>Pancreatic necrosis</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>( \leq 30% )</td>
<td>2</td>
</tr>
<tr>
<td>( &gt; 30-50% )</td>
<td>4</td>
</tr>
<tr>
<td>( &gt; 50% )</td>
<td>6</td>
</tr>
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</table>
APACHE Scoring System

(Acute Physiology And Chronic Health Evaluation Score II)

- Immediate assessment of the severity of pancreatitis possible

- Unlike ALL pancreatic specific scoring systems, APACHE includes **clinical features** of patient besides laboratory values

- (Clinical findings are more important than lab findings in predicting SIRS, sepsis and other complications)
The APACHE II Severity of Disease Classification System

<table>
<thead>
<tr>
<th>Physiologic Variable</th>
<th>+4</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
<th>+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature - rectal (°C)</td>
<td>≥41</td>
<td>39-40.9</td>
<td>38.5-38.9</td>
<td>36-38.4</td>
<td>34-33.9</td>
<td>32-33.9</td>
<td>30-31.9</td>
<td>≤29.9</td>
<td></td>
</tr>
<tr>
<td>Mean Arterial Pressure (mm Hg)</td>
<td>≥160</td>
<td>130-159</td>
<td>110-129</td>
<td>70-109</td>
<td>50-69</td>
<td>≤49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart Rate</td>
<td>≥180</td>
<td>140-170</td>
<td>110-139</td>
<td>70-100</td>
<td>55-69</td>
<td>40-54</td>
<td>≤39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate (ventilated or not)</td>
<td>≥50</td>
<td>35-49</td>
<td>25-34</td>
<td>12-24</td>
<td>10-11</td>
<td>6-9</td>
<td>≤5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygenation (mm Hg)</td>
<td>a</td>
<td>≥500</td>
<td>350-499</td>
<td>200-349</td>
<td>&lt;200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>FiO2 &lt; 0.5 use A-aDO2</td>
<td>≥70</td>
<td>61-70</td>
<td>55-60</td>
<td>&lt;55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial pH</td>
<td>≥7.7</td>
<td>7.6-7.69</td>
<td>7.5-7.59</td>
<td>7.33-7.49</td>
<td>7.25-7.32</td>
<td>7.15-7.24</td>
<td>≤7.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Sodium (mmol/l)</td>
<td>≥180</td>
<td>160-179</td>
<td>155-159</td>
<td>150-154</td>
<td>140-149</td>
<td>120-129</td>
<td>111-119</td>
<td>≤110</td>
<td></td>
</tr>
<tr>
<td>Serum Potassium (mmol/l)</td>
<td>≥7</td>
<td>6-6.9</td>
<td>5.5-5.9</td>
<td>3.5-5.4</td>
<td>3-3.4</td>
<td>2.5-2.9</td>
<td>≤2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Creatinine (mg/dl, Double point score for acute renal failure)</td>
<td>≥1.3</td>
<td>2.3-4</td>
<td>1.5-3.9</td>
<td>0.6-1.4</td>
<td>&lt;0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>≥40</td>
<td>30-40.9</td>
<td>40-49.9</td>
<td>40-43.9</td>
<td>20-29.9</td>
<td>&lt;20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Blood Count (in 1000/mm³)</td>
<td>≥240</td>
<td>15-20</td>
<td>10-15</td>
<td>5-10</td>
<td>≤5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glasgow-Coma Scale (GCS)</td>
<td>Score = 15 minus actual GCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum HCO3 (venous, mmol/l, if no ABGs)</td>
<td>≥25</td>
<td>41-51.9</td>
<td>32-40.9</td>
<td>22-31.9</td>
<td>18-21.9</td>
<td>15-17.9</td>
<td>≤15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A = Total Acute Physiology Score

APS

B = Age Points

C = Chronic Health Points

If the patient has a history of severe organ system insufficiency or is immunocompromised assign points as follows:

- a. For nonoperative or emergency postoperative patients – 5 points
- b. For elective postoperative patients – 2 points

APACHE II Score = Sum of A (APS points) + B (Age points) + C (Chronic Health points)

DEMERITS OF AP-specific scoring systems (ACG 2013)

- **No** single laboratory test is accurate to predict severity in patients with AP.
  - Even the acute-phase reactant **CRP**, the most widely studied inflammatory marker in AP, is not practical as it takes 72 h to become accurate.

Thus, in the absence of any available test to determine severity, close examination to assess early fluid losses, hypovolemic shock, and symptoms suggestive of organ dysfunction is crucial.

- **CT** and/or MRI imaging also cannot determine severity early in the course of AP, as necrosis usually is not present on admission and may develop after 24 – 48 h.
MANAGEMENT
Mild Acute Pancreatitis

- mild and self-limiting, needing only brief hospitalization.
- Rehydration by **IV fluids**
- Frequent **non-invasive observation/monitoring**
- **Brief period of fasting** till pain/vomiting settles
  - Little physiological justification for prolonged NPO
- No medication required other than **analgesics** (important) and **anti-emetics**
  - Antibiotics not indicated in absence of signs or documented sources of infection
  - Pain results in ongoing cholinergic discharge, stimulating gastric and pancreatic secretions
  - Avoid Morphine—cause sphincter of Oddi spasm
- **Metabolic support**
  - Correction of electrolyte imbalance
Modified WHO analgesic Ladder

Figure: New adaptation of the analgesic ladder

**STEP 1**
Nonopioid analgesics
NSAIDs

**STEP 2**
Weak opioids

**STEP 3**
Strong opioids
Methadone
Oral administration
Transdermal patch

**STEP 4**
Nerve block
Epidurals
PCA pump
Neurolytic block therapy
Spinal stimulators

- Chronic pain
- Non-malignant pain
- Cancer pain

NSAIDs (with or without adjuvants at each step)

Neurosurgical procedures

Acute pain
Chronic pain without control
Acute crises of chronic pain

No or little role of......................

- Nasogastric suction
- $H_2$-blockers
- Secretion-inhibiting drugs
  - Atropine, calcitonin, somatostatin and its analogue (Octreotide)
  - glucagon and fluorouracil
- Protease inhibiting drugs
  - Aprotinin, gabexate mesylate, camostate, phospholipase A$_2$ inhibitors, FFP
- Indomethacin or PG inhibitors
<table>
<thead>
<tr>
<th>CLINICAL</th>
<th>INVESTIGATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vitals</td>
<td>• Baselines</td>
</tr>
<tr>
<td>• UOP</td>
<td>• Serial ABGs</td>
</tr>
<tr>
<td>• CV pressure</td>
<td>• Serial BSR</td>
</tr>
<tr>
<td></td>
<td>• Serum calcium/magnesium</td>
</tr>
</tbody>
</table>
ACG 2013 Recommendations

- Despite dozens of randomized trials, no medication has been shown to be effective in treating AP.

- However, an effective intervention has been well described: **EARLY AGGRESSIVE IV hydration**.
Rationale for **EARLY AGGRESSIVE IV hydration**

- Frequent hypovolemia due to
  - vomiting,
  - reduced oral intake,
  - third spacing of fluids (increased vascular permeability)
  - increased respiratory losses, and
  - diaphoresis.

- Combination of microangiopathic effects and edema of the inflamed pancreas decreases blood flow, leading to increased cellular death, necrosis, and ongoing release of pancreatic enzymes activating numerous cascades.

*provides micro- and macrocirculatory support to prevent serious complications such as pancreatic necrosis*
EARLY AGGRESSIVE IV hydration

<table>
<thead>
<tr>
<th>Kon sa?</th>
<th>Lactated Ringer’s solution may be the preferred isotonic crystalloid replacement fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Normal saline given in large volumes may lead to the development of a non-anion gap, hyperchloremic metabolic acidosis and increased chances of SIRS</td>
</tr>
<tr>
<td></td>
<td>• Low pH activates the trypsinogen, makes the acinar cells more susceptible to injury and increases the severity of established AP</td>
</tr>
</tbody>
</table>

| Kab?    | Early aggressive IV hydration is most beneficial during the first 12 – 24 h, and may have little benefit beyond this time period |

| Kitna?  | Aggressive hydration, defined as 250 – 500 ml per hour of isotonic crystalloid solution should be provided to all patients, unless cardiovascular, renal, or other related comorbid factors exist. |
EARLY AGGRESSIVE IV hydration

- Hematocrit and BUN has been widely recommended as surrogate markers for successful hydration.
- In elderly and cardiac/renal comorbidities hydration is monitored by
  - Central venous pressure via CV line or
  - Intrathoracic blood volume index
    - Better/more accurate correlate with cardiac index than CVP
Antibiotics

- **Routine use** NOT recommended (ACG 2013) as
  - Prophylaxis in severe AP
  - Preventive measure in sterile necrosis to prevent development of infected necrosis

- **Indicated in**
  - Established infected pancreatic necrosis or
  - Extraperitoneal infections
    - Cholangitis, catheter-acquired infections, bacteremia, UTIs, pneumonia

*Routine use of antifungal agents along with prophylactic or therapeutic antibiotics NOT recommended (ACG 2013)*
Antibiotics

- Few antibiotics penetrate due to consistency of pancreatic necrosis
  - cefuroxime, or imipenem, or ciprofloxacin plus metronidazole
Nutrition

- In mild AP
  - Oral feedings can be started immediately if there is no nausea/vomiting, and the abdominal pain/tenderness/Ileus has resolved (amylase return to normal, patient feel hunger)
  - Initiation of feeding with a small and slowly increasing low-fat (low-protein) soft diet appears as safe as a clear liquid diet, providing more calories
    - Stepwise manner increase from clear liquids to soft diet NOT necessary

- In severe AP
  - Enteral route is recommended to prevent infectious complications
  - Parenteral nutrition should be avoided, unless enteral route is not available, not tolerated, or not meeting caloric requirements
RATIONALE OF EARLY ENTERAL NUTRITION

- The need to place pancreas at rest until complete resolution of AP no longer seem imperative
  - Bowel rest associated with intestinal mucosal atrophy and bacterial translocation from gut and increased infectious complications

- Early enteral feeding maintains the gut mucosal barrier, prevents disruption, and prevents translocation of bacteria that seed pancreatic necrosis
  - Decrease in infectious complications, organ failure and mortality
<table>
<thead>
<tr>
<th>RATIONALE</th>
<th>MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREVENTION OF STERILE NECROSIS</td>
<td>Early aggressive IV hydration</td>
</tr>
<tr>
<td>PREVENTION OF INFECTED NECROSIS</td>
<td>Early enteral feeding (NOT antibiotics)</td>
</tr>
<tr>
<td>TREATMENT OF INFECTED NECROSIS</td>
<td>Antibiotics, drainage, necrosectomy</td>
</tr>
</tbody>
</table>

Rather than using antibiotics to prevent infected necrosis, start early enteral feeding to prevent translocation of bacteria.
Route of enteral Nutrition

Traditionally naso-jejunal route has been preferred to avoid the gastric phase of stimulation BUT

- Nasogastric route appears comparable in efficacy and safety

<table>
<thead>
<tr>
<th>MERITS OF NASOGASTRIC ROUTE</th>
<th>DEMERITS OF NASOGASTRIC ROUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG tube placement is far easier than nasojejunal tube placement (requiring interventional radiology or endoscopy, thus expensive) especially in HDU/ICU setting</td>
<td>Slight increased risk of aspiration (Can be overcome by placing patient in upright position and be placed on aspiration precautions)</td>
</tr>
</tbody>
</table>
Role of Surgery in AP

- Cholecystectomy should be performed **before discharge** to prevent a recurrence of AP
  - Within 48-72 hour od admission or briefly delay intervention (after 72 hrs but during same admission)
  - Along with intraoperative cholangiography and any remaining CBD stones can be dealt with intra/post operative ERCP or
  - Along with preoperative EUS or MRCP

- In case of necrotizing biliary AP, in order to prevent infection, cholecystectomy is to be **deferred** until active inflammation subsides and fluid collections resolve or stabilize

- Cholecystectomy done for recurrent AP (IAP) with no stones/sludge on USG and no significant elevation of LFTs is associated with >50% recurrence of AP

If patient unfit for surgery (comorbid/elderly), **biliary sphincterotomy** alone may be effective to reduce further attacks of AP
<table>
<thead>
<tr>
<th>Asymptomatic</th>
<th>Sterile necrosis</th>
<th>infected necrosis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Does not mandate intervention regardless of size, location and extension</td>
<td>surgical, radiologic, and/or endoscopic drainage should be delayed preferably for more than 4 weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• to allow liquefaction of the contents and the development of a fibrous wall around the necrosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initially treated with antibiotics</td>
<td>Stable</td>
</tr>
<tr>
<td>Symptomatic (associated with GOO or bile obstruction)</td>
<td>minimally invasive methods of necrosectomy are preferred to open necrosectomy</td>
<td>Urgent debridement</td>
<td>unstable</td>
</tr>
</tbody>
</table>

Minimally invasive approach: laparoscopic surgery (ant or retroperitoneal approach), percutaneous radiologic catheter drainage or debridement, video-assisted or small incision-based left retroperitoneal debridement, and endoscopy
When to Discharge

- Pain is well controlled with oral analgesia
- Able to tolerate an oral diet that maintains their caloric needs, and
  - all complications have been addressed adequately

Follow up

- Routine clinical follow-up care (typically including physical examination and amylase and lipase assays) is needed to monitor for potential complications of the pancreatitis, especially pseudocysts.
  - Within 4 weeks
Idiopathic Recurrent AP

**CT scan**
- If neoplasia or chronic pancreatitis is found
- Addressed and treated accordingly.

**MRCP**
- Shows developmental abnormalities, strictures, or evidence of chronic pancreatitis
- Endoscopic or surgical treatment may be of benefit in a subset of patients

**EUS**
- Microlithiasis/biliary sludge → Cholecystectomy
- Periammpullary mass missed on CT or MRCP

**Genetic**
- Cationic trypsinogen mutations, *SPINK1* mutations, or *CFTR* mutations

**ERCP**
- Sphincter of Oddi manometry
- **Placed last** because very high rate of post-ERCP pancreatitis (benefits < risk)
## Prognosis

<table>
<thead>
<tr>
<th>TYPE OF AP</th>
<th>MORTALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>10-15 % (Biliary&gt;alcholic)</td>
</tr>
<tr>
<td>Mild Acute Pancreatitis (80 % cases)</td>
<td>1 %</td>
</tr>
<tr>
<td>Severe Acute Pancreatitis (20 % cases)</td>
<td>Severe → 20-50 %</td>
</tr>
<tr>
<td>&lt;1 week</td>
<td>1/3 cases</td>
</tr>
<tr>
<td>&gt;1 week</td>
<td>2/3 cases</td>
</tr>
<tr>
<td></td>
<td>MOF</td>
</tr>
<tr>
<td></td>
<td>Sepsis (+MOF)</td>
</tr>
</tbody>
</table>
Pseudocyst
Splenic Infarct
ARDS
Acute Pancreatitis

Complications

A **pancreatic pseudoaneurysm** is a malformation in the vessels of the pancreas and/or peripancreatic bed.

![CT scan with intravenous contrast enhancement within a pancreatic pseudocyst indicating the presence of a pseudoaneurysm.](image1)

![Mesenteric artery angiogram demonstrating contrast extravasating into a pseudoaneurysm](image2)
Purtscher Retinopathy: Uncommonly Recognized Complication of Acute Pancreatitis

Figure 1 and 2: Bilateral dilated fundoscopic exam illustrating cotton wool spots, peripapillary hemorrhages and mild macular edema consistent with Purtscher Retinopathy.
THANK YOU........