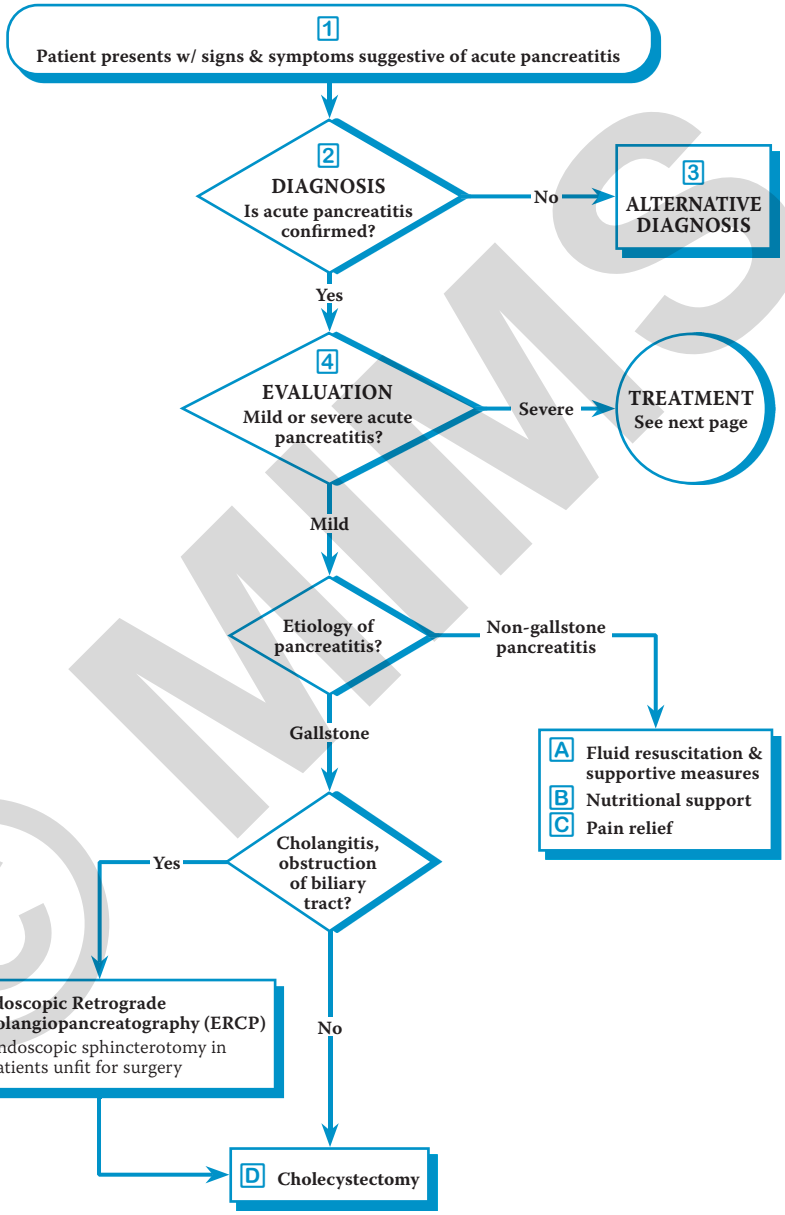
Pancreatitis - Acute (1 of 13)



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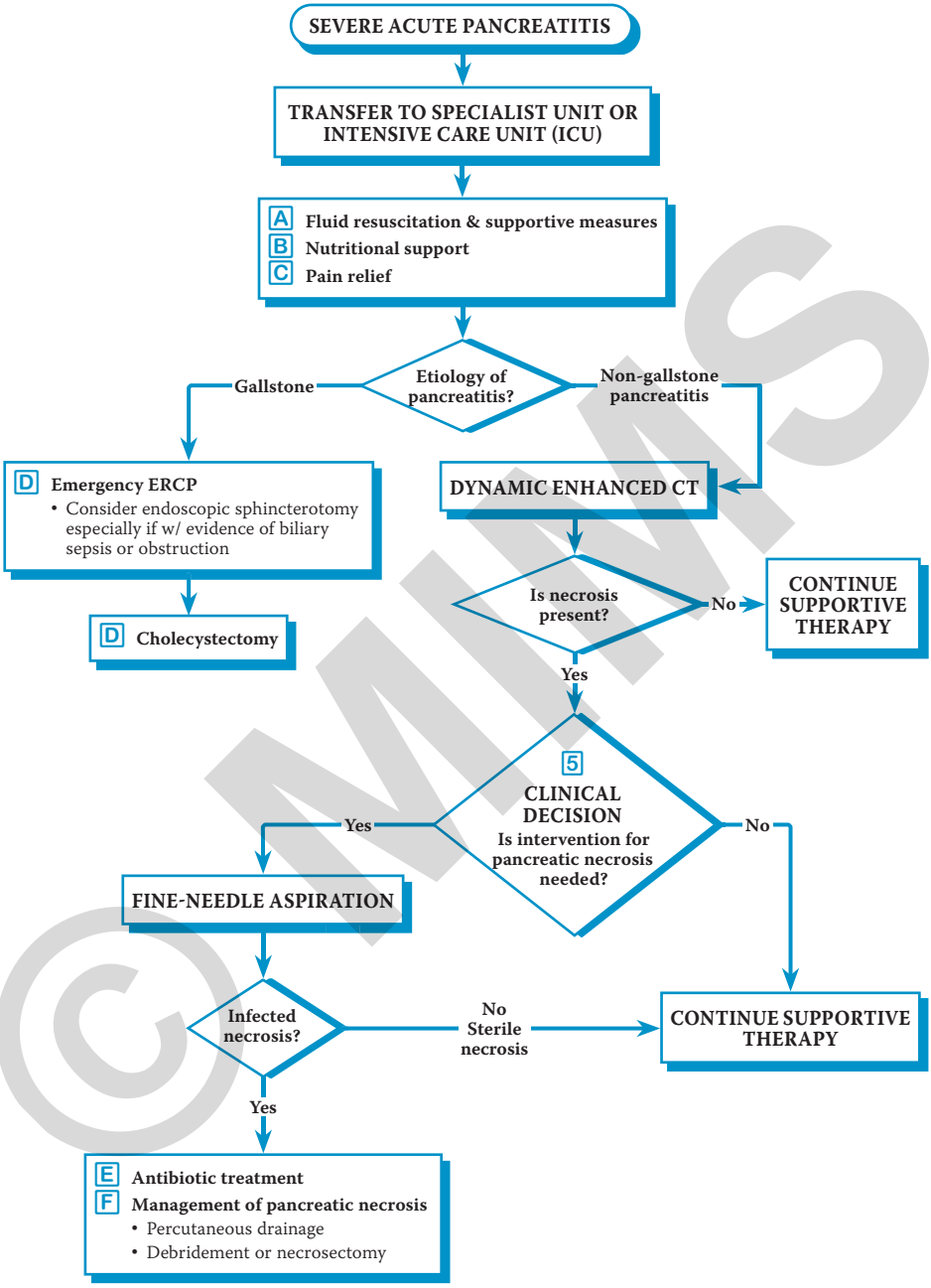

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1 ACUTE PANCREATITIS

- An inflammatory condition of the pancreas characterized histologically by destruction of the acinar cells which is most commonly caused by excessive alcohol use or by gallstones
- Abdominal pain is the most prominent symptom of acute pancreatitis
  - Commonly felt in the midepigastric area or the right upper quadrant of the abdomen
  - Often of rapid onset, reaching its maximal severity in 10-20 minutes & is persistent
  - Steady & moderate-severe in intensity; it may be unbearable, boring & refractory to narcotics
  - Often radiates to the back; also, change in position has little effect on the pain
- If pain lasts only a few hours & then is completely relieved, an alternative diagnosis should be sought
- Other symptoms include nausea & vomiting (N/V)
- Phases of acute pancreatitis include the early phase which occurs in the 1st 2 weeks after onset of disease & the late phase which lasts for weeks to months afterwards

Causes of Acute Pancreatitis

Alcohol

- Alcohol-related acute pancreatitis usually occurs 1-3 days following drinking
- The mechanism of alcohol-related acute pancreatitis is unclear but may include the effects of alcohol on the sphincter of Oddi & on the gland's level of enzyme secretion, as well as direct injury of pancreatic acinar cells

Gallstones

- Gallstone-related pancreatitis occurs more often w/ stones <5 mm in diameter because small stones are more likely to pass through & obstruct the common bile duct
- Biliary sludge in the gallbladder may also contain small stones

Hypercalcemia

- Hypercalcemia may be due to hyperparathyroidism, sarcoidosis, calcium (Ca) infusions, etc
- Excess Ca may deposit in the pancreatic duct, or may activate trypsinogen within the pancreatic parenchyma

Hypertriglyceridemia

- Free fatty acid release may damage pancreatic acinar cells or the capillary endothelium
- Acute pancreatitis associated w/ hypertriglyceridemia is often seen in the following groups of patients:
  - Alcoholic patient presenting w/ hypertriglyceridemia on admission
  - Diabetic patient w/ poorly controlled disease & a history of hypertriglyceridemia
  - Patients without predisposing factors but have drug- or diet-induced hypertriglyceridemia

Other Causes of Acute Pancreatitis

- Medications
  - Certain antibiotics, anti-inflammatory drugs, immunosuppressive agents & other drugs may cause acute pancreatitis
  - A complete medication history should be obtained from the patient
- Infections
  - Infection w/ a number of viruses (eg mumps, hepatitis, varicella-zoster, herpes simplex, etc) & bacteria (eg tuberculosis, *Legionella* sp, *Salmonella* sp, etc) may be associated w/ acute pancreatitis
  - Parasites & fungi may also be associated w/ acute pancreatitis
- Other conditions which may be associated w/ acute pancreatitis are the following:
  - Postoperative & post-endoscopic retrograde cholangiopancreatography (ERCP) state
  - Blunt & penetrating trauma to the pancreas
  - Pancreatic ischemia

Risk factors for severe pancreatitis include the following:

- Age ≥60 years old
- History of chronic alcohol use
- Presence of comorbid illnesses eg chronic liver & kidney disease, heart failure, cancer
- Obesity

2 DIAGNOSIS

Acute pancreatitis is diagnosed by at least 2 of the following: Characteristic abdominal pain, serum lipase &/or amylase levels ≥3x the upper limit of normal, & characteristic abdominal imaging findings

Physical Examination

- Physical findings will depend on the severity of an acute pancreatitis attack

Vital Signs

- Blood pressure may increase transiently, then decrease w/ third-space fluid losses
- Tachycardia, tachypnea & fever are usually present

Abdominal Findings

- Patient may exhibit guarding & tenderness especially in the upper abdomen
- Bowel sounds are often decreased
- Ecchymoses on the flanks or in the periumbilical area may be seen

Other Findings

- Dyspnea which may be secondary to congestive heart failure, pleural effusion or atelectasis
- Shallow respirations w/ limited diaphragmatic excursion
- Mental status changes eg hallucinations, disorientation & coma
- Physical exam may reveal findings related to the underlying cause of pancreatitis
  - Hepatomegaly & spider angiomas in alcoholic patients
  - Xanthomas & lipemia retinalis in hyperlipidemic patients

Lab Tests

Serum Amylase

- Serum amylase is frequently requested because it is affordable & readily available
- Serum amylase testing is not 100% sensitive or specific
- Nonpancreatic diseases eg tumors, salivary gland diseases & renal insufficiency may also cause hyperamylasemia
- A level 3x the upper limit of normal (ULN) is commonly set as being suggestive of acute pancreatitis, but this level is still not specific for the disease
- Hyperamylasemia supports a diagnosis of acute pancreatitis, but cannot be used to confirm it
- The degree of enzyme elevation does not correlate w/ disease severity

Serum Lipase

- Some authorities maintain that serum lipase is a more specific & more reliable test than serum amylase because of its higher sensitivity & greater diagnostic window; also, nearly all lipase in the body originates from the pancreas, in contrast to amylase which may also be secreted by the salivary glands
  - Should be done in all patients in whom acute pancreatitis is suspected
- The enzyme is elevated starting on the 1st day of illness & remains elevated longer than serum amylase; cut-off value is 3x ULN
- Sensitivity of serum lipase in diagnosing acute pancreatitis is considered similar to that of serum amylase
- Like serum amylase, the degree of enzyme elevation does not correlate w/ disease severity
- Certain nonpancreatic diseases may give rise to serum lipase elevations eg renal disease, acute cholecystitis, appendicitis, bowel obstruction, chronic pancreatitis

Other Tests

- C-reactive protein (CRP) is a marker of inflammation & necrosis
  - Elevated levels (≥150 mg/L) at 48-72 hours after onset of disease are useful in disease stratification & determining disease severity
- Complete blood count (CBC) usually shows leukopenia; hematocrit of >44% is a risk factor of pancreatic necrosis
- Serum glucose & glucagon levels are frequently elevated
- Liver function tests (LFTs), ie alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase & bilirubin are often high, especially in gallstone pancreatitis
- A serum triglyceride should be obtained if gallstones or a history of significant alcohol use is absent
  - If >1000 mg/dL, may be considered an etiology of acute pancreatitis
- A serum procalcitonin level of ≥3.8 ng/mL within 96 hours after symptom onset indicates pancreatic necrosis while a blood urea nitrogen (BUN) level of >20 mg/dL is an independent predictor of mortality

Imaging Tests

Abdominal & Chest X-rays

- Abdominal film may be used to exclude other causes of abdominal pain
  - May be normal in mild disease but in more severe disease may assist in assessing etiology or severity of pancreatitis
- Gallstones & pancreatic stones may also be visualized on abdominal X-rays
- Chest X-rays may reveal atelectasis, pulmonary infiltrates, pleural effusion or an elevated hemidiaphragm

2 DIAGNOSIS (CONT'D)

Imaging Tests (Cont'd)

Abdominal Ultrasound (US)

- US should be examined at baseline (on admission or within the 1st 48 hours) in all patients w/ possible acute pancreatitis
- US can demonstrate morphological changes in the pancreas 24-48 hours after disease onset & is useful in detecting presence or absence of biliary disease, ie gallstones &/or common bile duct stones
- US cannot be used to evaluate severity of disease
- Bowel gas, however, often precludes a good view of the pancreas

Abdominal Computed Tomography (CT) Scan

- CT scan is not mandatory upon initial presentation of the patient, unless diagnosis is uncertain or there are important differential diagnoses that need to be excluded, eg mesenteric ischemia or secondary perforation peritonitis
  - Patients who will likely benefit from CT scanning are those w/ persisting organ failure, new onset of organ failure or new complication & patients w/ persistent pain & signs of sepsis
- Contrast-enhanced CT (CECT) scan is used chiefly to establish the diagnosis & severity of acute pancreatitis, to search for complications of acute pancreatitis & to exclude other serious intra-abdominal conditions
  - Optimal timing is 72-96 hours after symptom onset in patients w/ severe acute pancreatitis
- The test is not useful for detecting gallstones

Magnetic Resonance Imaging (MRI)

- Detects pancreatic necrosis as well as CT scan, but is better at detecting gallstones
- An advantage of MRI over CT scan may be the lesser toxicity of gadolinium compared to contrast material
  - Preferred over CECT scan in young or pregnant patients to minimize exposure to radiation, patients w/ iodinated contrast allergy & in those w/ renal impairment or insufficiency

Magnetic Resonance Cholangiopancreatography (MRCP)

- Recommended to check for occult common bile duct stones in patients w/ unknown etiology, ie if liver enzymes are elevated suggesting biliary obstruction & the common bile duct is either normal or not adequately visualized on ultrasound

Endoscopic Retrograde Cholangiopancreatography (ERCP)

- ERCP only has role in severe acute pancreatitis when there is a confirmed acute biliary pancreatitis w/ concomitant cholangitis
  - In these cases, ERCP is done to remove common duct stones within 24 hours of admission

Idiopathic Pancreatitis

- Pancreatitis without established etiology after initial lab work-up & imaging tests
- Perform at least 2 ultrasound exams to exclude a biliary etiology, & an MRCP &/or endoscopic ultrasound for prevention of recurrent pancreatitis

3 ALTERNATIVE DIAGNOSIS

- Other conditions w/ similar presentation include acute cholecystitis, choledocholithiasis, penetrating duodenal ulcer, myocardial infarction, perforated viscus, ischemic bowel or bowel obstruction

4 EVALUATION

- Prognostic factors that help in determining disease activity include presence of systemic inflammatory response syndrome (SIRS), level of hematocrit, BUN, or creatinine
  - An increase in the number of SIRS criteria during the 1st 24 hours of hospitalization as well as increase in the values of hematocrit, BUN, or creatinine elevates the risk of organ failure, pancreatic necrosis, & mortality
- Persistent organ failure & high mortality are associated w/ severe acute pancreatitis thus the need for an ICU admission
  - Risk of mortality is high in patients w/ persistent organ failure & infected necrosis

Classifications Systems of Acute Pancreatitis

2012 Revised Atlanta Criteria

- Mild: Without organ failure or local or systemic complication
- Moderately severe: Presence of local or systemic complication &/or transient organ failure <48 hours
- Severe: Single or multiple organ failure persistent >48 hours

4 EVALUATION (CONT'D)

Classifications Systems of Acute Pancreatitis (Cont'd)

Determinant-based Classification

- Mild: Without organ failure **&** (peri)pancreatic necrosis
- Moderate: Presence of transient organ failure **&/or** sterile (peri)pancreatic necrosis
- Severe: Persistent organ failure **or** infected (peri)pancreatic necrosis
- Critical: Persistent organ failure **&** infected (peri)pancreatic necrosis

Initial Assessment

Predicting the severity of acute pancreatitis during the early part of disease is warranted to minimize complications & to obtain the most benefit from treatment

- All patients should undergo assessment of the following parameters immediately upon admission:
  - Clinical evaluation, w/ emphasis on the presence of organ failure, or any cardiovascular, respiratory or renal dysfunction
  - Determination of body mass index (BMI), Acute Physiology and Chronic Health Evaluation (APACHE) II score
    - APACHE score should be calculated on admission & every day for the 1st 72 hours following admission
    - The Bedside Index of Severity of Acute Pancreatitis (BISAP) is a recently developed simple prognostic scoring system for predicting severe acute pancreatitis w/ similar accuracy to the APACHE II score for predicting mortality; criteria include BUN >8.9 mmol/L, impaired mental status, SIRS, age >60 years old, pleural effusion on radiography
  - Chest X-ray should be obtained
- Clinical exam within the 1st 24 hours of admission is specific but lacks specificity in determining severity & therefore should be supported by objective measures
- **A severe attack is likely in patients who have the following features:**
  - Clinical impression of severity
  - BMI >30, pleural effusion
  - APACHE II score >8

24 Hours After Admission

- Clinical assessment & documentation of organ failure should be repeated
  - APACHE II score to assess the worst values in the 1st 24 hours
  - CRP may be useful based on time of onset of symptoms
  - Glasgow score may be applied
- **A severe attack is likely in patients who have the following features:**
  - Clinical impression of severity
  - APACHE II score >8
  - Glasgow score ≥3
  - CRP >150 mg/L
  - Persisting organ failure

48 Hours After Admission

- Clinical state, Glasgow score & CRP all contribute to the assessment of severity
- Contrast-enhanced CT may also be used to assist in staging severity
- **A severe attack is likely in patients who have the following features:**
  - Clinical impression of severity
  - APACHE II score >8
  - Glasgow score ≥3
  - CRP >150 mg/L
  - Persisting organ failure for >48 hours
  - Multiple or progressive organ failure

5 CLINICAL DECISION

- Consider performing interventions (eg percutaneous or endoscopic drainage) for pancreatic necrosis if 4 weeks after disease onset patient has ongoing organ failure w/ no sign of infected necrosis, ongoing gastric outlet, biliary or intestinal obstruction from a walled-off necrotic collection, disconnected duct syndrome, or growing or symptomatic pseudocyst; or ongoing discomfort &/or pain 8 weeks after disease onset
  - Usually done 4 weeks after disease onset to allow for the necrosis to be walled off
- All patients w/ persistent symptoms & >30% pancreatic necrosis or those who have clinical suspicion of sepsis should have CT-guided fine-needle aspiration (FNA) to obtain sample for Gram stain & culture 7-14 days after the onset of pancreatitis

A FLUID RESUSCITATION & SUPPORTIVE MEASURES

Fluid Resuscitation

- Timely & sufficient fluid resuscitation is critical in the prevention of complications of acute pancreatitis (eg hypovolemia & organ hypoperfusion)
  - Fluid resuscitation may also be associated w/ earlier resolution of organ failure
- Aggressive hydration should be given to all patients & adjusted according to patient's age, weight & pre-existing cardiac &/or renal conditions
  - 250-500 mL/hr of isotonic crystalloid solution is given in the 1st 12-24 hours
  - Goal is to achieve clinical & biochemical targets of perfusion (eg heart rate, mean arterial & central venous pressures, hematocrit & BUN)
- Balanced electrolyte solution (normal saline, Ringer's lactate) should be given quickly & rate titrated based on frequent assessment of the patient's volume status
  - 5-10 L of fluid daily may be needed for the 1st several days of illness
  - The daily basic requirement as well as third-space fluid losses should be included in the computation for fluid replacement
- Careful monitoring of volume status is crucial in patients w/ compromised cardiovascular or respiratory systems
- Check & measure intra-abdominal pressure regularly
- Fluid administration should continue until it is ensured that risk of organ failure has passed

Respiratory Care

- SaO_2 should be measured continuously & O_2 should be administered to maintain arterial SaO_2 >95%
- If signs of respiratory insufficiency develop, assess for pulmonary edema or acute respiratory distress syndrome (ARDS) & treat appropriately
  - Assess the need for endotracheal intubation & ventilatory support

Cardiovascular (CV) Support

- CV complications include shock, congestive heart failure, arrhythmias & myocardial infarction (MI)
- Crystalloids or colloids may be needed to maintain adequate intravascular volume & urine output
- Inotropics eg Dopamine may be used in hypotension

Metabolic Balance

- Hyperglycemia may be carefully managed w/ Insulin
- Magnesium (Mg) or Ca replacement may be required
- A brief alcohol intervention is recommended to be given during admission in patients w/ acute alcoholic pancreatitis

Nasogastric Tube

- Routine nasogastric intubation is not beneficial in mild pancreatitis
- If protracted vomiting occurs, ileus should be assessed by abdominal X-ray & nasogastric tube inserted to protect against aspiration

B NUTRITIONAL SUPPORT

- Patients w/ mild pancreatitis are advised to take nothing by mouth for the 1st few days, w/ hydration being carried out through the IV route
  - These patients usually tolerate oral feelings within 3-7 days of presentation
  - A solid diet of low fat is as safe as a diet of clear liquid
- In patients requiring nutritional support especially those w/ severe pancreatitis, the enteral route should be used if it is tolerated & started within 24-72 hours after admission
  - Enteral nutrition[1] preserves mucosal function & maintains the intestinal barrier, which reduces bacterial translocation from the gut
  - Less septic complications result from enteral nutrition as compared to parenteral nutrition
  - Enteral nutrition may be delivered using a nasogastric or nasojejunal tube; it is preferred to administer via a nasojejunal tube in patients w/ digestive intolerance or if indicated in patients who underwent minimally invasive necrosectomy
  - Low-fat, high-protein preparations may be preferred
- Parenteral nutrition[1] should be used in patients who cannot tolerate or has contraindications for enteral feeding, or used as supplement in those whose nutritional goals are not met within 2 days
  - Parenteral glutamine can be given to patients w/ severe acute pancreatitis

[1]Various enteral or parenteral nutritional products are available. Please see the latest MIMS for specific formulations & prescribing information

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B NUTRITIONAL SUPPORT (CONT'D)

- Oral feedings are resumed when abdominal pain & tenderness subside
  - In patients w/ mild pancreatitis, oral feeding should be restarted as soon as clinically tolerated w/ low-fat, soft oral diet
    - Patients may be allowed to transition from NPO to oral feeding within 24 hours as tolerated
  - In patients w/ severe pancreatitis, feedings may be started w/ liquids that do not contain calories, progressing gradually to soft then to solid foods
  - In patients who have undergone a minimally invasive necrosectomy, oral feeding should be started in the 1st 24 hours after the procedure if the patients' condition allows it
  - It is recommended that feedings should contain >50% carbohydrate w/ gradual increments in caloric content
  - Oral pancreatic enzymes can be given as supplements to patients w/ obvious pancreatic exocrine insufficiency

C PAIN RELIEF

- Pain relief may be achieved w/ Pethidine (Meperidine), given at 50-100 mg IV 3-4 hourly
- For severe pain, Hydromorphone may be administered using a patient-controlled anesthesia pump
  - Hydromorphone has a longer half-life than Pethidine & is preferred over Fentanyl or Morphine in a non-intubated patient in most institutions
- For patients w/ severe pancreatitis requiring high-dose opioids for an extended period of time, epidural analgesia may be considered
- Some experts suggest avoiding the use of Morphine for pain relief
  - There is no conclusive study in humans to support the theory that Morphine & its derivatives may worsen pancreatitis by inducing an increased sphincter of Oddi tone
- Anticholinergic agents eg Atropine should be avoided because these may aggravate ileus
- Nonsteroidal anti-inflammatory drugs (NSAIDs) should not be given in patients w/ acute kidney injury

D MANAGEMENT OF GALLSTONE PANCREATITIS

Endoscopic Retrograde Cholangiopancreatography (ERCP)

- ERCP should be performed urgently, ie within 24-48 hours, in severe acute pancreatitis patients w/ suspected or proven gallstone etiology, or when cholangitis, jaundice, or dilated common bile duct is present
  - However, patients without obstructive jaundice or biliary sepsis may not benefit
  - MRCP or endoscopic ultrasound may be an option
  - If ERCP is not feasible in unstable patients, consider placing a percutaneous transhepatic gallbladder drainage tube

Endoscopic Sphincterotomy (ES)

- ES in many cases protects against recurrence of gallstones
- Should therefore be considered in the following patients, if cholecystectomy cannot be done:
  - Patients who have severe gallstone pancreatitis w/ significant local &/or systemic complications
  - Patients w/ a dilated bile duct w/ or without demonstrated stones & at the same time a gallbladder that contains stones

Cholecystectomy

- Cholecystectomy, which constitutes definitive management of gallstones, should be done during the same hospital admission, after the patient has recovered from the acute pancreatic illness
- Indication & appropriate time interval between acute pancreatitis & cholecystectomy will depend on the presence of an ES & severity of the pancreatitis
  - Otherwise healthy patient w/ mild acute gallstone pancreatitis should undergo definitive surgical management during the index admission
  - Cholecystectomy may be deferred in necrotizing biliary acute pancreatitis until inflammation subsides & fluid collections resolve or stabilize
  - In patients w/ high surgical risk, ES alone may be sufficient
- Patients w/ severe pancreatitis should not be operated on within the 1st 48 hours after admission as there is a higher risk of complications

E ANTIBIOTIC TREATMENT

- Treatment w/ antibiotics is recommended for patients w/ infected acute pancreatitis; however, routine antibiotic prophylaxis is not recommended for all patients w/ acute pancreatitis as evidences have not shown a significant reduction in morbidity or mortality w/ its use
- Bacterial infection of the pancreas & peripancreatic tissues arises in about ⅓ of patients w/ severe acute pancreatitis
  - Infection is usually seen later in the course of disease, especially if there is massive pancreatic necrosis
  - A serum procalcitonin level may be of use in predicting the possibility of an infected pancreatic necrosis; a CT-guided FNA (not routinely used) can confirm an infected severe acute pancreatitis & can guide antibiotic therapy from Gram stain & culture
- The most important etiologic agents in necrotizing pancreatitis are part of the gut flora:
  - Gram-negative bacteria: *Escherichia coli*, *Klebsiella* sp; less commonly, *Enterobacter* sp, *Pseudomonas* sp, *Proteus* sp, etc
  - Gram-positive bacteria: *Enterococcus* sp, *Streptococcus* sp, *Staphylococcus* sp
  - Anaerobes
  - Occasional fungi: *Candida* sp
  - The microbial flora in necrotizing pancreatitis is similar to that in colonic perforation
- Antibiotics that exhibit adequate penetration into the pancreas should be used
  - Third-generation cephalosporins & acylureidopenicillins are effective against Gram-negative bacteria
  - Piperacillin-tazobactam is effective against both anaerobes & Gram-positive bacteria
  - Metronidazole is effective against anaerobes
  - Carbapenems should only be used in patients who are critically ill due to the spread of carbapenem-resistant *K pneumoniae*
  - Quinolones should only be used in patients w/ beta-lactam allergy due to high rates of resistance
- Antibiotics should be given for a maximum of 14 days in most cases
- The following are not recommended regarding antibiotic usage:
  - Routine use of prophylactic antibiotics in severe acute pancreatitis
  - Using antibiotics to prevent an infected necrosis in patients w/ sterile necrosis
  - Routine prophylactic use of antifungals given w/ antibiotics

F MANAGEMENT OF PANCREATIC NECROSIS

- Pancreatic necrosis develops in about 20% of acute pancreatitis (typically moderately severe or severe) & is usually confirmed through CT scanning
- Associated w/ early organ failure, need for intervention, & mortality
- When patients do not suffer from organ failure or systemic toxicity, pancreatic necrosis may usually be treated conservatively w/ IV fluids & analgesia
- Infected necrosis of the pancreas should be suspected in patients who exhibit organ dysfunction or systemic toxicity after 7-10 days
  - Infected necrosis may be diagnosed either by the presence of gas within the pancreatic collection or by FNA
  - CT-guided FNA of the infected necrosis w/ Gram stain & culture for aerobic & anaerobic bacteria & for fungi should be done if infected necrosis is being considered & to distinguish it from sterile necrosis
  - If without CT FNA, empiric antibiotics should be given
- Patients w/ necrosis involving >30% of the pancreas may also need to undergo FNA
- Patients who develop infection & have previously received antibiotics should be considered as having a healthcare-associated infection

Sterile Necrosis

- Clinically mild & not usually associated w/ systemic complications
  - Clinically stable patients should be managed non-surgically & antibiotics are not needed
- If organ failure & systemic toxicity improve, medical therapy should be continued & may consist of systemic antibiotics to prevent secondary pancreatic infection
  - These patients occasionally need surgical intervention but this is uncommon

F MANAGEMENT OF PANCREATIC NECROSIS (CONT'D)

Infected Necrosis

- FNA-confirmed infection may be treated w/ a step-up approach that includes antibiotics, percutaneous or endoscopic drainage, then surgical intervention
- Antibiotics should be chosen based on culture & sensitivity results & should penetrate well into the pancreas
- Percutaneous drainage may result in resolution of infection in 25-60% of patients
- When percutaneous drainage fails, pancreatic infection calls for prompt debridement or necrosectomy
  - Minimally invasive methods are preferred to open methods
- In stable patients, interventions (eg surgical, radiologic &/or endoscopic drainage) should be done after >4 weeks to permit content liquefaction & fibrous wall formation around necrosis

FOLLOW-UP

- A follow-up CECT scan may be performed 7-10 days after the initial CT scan in patients w/ severe acute pancreatitis
  - Additional CECT scans may be done only if patient's condition does not improve or if an invasive intervention is being considered

Patients treated for acute pancreatitis should be followed up for the common complications of the disease & treated accordingly

Pancreatic Pseudocyst

- A pseudocyst contains pancreatic enzymes & tissue debris & is usually sterile
- If asymptomatic, the pseudocyst does not need intervention
- The development of clinical symptoms, eg abdominal pain or fever, or the increasing size on serial imaging should prompt therapeutic intervention
- Treatment options include surgical, radiologic & endoscopic methods, eg decompression via endoscopic cyst gastrostomy w/ endoscopic ultrasound guidance

Pancreatic Abscess

- Most abscess occur at least 4 weeks following the onset of acute pancreatitis
- Treatment is through percutaneous or surgical drainage

Dosage Guidelines

AGENTS AFFECTING BONE METABOLISM

Drug	Dosage	Remarks
Calcitonin (Calcitonin salmon, Salcatonin)	300 IU by IV infusion in normal saline over a 24-hr period for up to 6 consecutive days	**Adverse Reactions** • GI effects (N/V); Other effects (dizziness, flushing; rarely polyuria, chills); hypersensitivity including local effects on inj site or generalized skin reactions; very rarely anaphylactic reactions w/ tachycardia, hypotension & collapse **Special Instructions** • Skin testing if hypersensitivity is suspected

CEPHALOSPORINS

Drug	Dosage	Remarks
Second Generation		
Cefuroxime	750 mg-1.5 g IM/IV 8 hrly **Max dose:** 6 g/day	**Adverse Reactions** • GI effects (diarrhea, N/V; rarely antibiotic-associated diarrhea/colitis); Other effects (candidal infections); hypersensitivity reactions include urticaria, pruritus, rash, severe reactions eg anaphylaxis can occur • High doses may be associated w/ CNS effects (encephalopathy, convulsions); rarely hematologic effects; hepatic & renal effects have occurred • Prolonged prothrombin time (PT), prolonged activated partial thromboplastin time (aPTT), &/or hypoprothrombinemia (w/ or without bleeding) have been reported & occur most frequently w/ N-methylthiotetrazole (NMTT) side chain-containing cephalosporins **Special Instructions** • Use w/ caution in patients allergic to Penicillin, there may be 10% chance of cross sensitivity • Use w/ caution in patients w/ renal impairment
Third Generation		
Cefotaxime	1-2 g IM/IV 6-12 hrly **Max dose:** 12 g/day	
Ceftazidime	1-2 g IM/IV 8-12 hrly **Max dose:** 6 g/day	

DIGESTIVES

Drug	Dosage	Remarks
Pancreatin (Lipase, Amylase & Protease)[1]	Individualized dosage according to the degree of maldigestion & fat content of the meal **Required dose range:** 25,000-80,000 lipase u/kg/meal, ½ of individual dose for snacks	**Adverse Reactions** • GI effects (mucosal irritation or stomatitis, N/V, abdominal discomfort, loose stools); hypersensitivity reactions include lacrimation, sneezing, rashes **Special Instructions** • Instruct patient to swallow capsules whole to avoid irritation of the oral mucosa • Maintain adequate hydration during treatment

[1]Various combination products are available. Please see the latest MIMS for specific formulations.

All dosage recommendations are for non-pregnant & non-breastfeeding women, & non-elderly adults w/ normal renal & hepatic function unless otherwise stated.
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Products listed above may not be mentioned in the disease management chart but have been placed here based on indications stated in locally approved product monographs.
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Dosage Guidelines

OTHER ANTIBIOTICS		
Drug	**Dosage**	**Remarks**
Lincosamide		
Clindamycin	600-1,200 mg/day IV in 2-4 equally divided doses, infused over at least 10-60 min **Max infusion rate:** 30 mg/min **Max dose:** 1,200 mg (single 1-hr IV infusion)	**Adverse Reactions** • GI effects (diarrhea, severe antibiotic-related pseudomembranous colitis, N/V, abdominal pain, metallic taste); Other effect (polyarthritis) • Severe dermatologic effects have occurred (erythema multiforme, exfoliative & vesiculobullous dermatitis); hematologic & hepatic effects have occurred; hypersensitivity reactions include rash, urticaria, rarely anaphylaxis **Special Instructions** • Use w/ caution in patients w/ GI disease especially w/ history of colitis • Use w/ caution in atopic patients & in patients w/ renal or hepatic impairment • Discontinue if diarrhea occurs
Nitroimidazole Derivative		
Metronidazole	500 mg IV 8 hrly **Max dose:** 4 g/day	**Adverse Reactions** • GI effects (N/V, metallic taste, diarrhea, constipation); CNS effects (weakness, dizziness, headache, mood changes, peripheral neuropathy has occurred at high/prolonged doses); Other effect (candidal infection); hematologic & hepatic effects have occurred; rarely hypersensitivity reactions; may cause darkening of urine • High dose or prolonged use has caused peripheral neuropathy & epileptiform seizures **Special Instructions** • When given w/ alcohol, a Disulfiram-like reaction can occur • Use w/ caution in patients w/ severe hepatic impairment • If given >10 days, recommend monitoring CBCs & clinical monitoring for CNS effects

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Dosage Guidelines

OTHER BETA-LACTAM		
Drug	**Dosage**	**Remarks**
Carbapenem		
Imipenem/ cilastatin	As Imipenem: 1-2 g/day in divided doses 6-8 hrly via IV infusion Doses 250 or 500 mg are infused over 20-30 min, & doses of 750 mg or 1 g over 40-60 min	**Adverse Reactions** • GI effects (diarrhea, N/V, antibiotic-associated diarrhea/ colitis, tongue/tooth discoloration, altered taste); CNS effects (mental disturbances, confusion; seizures & convulsions have been reported especially in patients w/ a history of CNS lesions &/or renal dysfunction); Other effect (candidal infections); hypersensitivity reactions ranging from mild (eg rash) to severe (eg anaphylaxis) can occur; rarely severe dermatologic reactions (eg exfoliative dermatitis, Stevens-Johnson syndrome, etc); rarely hepatic effects **Special Instructions** • Use w/ caution in patients allergic to penicillins, cephalosporins or other beta-lactams, patients w/ renal impairment • Use w/ caution in patients w/ CNS disorders (eg epilepsy)

QUINOLONES		
Drug	**Dosage**	**Remarks**
Ciprofloxacin	200-400 mg IV 12 hrly	**Adverse Reactions** • GI effects (N/V, diarrhea, abdominal pain, dyspepsia, rarely antibiotic-associated diarrhea/colitis); CNS effects (headache, dizziness, sleep disorders, restlessness, drowsiness); Dermatologic effects (rash, pruritus, photosensitivity); hypersensitivity reactions can range from mild (eg rash) to severe/life-threatening (eg Stevens-Johnson syndrome); rarely hematologic effects; hepatic & renal effects • Some quinolones have the potential to prolong the QT interval **Special Instructions** • Administer at least 2 hr before or 3 hr after Al- or Mg-containing antacids, dietary supplements containing Zn or Fe or buffered ddl preparations • Avoid exposure to strong sunlight or tanning beds • Use w/ caution in patients w/ epilepsy or history of CNS disorders, in patients w/ impaired renal or hepatic function & in those w/ G6PD deficiency
Ofloxacin	200-400 mg IV 12 hrly	

All dosage recommendations are for non-pregnant & non-breastfeeding women, & non-elderly adults w/ normal renal & hepatic function unless otherwise stated.
Not all products are available or approved for above use in all countries.
Products listed above may not be mentioned in the disease management chart but have been placed here based on indications stated in locally approved product monographs.
Please refer to local product monograph in the latest copy of MIMS or in www.mims.com for country-specific prescribing information.

Please see the end of this section for the reference list.