Imaging of Acute Pancreatitis

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KEYWORDS

• Acute pancreatitis • Interstitial edematous pancreatitis • Necrotizing pancreatitis
• Acute peripancreatic fluid collections • Acute necrotic collection • Pseudocyst
• Walled-off pancreatic necrosis • Systemic inflammatory response syndrome

KEY POINTS

- The revised Atlanta classification of acute pancreatitis provides a consistent and universally adaptable system for defining acute pancreatitis in its various stages.
- The revised Atlanta classification of acute pancreatitis distinguishes interstitial edematous pancreatitis from necrotizing pancreatitis and defines early and late phases.
- The revised Atlanta classification of acute pancreatitis divides severity into mild, moderately severe, and severe form and describes transient (≤48 hours) and persistent (>48 hours) organ failure, the presence or absence of which defines these stages.
- The revised Atlanta classification of acute pancreatitis provides a new and clear definition for pancreatic fluid collections (local complications) based on the absence or presence of necrosis: acute peripancreatic fluid collection, acute necrotic collection, pseudocyst, walled-off necrosis, and postnecrosectomy pseudocyst. All fluid collections may be sterile or infected.
- In the first week, only clinical parameters are important for treatment planning, but after the first week, morphologic criteria defined by computed tomography combine with clinical parameters to determine care.

INTRODUCTION

Acute pancreatitis represents an acute inflammatory disorder of the pancreas that is initiated by premature activation of digestive enzymes in the pancreatic acinar cells, leading to autodigestion of the pancreas. The process consists of local inflammation of the pancreas and an exaggerated systemic inflammatory response syndrome (SIRS) to the pancreatic injuries, which may result in multisystem organ failure.[1] Its incidence is increasing worldwide related to well-established risk factors, such as obesity, increased aging of the general population, and rising incidence of gallstone disease.[2] In the United States, alcohol abuse and gallstone disease are the most common causes of acute pancreatitis.[2,3] About 80% to 85% of patients suffer only from the mild form of pancreatitis, whereas approximately 15% to 20% develop a severe course with complications that can include organ failure, local complications, and even death.[4]

In 1992, the original Atlanta classification system was introduced as a method for defining terminology of acute pancreatitis, its severity, organ failure, and complications.[5] However, over the years, many researchers and clinicians found this classification system insufficient and at times confusing. The need for revision also was prompted by new insights into the pathophysiology of the disease, markedly improved imaging, and new treatment options. These new treatment options included minimally invasive radiologic, endoscopic, and operative procedures for local complications that

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Radiol Clin N Am 53 (2015) 1189–1208
http://dx.doi.org/10.1016/j.rcl.2015.06.006
0033-8389/15/$ – see front matter

changed the management of patients. Therefore, an international working group on acute pancreatitis was formed to revise the Atlanta classification and published its revision in 2013.[6] The important topics that were included in this revision were a clear assessment and definition of clinical and morphologic severity of disease and clear definition of the various pancreatic and peripancreatic fluid collections that develop over the course of this disease. It also outlined what radiologists should look for when evaluating a patient with acute pancreatitis who undergoes imaging. Importantly, it stressed that in the early phase of the disease, there is no correlation between the severity of clinical disease and morphologic manifestations as seen by imaging, which limits the role of imaging in the early phase.

Because computed tomography (CT) is widely available and considered the standard in evaluating patients with acute pancreatitis, the emphasis of this revision is on CT. Magnetic resonance (MR) was recommended in selected cases to define the nature of a fluid collection or when CT is contraindicated. Both ultrasound and MR are considered superior to CT in diagnosing the heterogeneity of pancreatic collections and visualizing the presence of nonliquefied necrotic material, which is important for management. It remains to be seen if dual-energy CT might improve results in this area.[7] This article addresses the clinical definition of acute pancreatitis, defines the various pancreatic fluid collections and complications as demonstrated by CT and MR, and assesses the role of imaging in these patients.

REVISED TERMINOLOGY AND CLASSIFICATION

Diagnosis of Acute Pancreatitis

The clinical diagnosis of acute pancreatitis is based on 2 of 3 features[6]:

1. Abdominal pain highly suggestive of acute pancreatitis (acute onset of severe epigastric pain, often radiating to the back).
2. Serum lipase or amylase activity at least 3 times the upper limits of normal.
3. Characteristic features of acute pancreatitis on CT and less commonly on MR imaging or ultrasound.

If serum lipase and amylase are not sufficiently elevated but symptoms strongly suggest acute pancreatitis, imaging needs to be used to confirm the diagnosis. Imaging is usually not required in the emergency department or on the first day of admission if acute pancreatitis can be diagnosed based on typical symptoms and elevated lipase/amylase activity. However, imaging may be needed in patients with inconclusive presentations.

Onset of acute pancreatitis is defined by the beginning of acute abdominal pain and not by the time of arrival in the hospital or emergency room.

Phases of Pancreatitis

The revised Atlanta classification distinguishes between an early (within the first week) and a late phase (after the first week).[6]

Early phase

This phase usually takes place in the first week only but occasionally extends into the second week. The early phase is characterized by a systemic response to the pancreatic injury. As a result of a cytokine cascade caused by the inflammatory injury to the pancreas, a SIRS develops. If SIRS persists, organ failure may develop. During the early phase of acute pancreatitis, the severity of the attack is determined by the presence and duration of organ failure. The Atlanta classification defines organ failure as transient if it lasts for 48 hours or less, and as persistent if it lasts for greater than 48 hours. It may affect a single organ or multiple organs (multiorgan failure). In the early stage, possible pancreatic necrosis cannot by diagnosed with certainty. Local complications do not determine severity, because there is no direct correlation between the degree of morphologic changes and the severity of organ failure. In the early phase, the categorization of acute pancreatitis as moderately severe or severe is defined by the presence and duration of organ failure, which is determined based entirely on clinical criteria.

Late phase

The late phase occurs only in patients with moderately severe or severe pancreatitis because it is characterized by persistence of systemic signs of inflammation or by development of local or systemic complications. Local complications evolve over time and CT plays an important role in defining the type and extent of complications for best management. Nevertheless, persistent organ failure is an important factor in determining severity, and this phase is categorized based on both clinical data and morphologic findings.

Types of Pancreatitis

According to the revised Atlanta classification, acute pancreatitis is split into interstitial edematous pancreatitis and necrotizing pancreatitis.[6]

Interstitial edematous pancreatitis

In interstitial, edematous pancreatitis, the pancreas shows diffuse and sometimes localized