

Acute Pancreatitis in Children — Causes and Symptoms

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The incidence of pancreatitis in the pediatric population has been on the rise recently. It has a grave impact on the quality of life when present from a young age. This article expounds the basics of pediatric pancreatitis while focusing on the clinicopathological aspects of pancreatitis.



Introduction to Pancreatitis in Children

Pancreatitis epitomizes the inflammation of the pancreas, an organ that secretes various [enzymes](#) that help digestion. **These enzymes aid the breakdown of critical molecules, such as proteins, fats, and carbohydrates**, and are important for the proper absorption of these nutrients from ingested food. However, these enzymes have deleterious effects if improperly secreted with respect to location and time because the enzymes induce autolysis and inflammation. Pancreatitis may have a subtle presentation. Pancreatitis can be mild, severe, lethal, or incapacitating, seriously impairing quality of life.

Epidemiology of Pancreatitis in Children

Pancreatitis is more frequent in the adult population; however, evidence suggests a **possible increase in the incidence of pediatric pancreatitis**. This rise in incidence

could be due to a true increase in the frequency of pediatric pancreatitis or due to increased awareness about the condition.

Note: The incidence of pancreatitis in children is estimated to be approx. 1 in 10,000 children.

Classification of Pancreatitis in Children

Pancreatitis is **classically divided into 2 groups(acute and chronic).**

Acute pancreatitis is often characterized by episodic bouts of inflammation, while chronic pancreatitis involves a long-standing process.

There are **many cumulative scoring systems for assessing and prognosticating various aspects of pancreatitis**, but there is also conflicting evidence regarding the superiority of one score over the others.

The most notable scores are as follows:

- Ranson criteria
- APACHE score
- Balthazar grade
- CT severity index (CTSI)
- Glasgow criteria
- BISAP score

Ranson criteria

Formulated in the second half of the 20th century; Ranson's criteria are used to grade the severity of acute pancreatitis.

For patients with non-gallstone pancreatitis, the parameters introduced are as follows:

At admission:

- Age > 55 years
- WBC count > 16,000 cells/mm³
- Blood glucose > 11 mmol/L (> 200 mg/dL)
- Serum AST > 250 IU/L
- Serum LDH > 350 IU/L within 48 hours

Parameters deemed relevant are as follows:

- Serum calcium =, >, or < 2.0 mmol/L
- Hematocrit decrease > 10%
- Hypoxemia with PaO₂ < 60 mm Hg
- BUN increase > 5 mg/dL after intravenous hydration
- Base deficit > 4 mEq/L
- Sequestration of fluids > 6 L

For gallstone pancreatitis, the relevant features are as follows:

At admission:

- Age > 70 years
- Leukocyte count > 18,000 cells/mm³

- Blood glucose > 12.2 mmol/L
- Serum AST > 250 IU/L
- Serum LDH > 400 IU/L at 48 hours

The following features should be assessed:

- Serum calcium < 2.0 mmol/L
- Hematocrit fall > 10%
- Hypoxemia PaO₂ < 60 mm Hg
- BUN increase ≥ 2 mg/dL after intravenous hydration
- Negative base excess > 5 mEq/L
- Fluid sequestration of > 4 L

If the score is ≥ 3, the diagnosis is likely severe pancreatitis. A score < 3 is indicative of non-severe pancreatitis.

APACHE II score

APACHE is an abbreviation for Acute Physiology and Chronic Health Evaluation. Several factors, such as serum calcium, obesity, and indicators of organ failure, are taken into consideration when calculating the score. An APACHE score > 8 signifies severe pancreatitis and is directly associated with an increased risk of mortality.

Balthazar score

Introduced by Emil Balthazar, the Balthazar grade is now an integral part of the Computed Tomography Severity Index (CTSI). **The Balthazar grade can be described as follows:**

- Normal CT: Grade A
- Focal or diffuse enlargement of the pancreas: Grade B
- Pancreatic gland abnormalities and peripancreatic inflammation: Grade C
- Fluid collection in a single location: Grade D
- Two or more fluid collections and/or gas bubbles in or around the pancreas: Grade E

CT Severity Index (CTSI)

The CTSI has a total of 10 points. CTSI is a cumulative result of the evaluation of the Balthazar grade and pancreatic necrosis. The Balthazar grade is serially scored from 0–4.

The extent of pancreatic necrosis determines the number of points allotted as described below:

- No necrosis: 0 points
- 0–30% necrosis: 2 points
- 30–50% necrosis: 4 points
- Greater than 50% necrosis: 6 points

Glasgow criteria

The Glasgow criteria are useful for various etiologies of pancreatitis, such as alcohol- or gallstone-induced pancreatitis. A score ≥ 3 is indicative of severe pancreatitis.

The parameters studied can be memorized with the acronym, PANCREAS, as

follows:

- **P:** PaO₂ < 60 mm Hg
- **A:** Age > 55 years
- **N:** Neutrophilia with a total leukocyte count > 15,000 cells/mm³
- **C:** Hypocalcemia with a calcium level < 2 mmol/L
- **R:** Renal dysfunction with a urea level > 16 mmol/L
- **E:** Elevated enzymes, such as an AST level > 200 IU/L and a LDH level > 600 IU/L
- **A:** Albumin level < 32 g/L
- **S:** Glucose level > 10 mmol/L

BISAP scoring

- BUN > 25 mg/dL
- Impaired mental status
- > 2 SIRS criteria
- Age > 60
- Pleural effusions present

Clinical Presentation of Pancreatitis in Children

Example case

A 17-year-old male patient who admits to drinking alcohol with his friends after school presents with nausea and marked vomiting for the past 12 hours, and he attributes his symptoms to alcohol.

On physical examination, he has abdominal tenderness, fever, decreased bowel sounds, and upper abdominal pain that radiates to the back and worsens after eating. Laboratory testing shows an elevated lipase level.

What pathologic process is relevant to the patient's condition?

Etiopathogenesis of Pancreatitis in Children

Pancreatitis is an acute or chronic inflammatory process of the pancreas. Acute pancreatitis is a reversible injury associated with inflammation, while chronic pancreatitis is irreversible destruction from prolonged inflammation. **Metabolic disorders and anatomic or mechanical anomalies increase the risk of acute pancreatitis**, such as pancreas divisum, choledochal cyst, and sphincter of Oddi dysfunction.

The etiopathogenesis of acute pancreatitis can be understood with respect to the **3 most important causes (duct obstruction, acinar cell injury, and defective intracellular transport)**. All three causes lead to the activation of enzymes, which results in acute pancreatitis.

The etiologies of pediatric acute pancreatitis differ from the etiologies of adult acute pancreatitis.

The **most common causes** of pediatric acute pancreatitis belong to the **biliary obstruction category**. Gallstones, biliary sludge, pancreas divisum, choledochal cyst,

sphincter of Oddi dysfunction, and annular pancreas are the most common examples of biliary obstruction in children that lead to acute pancreatitis. Up to one-third of the cases of acute pancreatitis in children are due to biliary tract obstruction.

While alcohol is a common cause of acute pancreatitis in adults, alcohol is rarely a cause of acute pancreatitis in the pediatric population. Medications appear to account for up to one-fourth of the cases of acute pancreatitis in children. Valproic acid, 6-mercaptopurine/azathioprine, mesalamine, trimethoprim/sulfamethoxazole, furosemide, tacrolimus, and steroids are commonly used in children and have been associated with acute pancreatitis. These medications might cause direct acinar cell injury.

Systemic diseases are responsible for almost all of the remaining cases of acute pancreatitis in children. **Sepsis, shock, and hemolytic-uremic syndrome are 3 common examples of systemic illnesses that can cause acute pancreatitis in children.**

Other less common causes of acute pancreatitis in children include trauma, viral infections, diabetic ketoacidosis, hypertriglyceridemia, hypercalcemia, and idiopathic etiologies.

The **key features of the cellular cascade** that follows as a consequence of any of the previously mentioned etiologies, which ultimately culminate in pancreatitis, are as follows:

- Interstitial edema
- Impaired blood flow
- Ischemia
- Acinar cell injury
- Inappropriate activation of pancreatic lytic enzymes

Clinical Signs and Symptoms of Pancreatitis in Children

Acute pancreatitis is usually a clinical diagnosis with signs and symptoms as elicited in the clinical vignette above. However, pancreatitis can be difficult to diagnose and is commonly a silent mimicker of many seemingly innocuous pathologies.

The signs and symptoms of pancreatitis can be briefly summarized as follows:

Signs	Symptoms
Hypotension	Nausea
Abdominal distension in the epigastric region	Vomiting
Decreased bowel sounds	Fever
Jaundice	A sick, exasperated, flushed look on the face
Palpable abdominal mass if pseudocyst is present	Diffuse abdominal pain that radiates to the back and worsens with meals

Diagnosis of Pancreatitis in Children

Pancreatitis is often a clinical diagnosis based on the presence of classical signs and symptoms. However, **chronic pancreatitis is difficult to diagnosis.** Although no single study has provided comprehensive information regarding the diagnosis of pancreatitis, information regarding its diagnosis, a battery of tests has been developed to diagnose

pancreatitis with high sensitivity and specificity.

Investigations for making a diagnosis of pancreatitis can be categorized as outlined below:

- Blood work
- Imaging studies, such as abdominal ultrasound, MRI, and contrast CT
- Invasive studies, such as endoscopic retrograde cholangiopancreatography (ERCP)

Laboratory investigations based on blood and serum, and the interpretations which facilitate diagnosing pancreatitis, are noted below:

Investigation	Interpretation
Lipase	Elevated
CRP	Increased (often reflects severe disease)
Alkaline phosphatase	Markedly increased in cases of duct obstruction and biliary etiology
GGT	Escalated in alcoholic pancreatitis

Other findings often encountered in blood laboratory testing in pancreatitis which reflects a poor prognosis are a hypocalcemia, hyperglycemia, coagulopathy, and metabolic acidosis.

INSPPIRE Diagnostic Criteria for Acute Pancreatitis in Children

The International Study Group of Pediatric Pancreatitis: In the search for a cure 'INSPPIRE' attempted to define pediatric acute pancreatitis in 2014. The following diagnostic criteria can be used to objectively define a case of acute pancreatitis in a child:

The patient should have at least 2 of the following:

- Abdominal pain compatible with acute pancreatitis
- Elevated serum lipase and/or amylase > 3 times the upper limit of normal
- Imaging findings consistent with acute pancreatitis

Management of Pancreatitis in Children

Treatment depends on severity. For acute uncomplicated pancreatitis, **pain control measures and intravenous fluids for dehydration and electrolyte control form the mainstay of therapy.** PPI for acid suppression and maintenance of nothing per mouth (NPO) while vomiting is also essential adjuncts to treatment. Treatment for chronic pancreatitis is often aimed to prevent acute bouts and to maintain a new compensated balance between pancreatic function and inflammation of the organ.

Pancreatic enzyme supplements are available for patients to ease digestion. Some etiologies, such as choledochal cyst, pancreatitis secondary to duct obstruction, gallstones, and biliary sludge, often necessitate surgical intervention. Surgical procedures for severe necrotic pancreatitis, such as necrosectomy, are often associated with high morbidity and mortality.

Prognosis of Pancreatitis in Children

The chief complications of pancreatitis are as follows:

- Pseudocyst formation
- Splenic vein thrombosis
- Acute respiratory distress syndrome
- Multi-organ failure
- Sepsis
- Nutritional issues

Splenic vein thrombosis occurs in 19% of patients with pancreatitis. Uncomplicated cases usually achieve resolution in 3–7 weeks. Evidence suggests an **increased risk of carcinoma in patients with hereditary pancreatitis**. A poor prognosis is also present with associated conditions, such as underlying systemic disease and trauma.

Children with acute pancreatitis are usually hospitalized for approx. 1 week. Infants and toddlers who develop acute pancreatitis might be hospitalized for up to 3 weeks. The estimated cost of pediatric acute pancreatitis in the United States is approx. \$52 million per year.

Prevention of Pancreatitis in Children

Alcohol- and gallstone-induced pancreatitis are the most crucial etiologies of pancreatitis.

Pancreatitis can be prevented if the known etiology is promptly addressed.

Moreover, a low-fat diet helps to prevent recurrent acute episodes.

Summary of Pancreatitis in Children

Epidemiology

Pancreatitis represents inflammation of the pancreas and can be acute or slow and indolent, such as in chronic pancreatitis. Although pancreatitis is more common in adults, the incidence of pediatric pancreatitis is increasing. **Pancreatitis has a severe negative impact on the quality of life;** hence, thorough knowledge and early care to prevent, detect, and treat pediatric pancreatitis are essential.

Cumulative scoring systems

Cumulative scoring systems based on, clinical signs, symptoms, and laboratory investigations, and imaging studies have been developed to grade the severity of pancreatitis. The **severity of pancreatitis is the most important determining factor regarding treatment and subsequent prognosis**. None of the scoring systems are superior over the others.

Etiology

The chief etiologies of pancreatitis are duct obstruction, acinar cell injury, and defective intracellular transport, all of which lead to a vicious cycle of cell injury, inappropriate activation of pancreatic enzymes, and inflammation with destruction of the pancreas. **While gallstones cause duct obstruction, alcohol affects acinar cells and**

deregulates the intracellular transport machinery.

Diagnosis

Acute pancreatitis is often a clinical diagnosis; however, when the diagnosis is uncertain, several **diagnostic tests, such as routine blood testing, to invasive modalities, such as ERCP, are useful.** These investigations, when appropriately used, provide marked sensitivity and specificity in diagnosing pancreatitis. Blood tests that are associated with a poor prognosis are [hypocalcemia](#), hyperglycemia, [coagulopathy](#), and metabolic acidosis.

Treatment

Treatment depends on severity. While the treatment of acute pancreatitis is often symptom-based and conservative with painkillers and hydration forming the mainstay of treatment, severe necrotic pancreatitis often requires surgical intervention. The latter is invariably associated with high morbidity and mortality. **Dietary changes, enzyme supplementation, and prevention** of further bouts are also essential in the management of pancreatitis.

Pancreatitis is often associated with complications, such as splenic vein thrombosis, sepsis, and pseudocyst formation. Pancreatitis markedly affects the quality of life.

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