Acute Pancreatitis

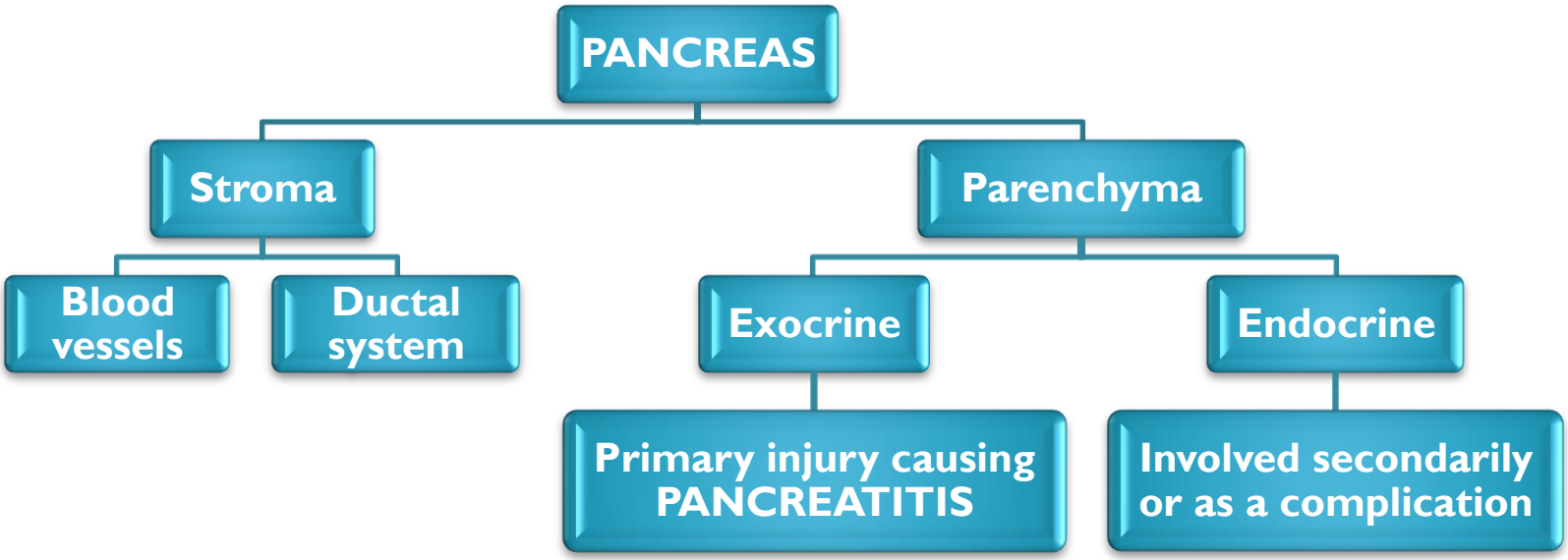
Prof .Yaser Rayyan MD,FACP,FASGE
JUSOM

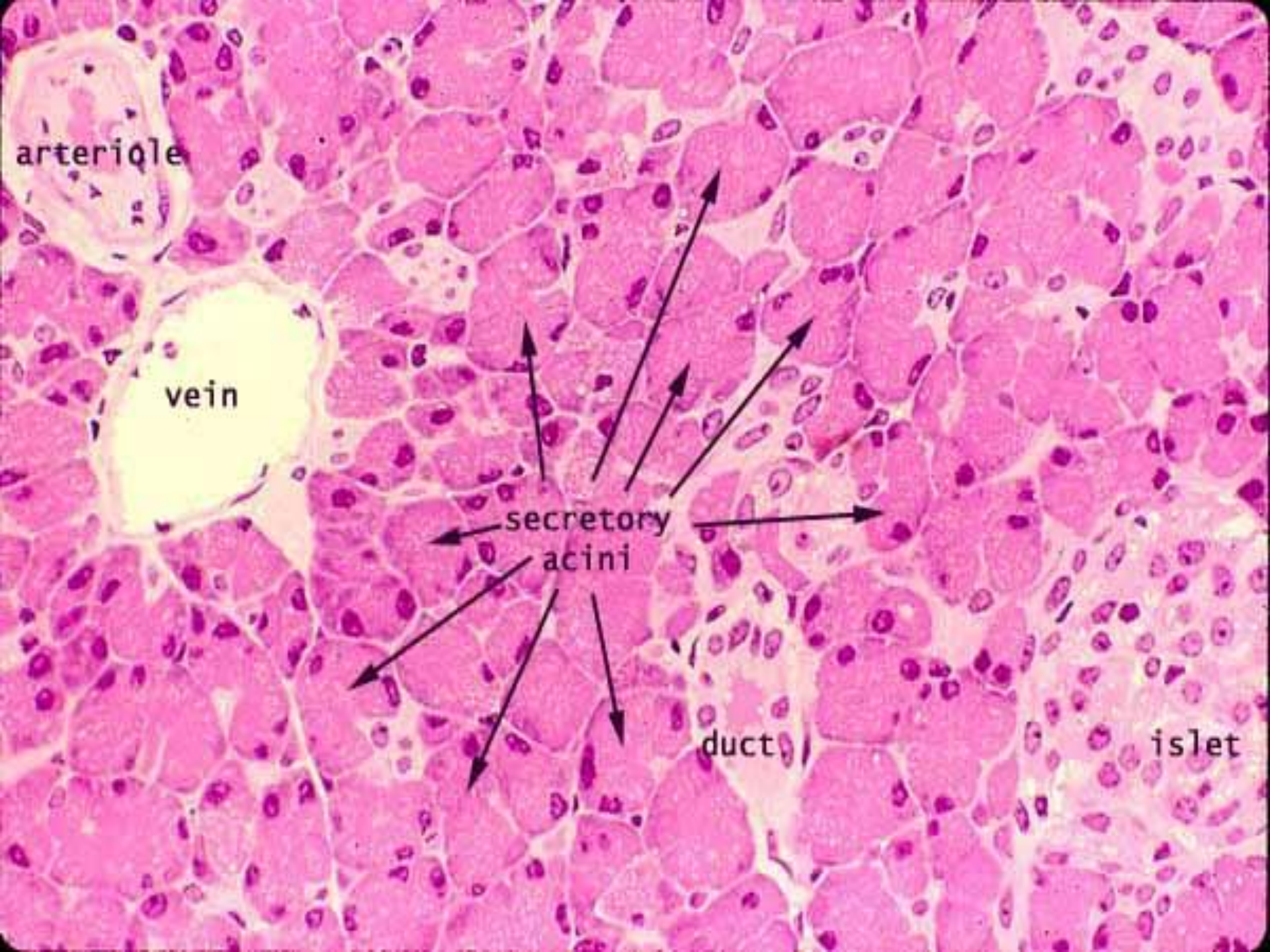
Outline

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

PANCREATITIS

Inflammation in pancreas associated with injury to exocrine parenchyma




arteriole
vein
secretory
acini
duct
islet

ACUTE PANCREATITIS

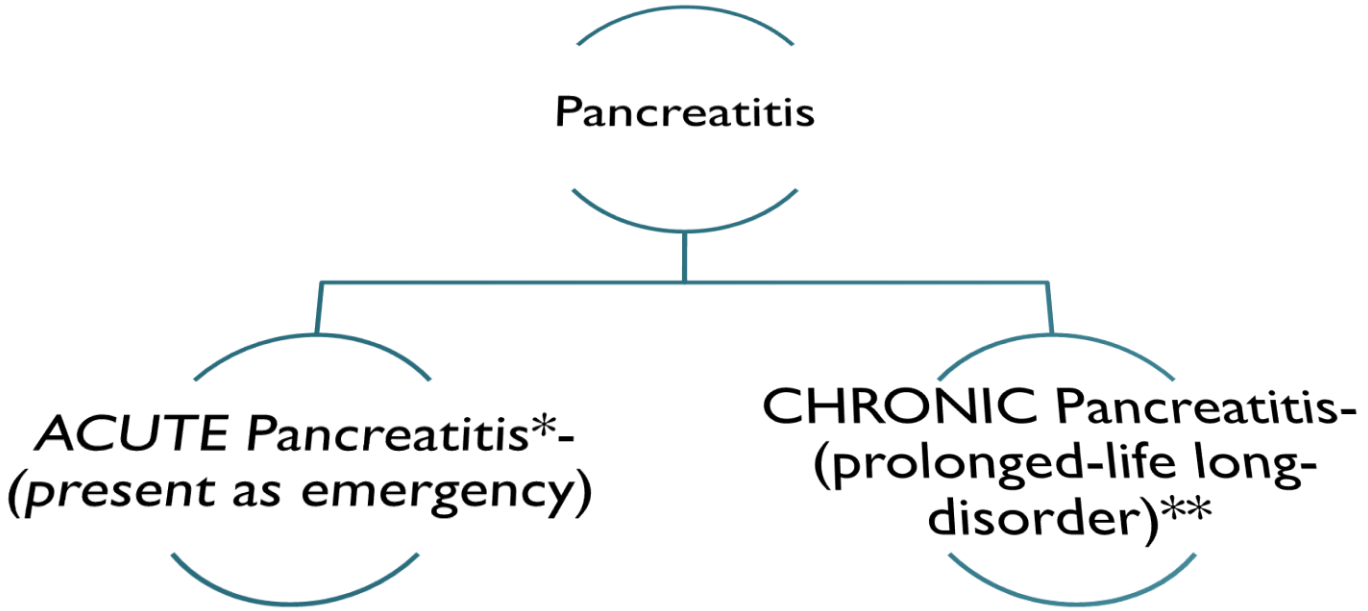
- CLINICAL DEFINITION
  - **Abdominal Pain-Typical**
  - **Elevated Pancreatic Enzymes**
  - **Imaging studies**
- PATHOLOGICAL DEFINITION
  - Reversible* pancreatic parenchymal injury associated with inflammation

---

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

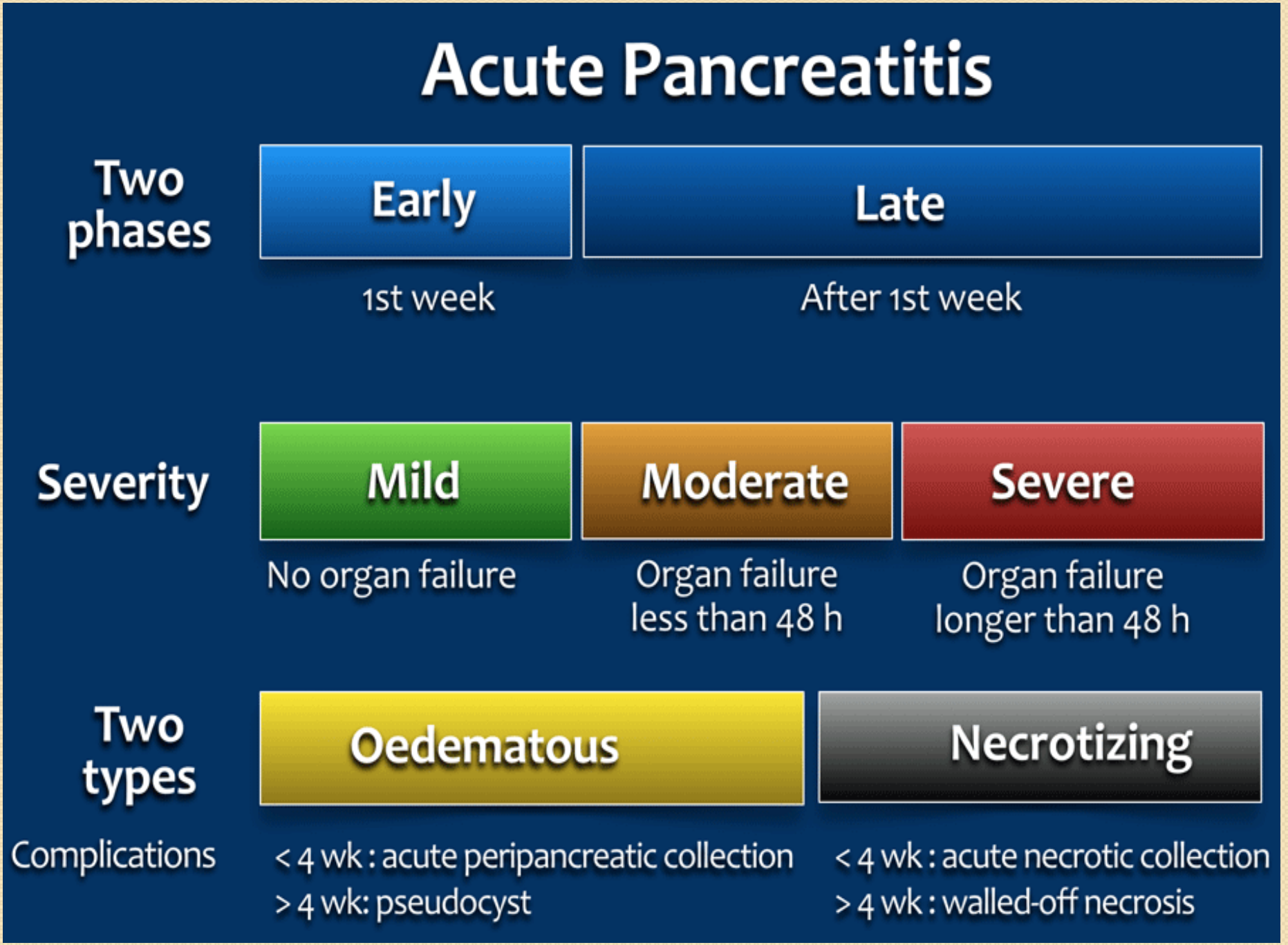
*Recurrent attacks with irreversible parenchymal injury leading to impairment of function and morphologic loss is chronic pancreatitis

CLINICAL CLASSIFICATION



*Considered a phase of chronic pancreatitis
** resulting from fibrosis within pancreas

Acute Pancreatitis



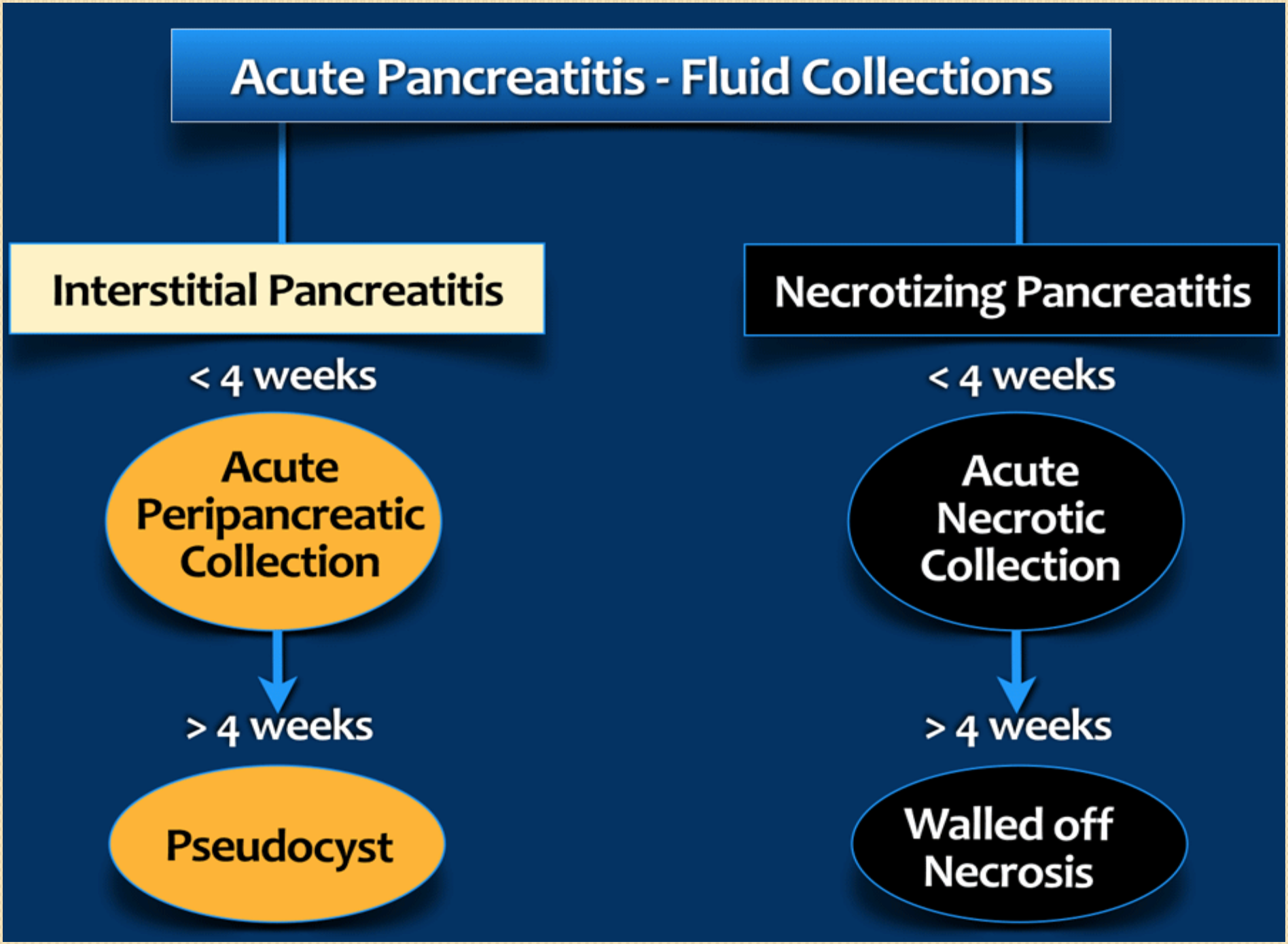
CLASSIFICATION OF ACUTE PANCREATITIS

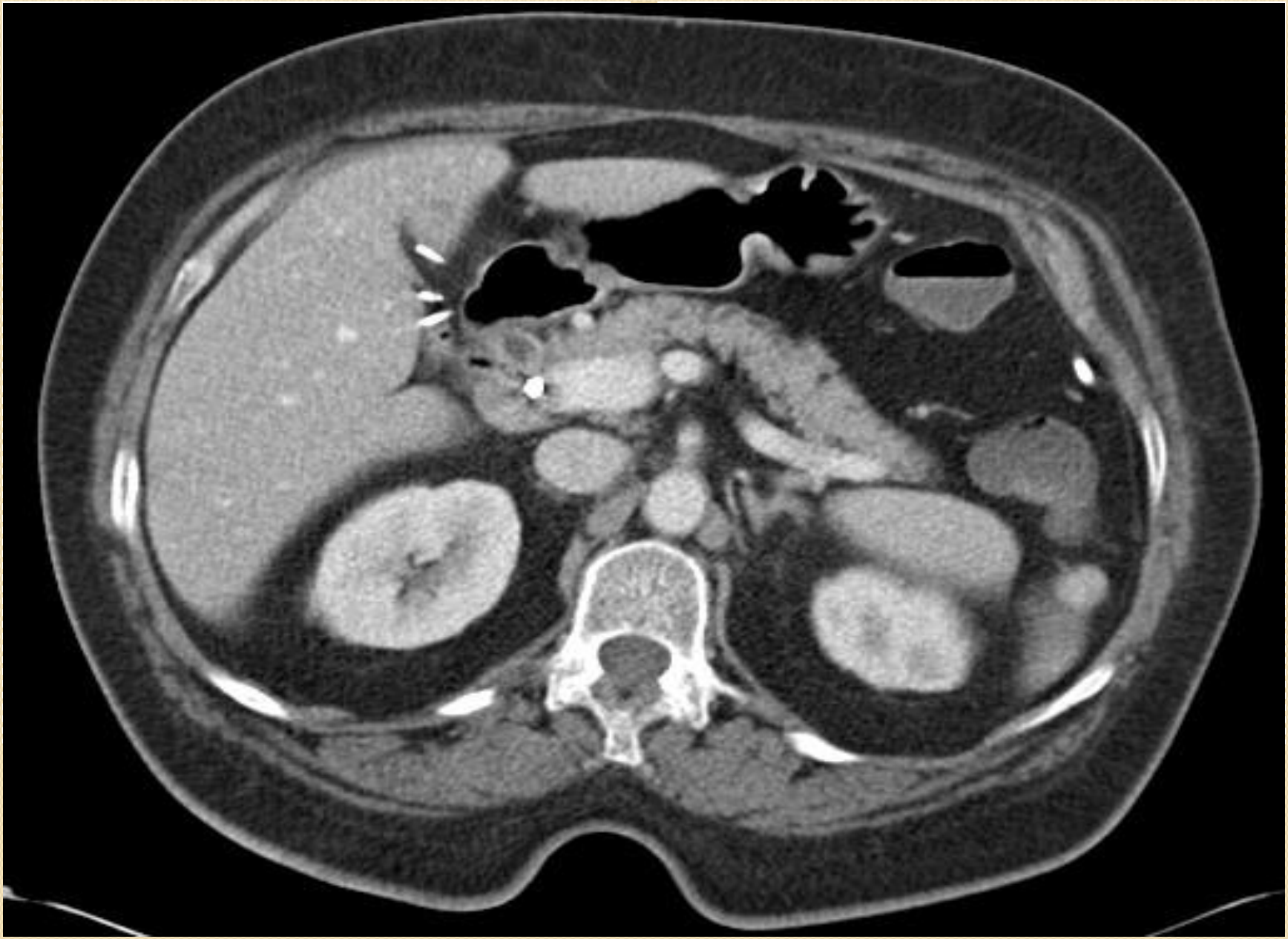
- Mild acute pancreatitis (80% cases)

  (Acute Interstitial/edematous pancreatitis)
  - Absence of organ failure
  - Absence of local complications

- Severe acute pancreatitis(20 % cases)

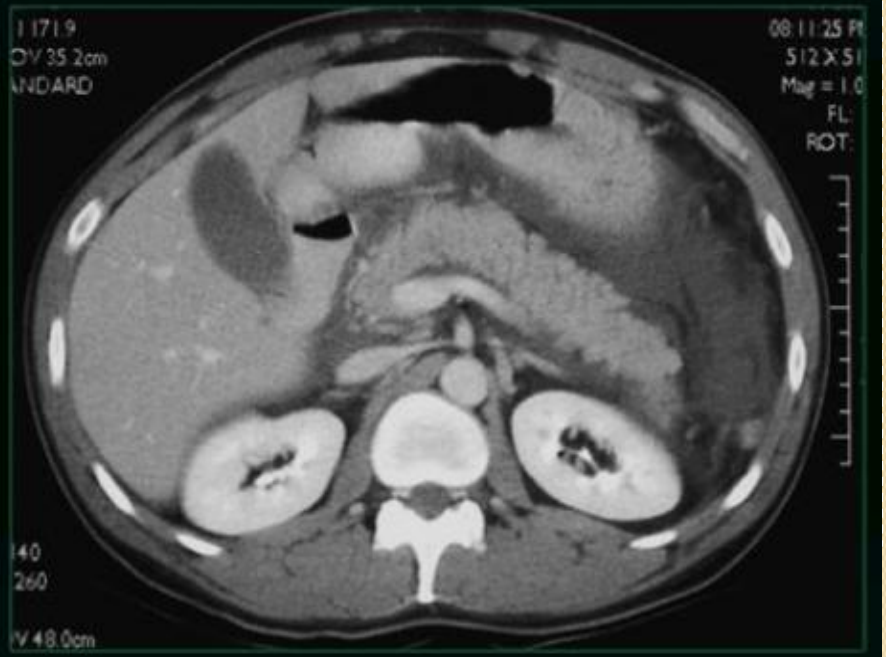
  (Acute Hemorrhagic Necrotizing (fulminant) pancreatitis)
  - Local complications **+/-**
  - Organ failure defined as
    - SBP < 90 mm Hg
    - $PaO_2 \leq 60$ mm Hg
    - GI bleed ≥ 500 ml/24 hrs
    - Cret ≥ 2 mg/dL after rehydration
  - Ranson score ≥ 3
  - or APACHE ≥ 8


Acute Pancreatitis - Fluid Collections
Interstitial Pancreatitis
Necrotizing Pancreatitis
< 4 weeks
< 4 weeks
Acute Peripancreatic Collection
Acute Necrotic Collection
> 4 weeks
> 4 weeks
Pseudocyst
Walled off Necrosis



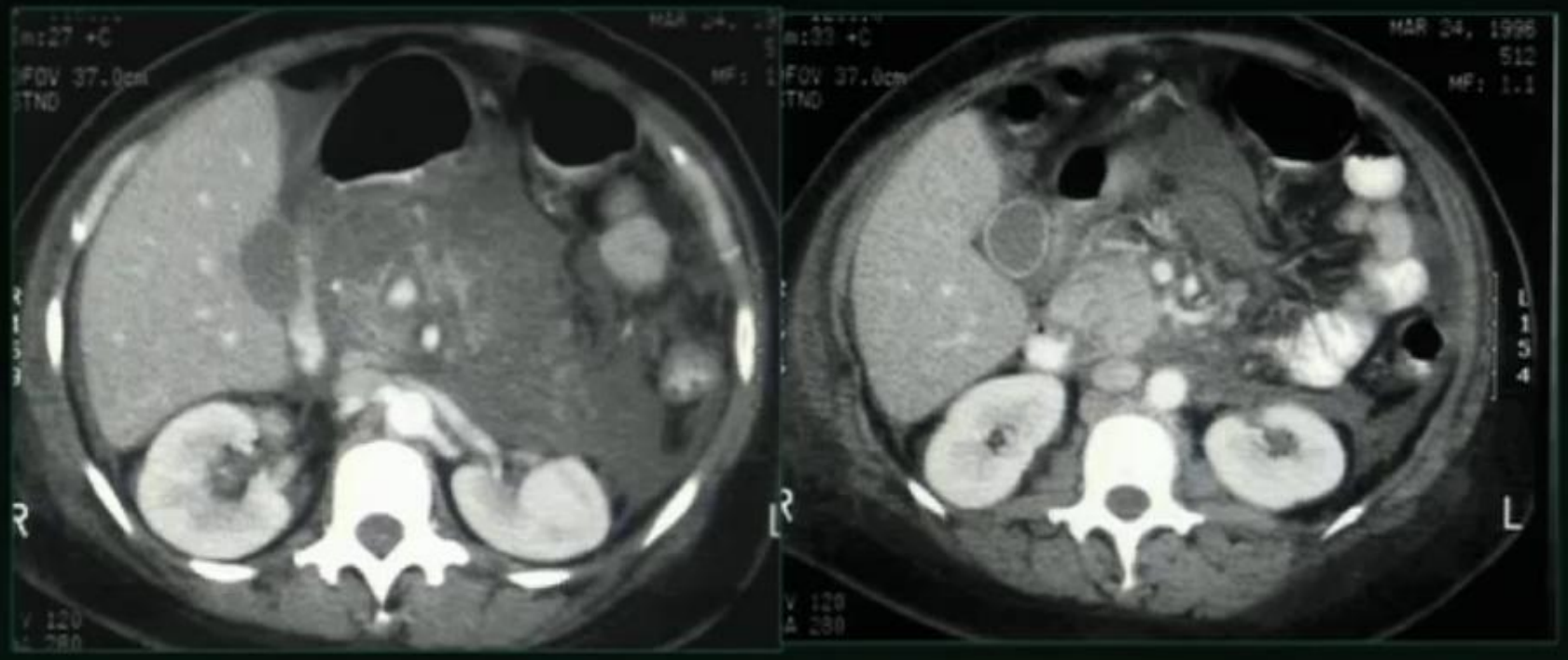
Acute Fluid Collection =
Acute peripancreatic fluid collection (APFC)

- 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 100,000n of population per year

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

Epidemiology

Median ages of onset for various etiologies

Etiology	Median Ages of onset
Alcohol-related	**39 years**
Biliary tract–related	**69 years**
Trauma-related	66 years
Drug-induced etiology	42 years
ERCP-related	58 years
AIDS-related	31 years
Vasculitis-related	36 years

Epidemiology

Gender Predilection

Generally→ M>F

In males→ more often related to alcohol

In females→ more often related to biliary tract disease

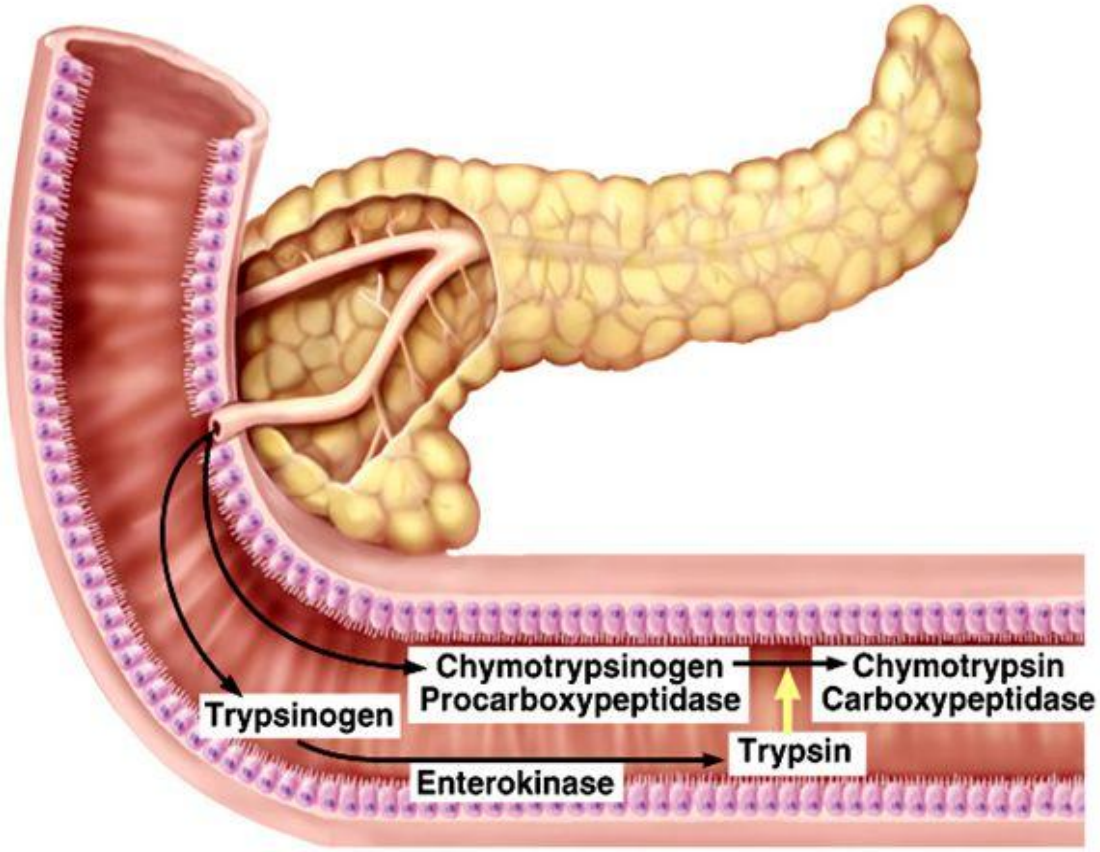
Race

→3 times higher for blacks than whites

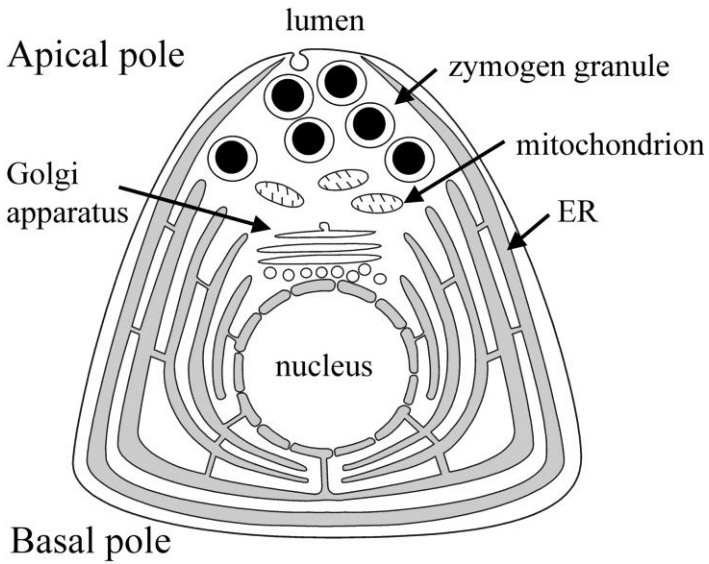
PATHOPHYSIOLOGY

Autodigestion *of pancreatic substance by* ***inappropriately activated*** *pancreatic enzymes (especially* ***trypsinogen****)*

Activation of Zymogens

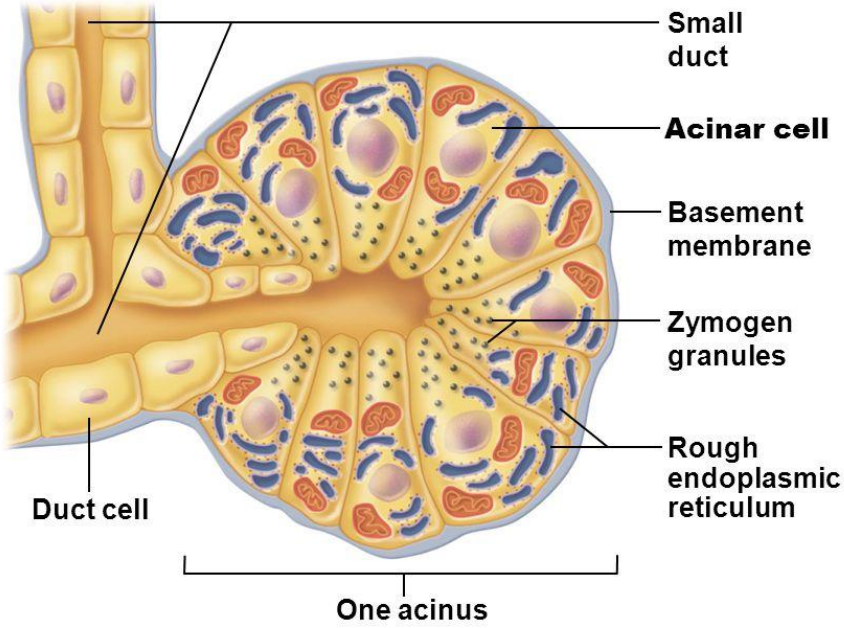


- Trypsinogen converted to trypsin by intestinal epithelium
- Trypsin converts other 2 as well as digests dietary protein



Premature enzymes
Trypsin inhibitor
Zymogen granules

Figure 23.26a **Enzyme-producing tissue of pancreas**



ANATOMY AND PHYSIOLOGY

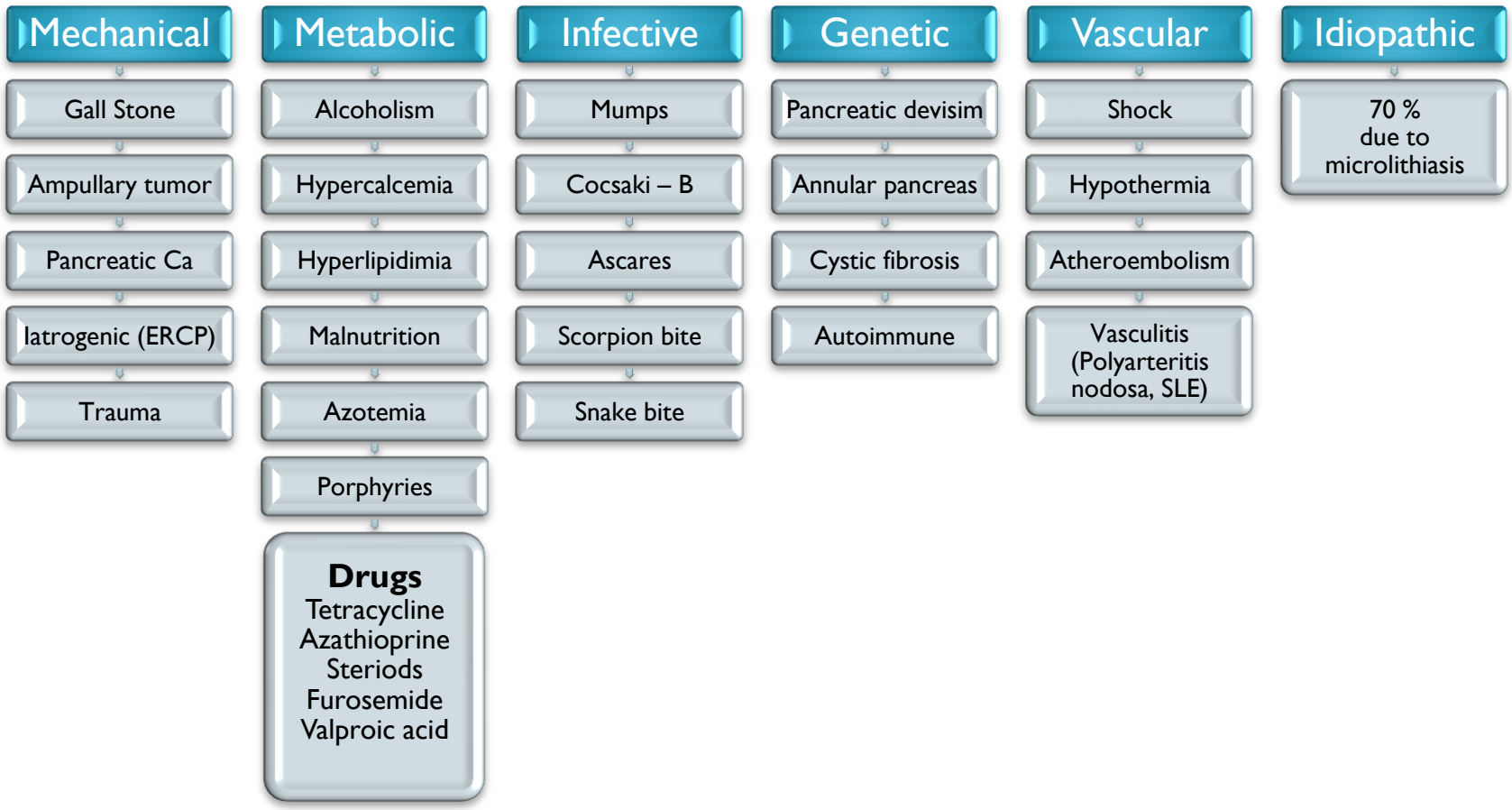
Protection

- **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

PATHOPHYSIOLOGY

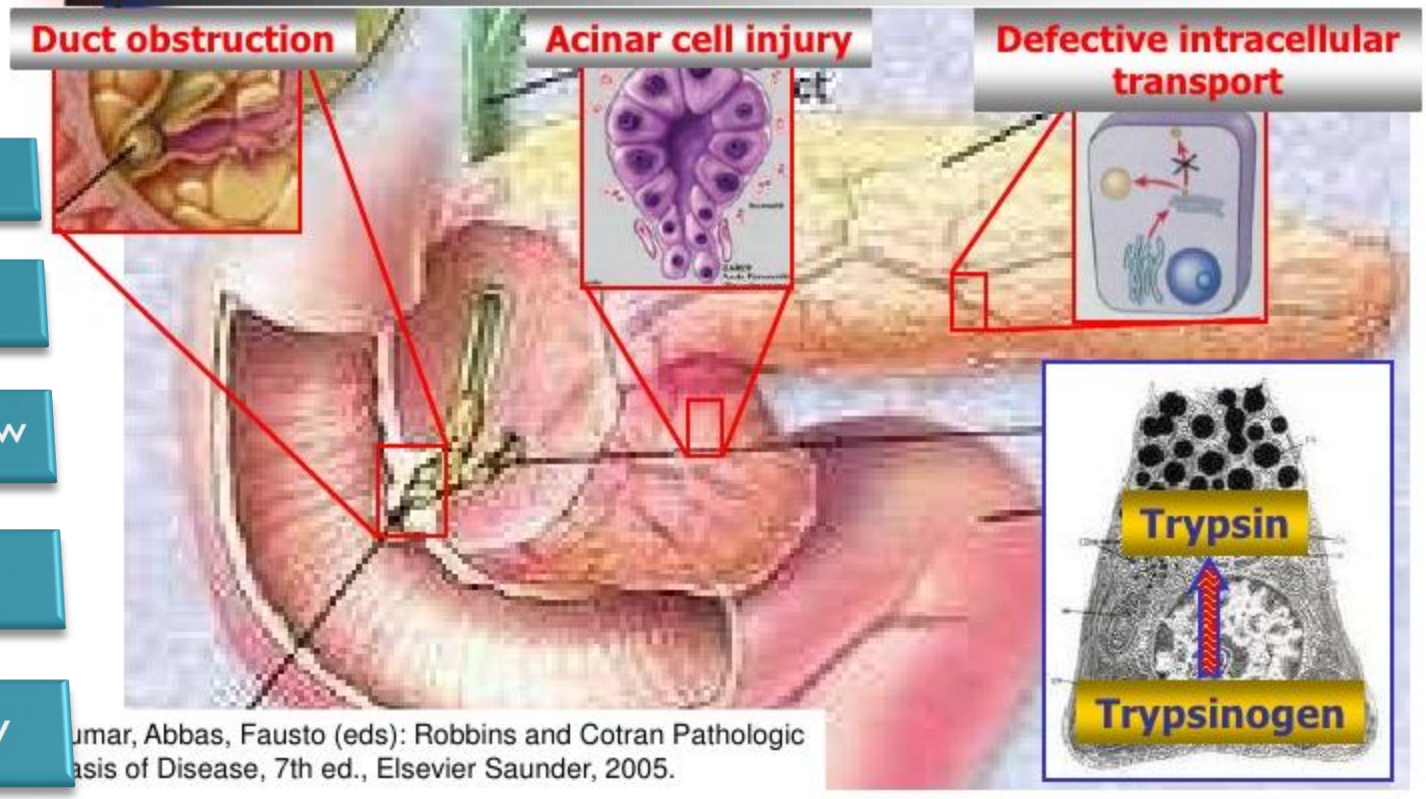
TRYPSINOGEN → TRYPSIN	Activation of **Hageman factor-XII**	Activation of **clotting** and **complement** systems→ **thrombosis** → Splenic vein thrombosis
	Lipase activation→ Triglycerides→ Glycerol + Fatty acids	Fatty acids+ calcium → Saponification → **Hypocalcemia**
	Elastase activation→ Digestion of elastic fibers→ Capillary leak/rupture Psudoanurysm	3rd space Sequestration of blood/fluid → **Hemorrhage+ Hypovolemic shock**
	Activation of **Lysolecithinase** (derived from bile)	Membrane damage→ Necrosis
	Release of **inflammatory mediators** into circulation	systemic complications

Etiology of Pancreatitis



Pathophysiology –acute biliary pancreatitis

- Duct Obstruction
- Interstitial edema
- Impaired blood flow
- Ischemia
- Aciner cell Injury



umar, Abbas, Fausto (eds): Robbins and Cotran Pathologic
asis of Disease, 7th ed., Elsevier Saunder, 2005.

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**

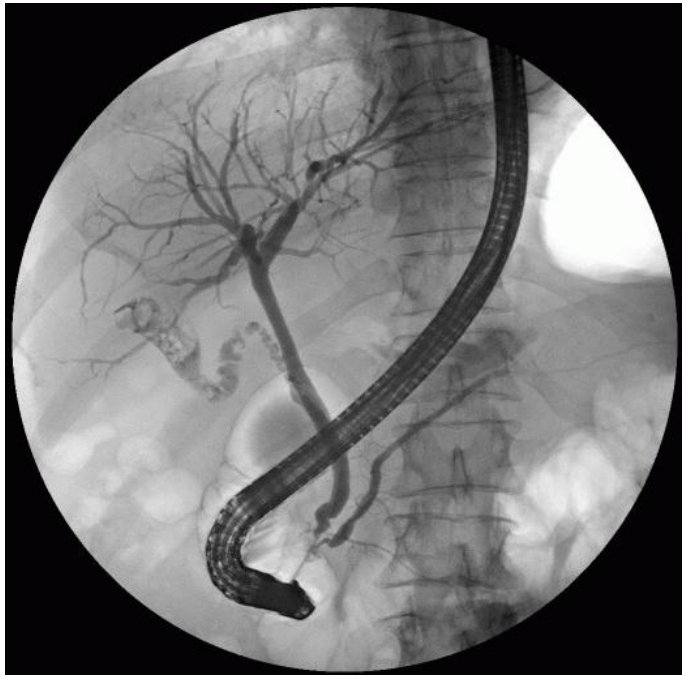
Post-ERCP Pancreatitis

- 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
- **RELEIVING 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

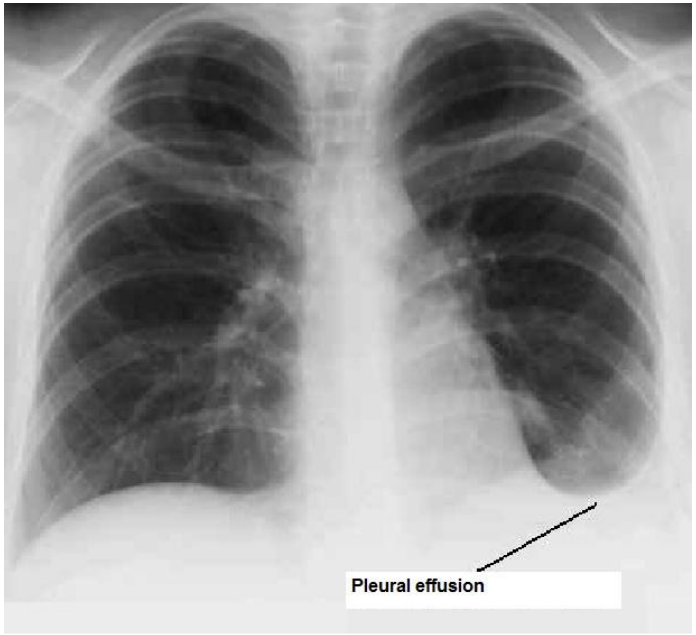
- **CARDIOVASCULAR**
  - Shock- hypovolemic and septic
  - Arrhythmias/pericardial effusion/sudden death
  - ST-T nonspecific changes
- **Pulmonary**
  - Respiratory failure/pneumonia/atelectasis/pleural effusion
  - Acute Respiratory Distress Syndrome (ARDS)
- **Renal Failure**
  - Oliguria
  - Azotemia
  - Renal artery/vein thrombosis
- **Hematological**
  - Hemoconcentation
  - 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

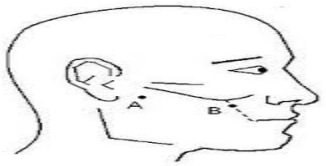
Left sided* Pleural effusion(10-20%) - exudative

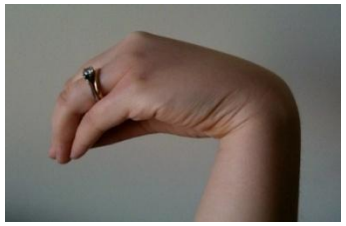


* Due to close approximation of body and tail of pancreas to the left sided diaphragm

MANIFESTAIONS OF COMPLICATIONS

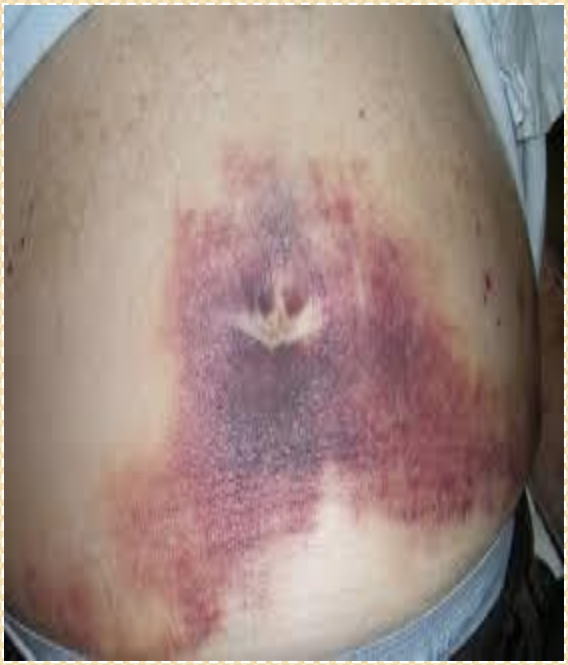
- **Hypocalcaemia**
  - circumoral numbness or paresthesia (1st symtpom to develop).
  - carpopedal spasm .
  - Laryngospasm.
  - generalized seizures
  - Chvostek sign :
    - Depending on calcium level, graded response occur: twitching first at angle of mouth, then by nose, the eye and the facial muscles
    - 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(postive even before tetany/hyperreflxia)



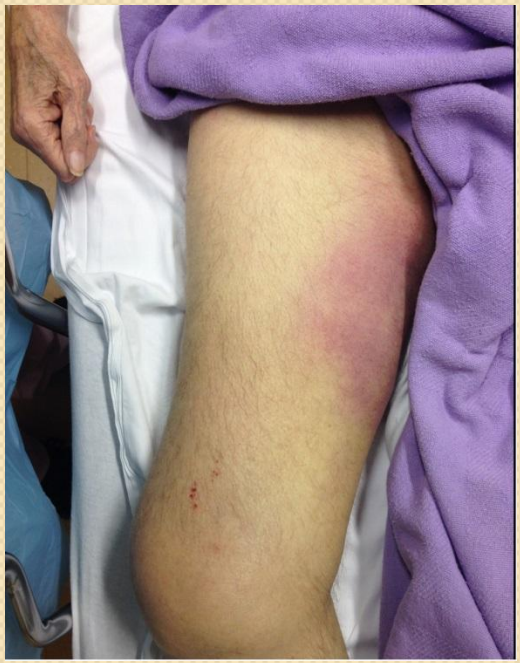


GREY TURNER[1] SIGN

CULLEN[2] SIGN



FOX[3] SIGN



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

ABDOMINAL CONDITONS

- 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 CONDITONS

- Ectopic pregnancy
- Salpingtis

SYSTEMIC CONDITIONS

- DKA

DIFFERENTIAL DIAGNOSIS

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 hemetemesis/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**

Acid-Base Disturbance	Etiology
Metabolic (Lactic)**acidosis** with high anion gap	Hypovolemic shock
Hypokalemic Hypochloremic metabolic alkalosis	persistent vomiting
Respiratory acidosis	ARDS

- **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.

Raised Amylase → may not AP

Normal Amylase → may be AP

  - **Serum Lipase:**
    - more sensitive/specific than amylase
    - Remains elevated longer than amylase(12 days)
    - Useful in late presentation and if the cause is High TG

SERUM INDICATOR OF HIGHEST PROBABILITY OF DISEASE

- **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

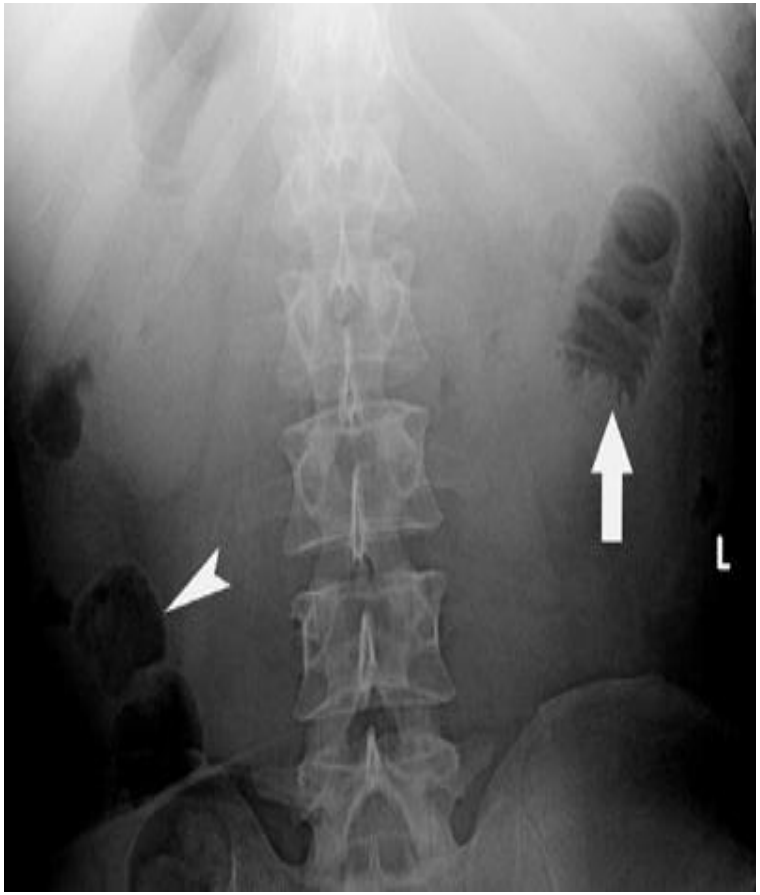
OTHERS

- **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



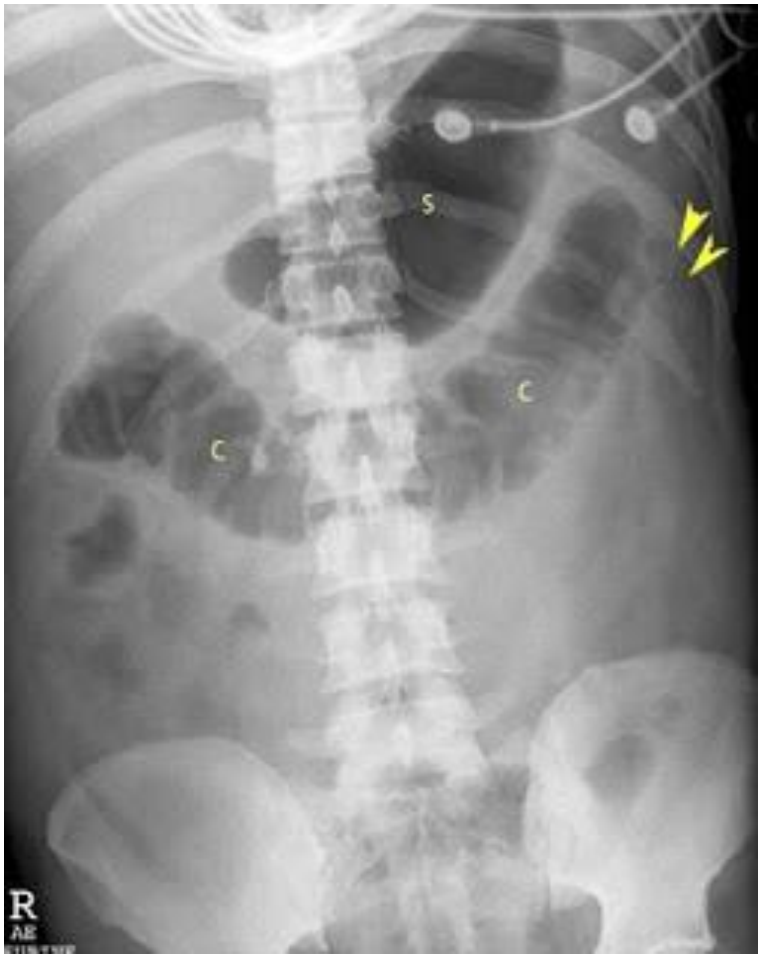
Plain X-ray abdomen erect AP view

- **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

  - **RANTIONALE**: 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 cholecystits 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, psduoaneurysm,
    - Bowel distension, mesenteric edema, hemorrhage

Magnetic **R**esonant **C**holangio**p**ancreatography

- 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
- **B**edside **I**ndex for **S**everity in **A**cute **P**ancreatitis(BISAP) score
- **H**armless **A**cute **P**ancreatitis **S**core(HAPS)
- Hong Kong Criteria

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

- **A**cute **P**hysiology **A**nd **C**hronic **H**ealth **E**valuation(APACHE) II score
- **S**equential **O**rgan **F**ailure **A**ssessment(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)

ON ADMISSION	AFTER 48 HOURS
• Age > 55 yrs	• BUN rise >5 mg/dL
• WBC > 16,000/mm3	• $Pa0_2$ < 60 mmHg (8 KPa)
• BSR > 200 mg/dL	• Serum Calcium < 8 mg/dL
• A**S**T > 250 IU/L	• Base deficit > 4 meq/L
• LDH > 350 IU/L	• Fluid Sequestration > 6000 mL
	• Hct fall > 10 %

NOTE: Disease classified as SEVERE when 3 or more factors are present

Revised RANSON SCORE-1979
(for Gallstone pancreatitis)

ON ADMISSION	AFTER 48 HOURS
• Age > 70 years	• BUN rise >5 mg/dL
• WBC > 18,000/mm^3	• $Pa0_2$ < 60 mmHg (8 KPa)
• BSR > 220 mg/dL	• Serum Calcium < 8 mg/dL
• A**S**T> 250 IU/L	• Base deficit > 5 meq/L
• LDH >400 IU/L	• Fluid Sequestration > 4000 ml
	• Hct fall > 10 %

NOTE: Disease classified as SEVERE when 3 or more factors are present

RANSON SCORE

Ranson score	Mortality rate	SEVERITY	Interpretation
0-2	0-2 %	Mild	Admit in regular ward
3-5	10-20 %	Moderate	Admit in ICU/HDU
6-7	40 %	Severe	Associated with more systemic complications
>7	>50 %		Same as above

BALTHAZAR CT severity index(CTSI)-1994

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

CT Severity Index	Inflammation score + Necrosis score

Prognostic Indicator	Points
Pancreatic inflammation	
Normal pancreas	0
Focal or diffuse enlargement of the pancreas	1
Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Single, ill-defined fluid collection or phlegmon	3
Two or more poorly defined collections or presence of gas in or adjacent to the pancreas	4
Pancreatic necrosis	
None	0
≤ 30%	2
> 30–50%	4
> 50%	6

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

Physiologic Variable		+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature - rectal (°C)		≥41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	≤29.9
Mean Arterial Pressure (mm Hg)		≥160	130-159	110-129		70-109		50-69		≤49
Heart Rate		≥180	140-179	110-139		70-109		55-69	40-54	≤39
Respiratory Rate (nonventilated or ventilated)		≥50	35-49		25-34	12-24	10-11	6-9		≤5
Oxygenation (mmHg) a. $FiO_2 > 0,5$ use $A\text{-}aDO_2$ b. $FiO_2 < 0,5$ use PaO_2	a	≥500	350-499	200-349		<200				
	b					> 70	61-70		55-60	<55
Arterial pH		≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
Serum Sodium (mmol/l)		≥180	160-179	155-159	150-154	130-149		120-129	111-119	≤110
Serum Potassium (mmol/l)		≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Serum Creatinine (mg/dl, Double point score for acute renal failure)		≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit (%)		≥60		50-59.9	46-49.9	30-45.9		20-29.9		<20
White Blood Count (in 1000/mm³)		≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
Glasgow-Coma-Scale (GCS)		Score = 15 minus actual GCS								
Serum HCO_3 (venous, mmol/l, use if no ABGs)		≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
A = Total Acute Physiology Score APS		Sum of the 12 individual variable points								

B = Age Points

≤44 years	0 points
45-54 years	2 points
55-64 years	3 points
65-74 years	5 points
≥75 years	6 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)

(From: Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985;13(10):818-29)

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

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.

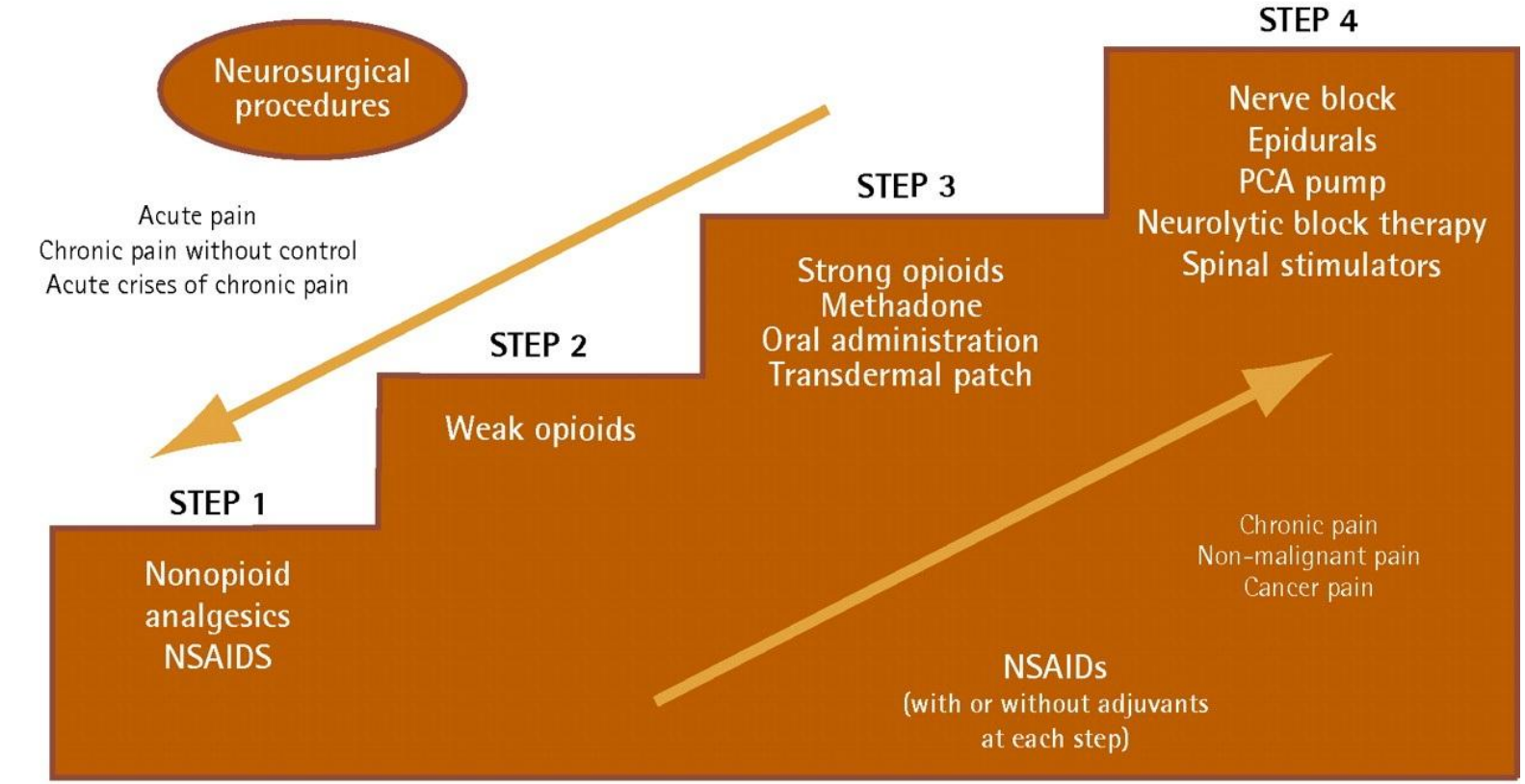
MANAGEMENT

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



NSAID—nonsteroidal anti-inflammatory drug, PCA—patient-controlled analgesia.

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

Monitoring

CLINICAL	INVESTIGATIONS
• Vitals • UOP • CV pressure	• Baselines • Serial ABGs • Serial BSR • Serum calcium/magnesium

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 AGRESSIVE IV hydration**.

Rationale for **EARLY AGRESSIVE 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 AGRESSIVE IV hydration

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

RATIONALE	MANAGEMENT
PREVENTION OF STERILE NECROSIS	Early aggressive IV hydration
PREVENTION OF INFECTED NECCROSIS	Early enteral feeding(NOT antibiotics)
TREATMENT OF INFECTED NECROSIS	Antibiotics, drainage, necrosectomy

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

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

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

- Cholecysectomy 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 sphincherotomy alone may be effective to reduce further attacks of AP

	Sterile necrosis	infected necrosis	
Asymptomatic	Does not mandate intervention regardless of size, location and extension	surgical, radiologic, and/or endoscopic drainage should be delayed preferably for more than 4 weeks • to allow liquefaction of the contents and the development of a fibrous wall around the necrosis • Initially treated with antibiotics	Stable
Symptomatic (associated with GOO or bile obstruction)	minimally invasive methods of necrosectomy are preferred to open necrosectomy	Urgent debridement	unstable

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

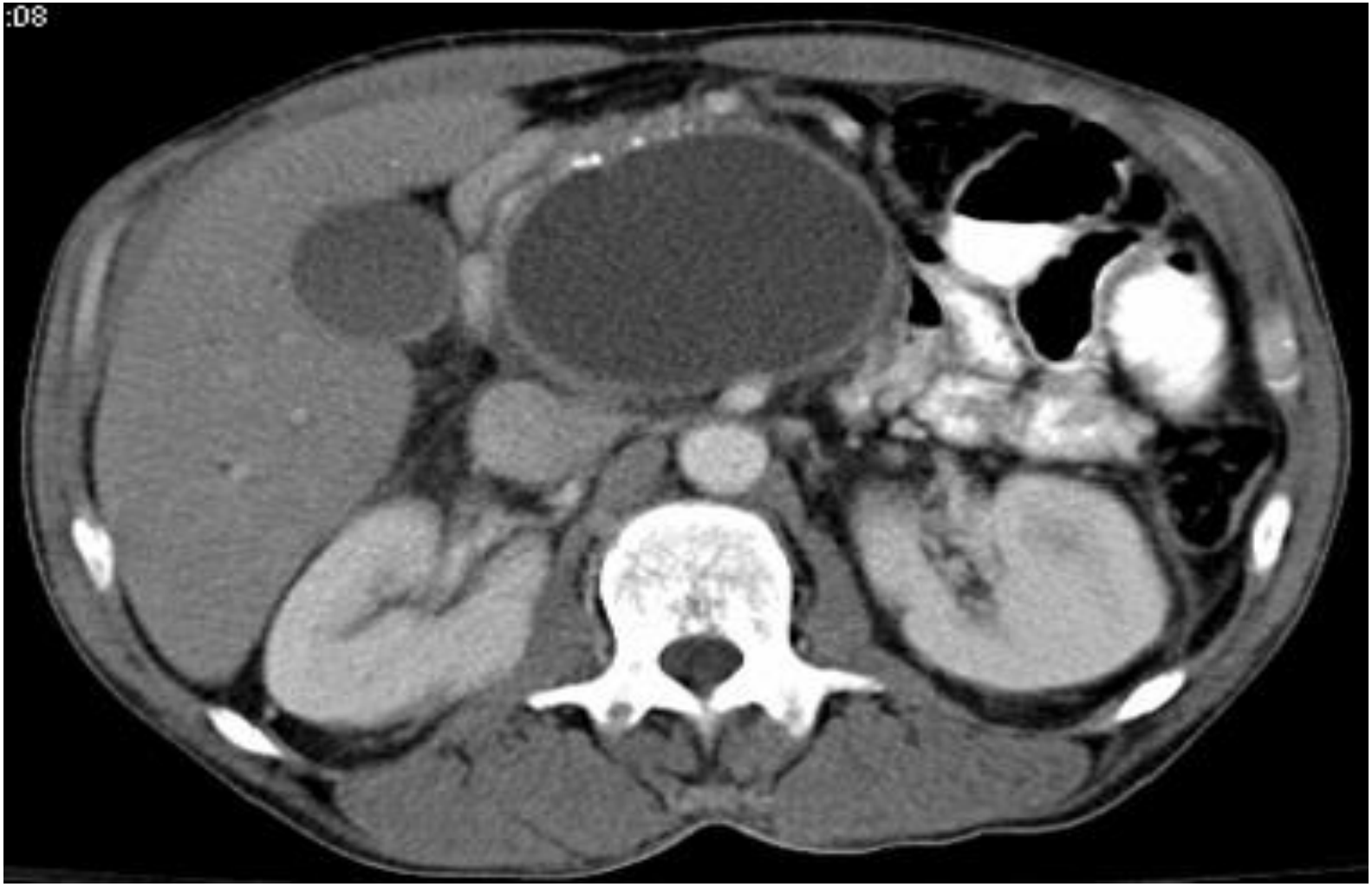
ERCP

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

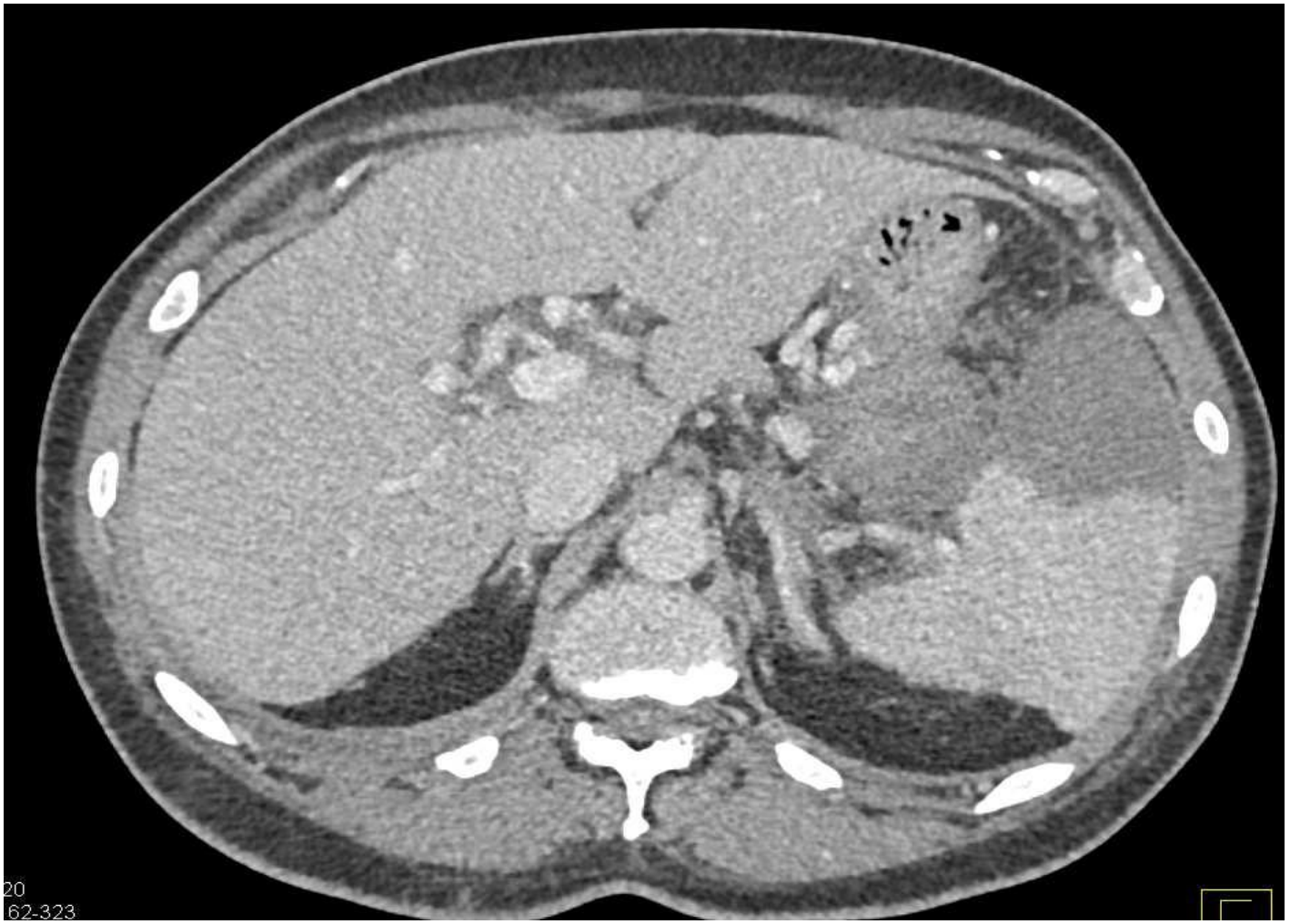
Prognosis

TYPE OF AP	MORTALITY		
Overall	10-15 % (Biliary>alcholic)		
Mild Acute Pancreatitis(80 % cases)	1 %		
Severe Acute Pancreatitis(20 % cases)	Severe → 20-50 %		
	<1 week	1/3 cases	MOF
	>1 week	2/3 cases	Sepsis (+MOF)

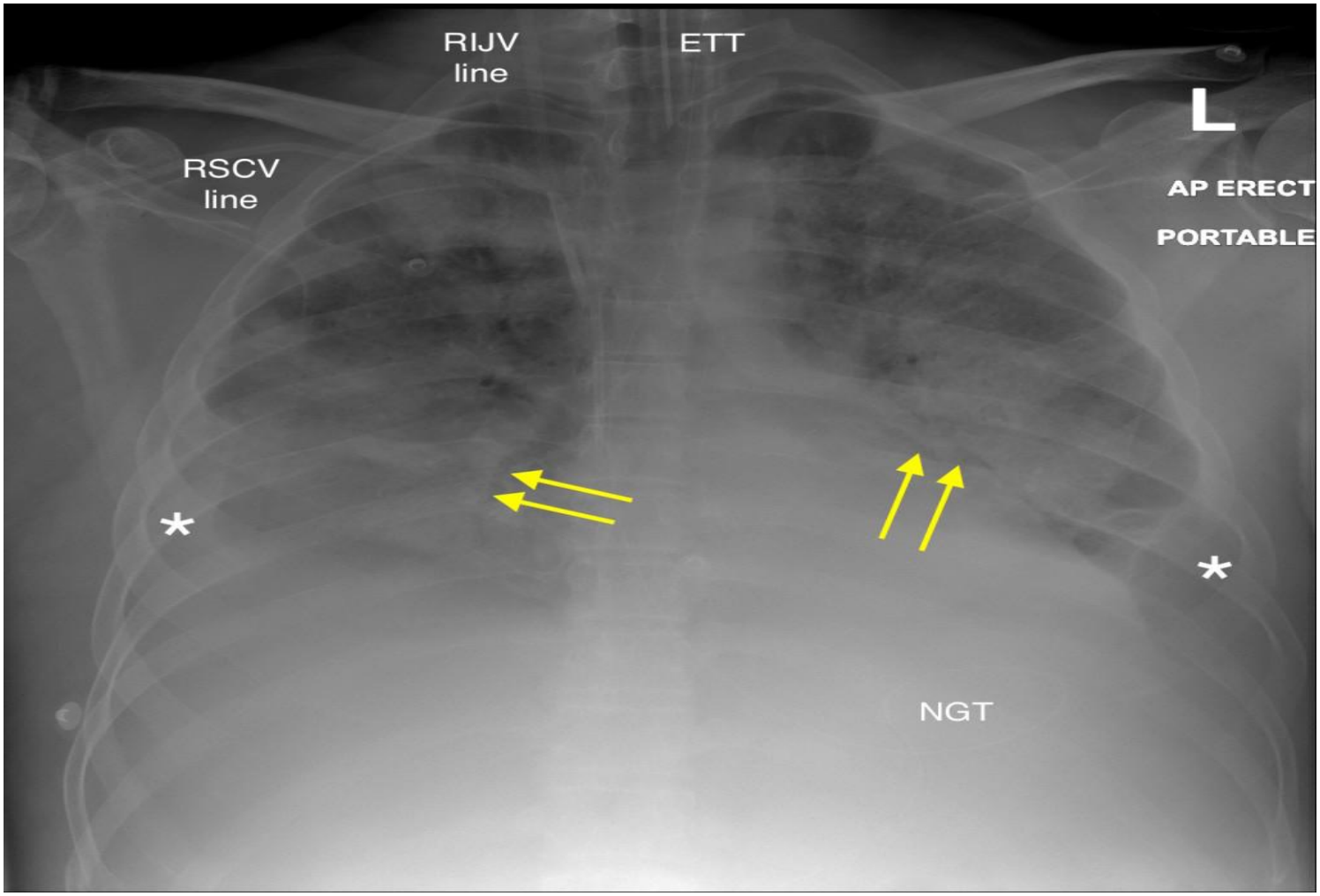
Pseudocyst



Splenic Infarct



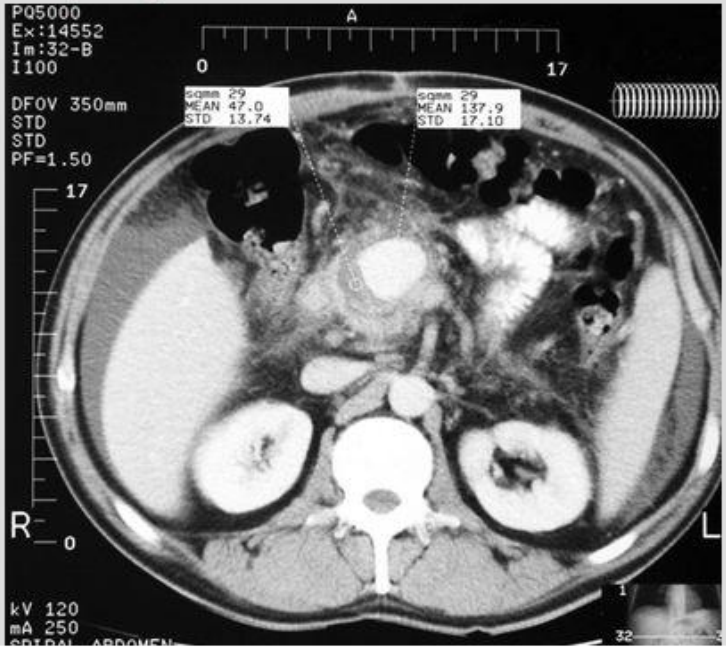
ARDS



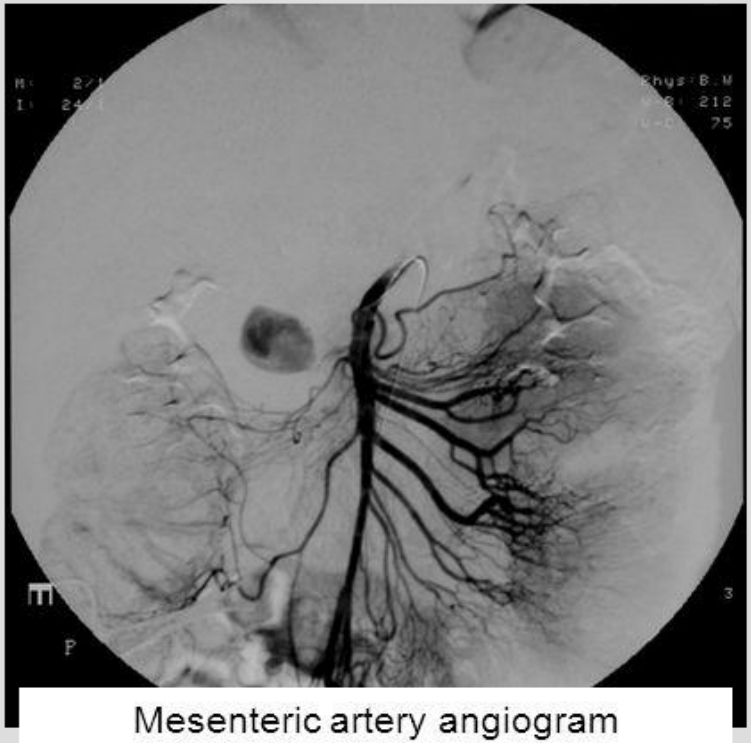
Acute Pancreatitis

Complications

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



A CT scan with intravenous contrast enhancement within a pancreatic pseudocyst indicating the presence of a pseudoaneurysm.



Mesenteric artery angiogram demonstrating contrast extravasating into a pseudoaneurysm

Purtscher Retinopathy: Uncommonly Recognized Complication of Acute Pancreatitis

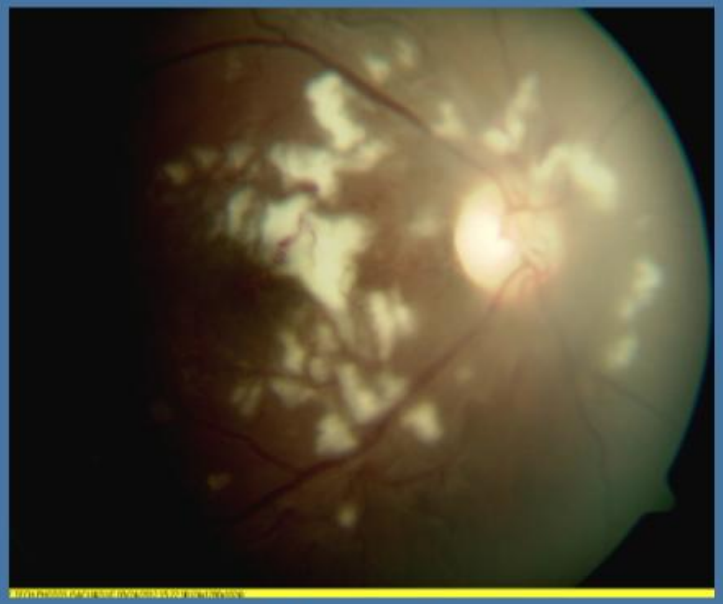


Figure 1

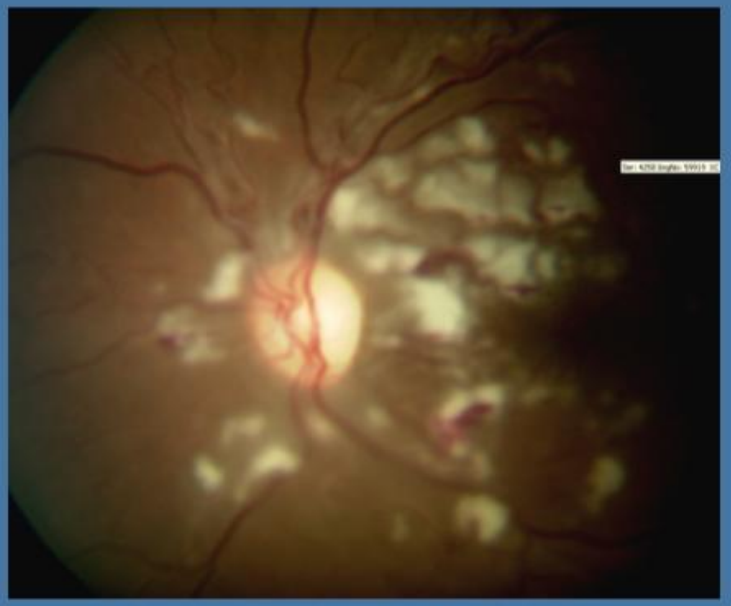


Figure 2

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

THANK YOU……