Acute pancreatitis: an intensive care perspective

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Abstract

Acute pancreatitis (AP) is a sudden inflammation of the pancreas, which is often mild and resolves spontaneously. However, if severe it can cause significant morbidity and mortality and commonly requires management in the intensive care unit. The diagnosis of AP involves a combination of clinical symptoms, elevations in pancreatic enzymes and/or characteristic findings on computer tomography. In 2012, the Atlanta Symposium revised the classification of pancreatitis into mild, moderate and severe. The key to appropriate management is identifying patients with severe AP, and initiating intensive care supports at an early stage. Scoring systems such as the Ranson/Imrie score, and the Acute Physiology and Chronic Health Evaluation II score are used to help determine severity. The general management involves physiological support, with fluid resuscitation, enteral feeding and support of the vital organs. The use of prophylactic antibiotics is currently not supported. Pancreatic collections should be drained by interventional radiology and sent for culture and antimicrobial sensitivity assessment. This review article outlines the assessment and management principles of severe pancreatitis in the intensive care setting.

Keywords Acute pancreatitis; complications; intensive care; management

Royal College of Anaesthetists CPD Matrix: 2C00

Learning objectives

After reading this article, you should be able to:

- state the diagnostic criteria for acute pancreatitis
- recall the different scoring systems available for severity assessment
- list the main complications of severe acute pancreatitis
- outline the mainstays in treatment for acute pancreatitis in the ICU

Epidemiology

Acute pancreatitis (AP) is a common disease of the gastrointestinal tract, which causes a significant burden on intensive care resources worldwide. In the UK, the incidence is 150–420 cases per million population and is increasing annually[1] due to a rise in the number of cases secondary to alcohol in females and improved diagnostic techniques. Although 80% of cases are mild and resolve spontaneously, 20% require intensive care management and are associated with significant morbidity and mortality. The ICU mortality for severe acute pancreatitis (SAP) is 16% with a hospital mortality of 20%. Despite advances in diagnosis and management of SAP, the overall mortality remains largely unchanged.

Aetiology

Box 1 lists the causes of acute pancreatitis. The two most common causes of AP are gallstones (40–70%) and alcohol (25–35%).[2] These both must be excluded prior to attributing the cause to another possible association. In up to 20% of cases no cause can be identified and these are referred to as idiopathic, the incidence of which rises with age.

Two important risk factors for the development of acute pancreatitis are morbid obesity and diabetes. Morbid obesity is also a risk factor for developing severe acute pancreatitis.

Pathophysiology

The underlying mechanism of AP is dysfunction of the acinar cells of the exocrine pancreas. In healthy individuals, these acinar cells produce, store and regulate the secretion of digestive enzymes into

Aetiology of acute pancreatitis

- Alcohol
- Gallstones
- Hypertriglyceridaemia (TG > 11.3 mmol/L)
- Hypercalcaemia
- Hypothermia
- Post-endoscopic retrograde cholangiopancreatography (ERCP)
- Abdominal trauma
- Post perforated duodenal ulcer
- Post cardiac surgery
- Bacteria: mycoplasma, campylobacter, TB, legionella, leptospirosis
- Viral: measles, mumps, rubella, VZV, HCV, EBV, HIV, Coxsackie B
- Parasites: ascariasis, clonorchis sinensis
- Autoimmune eg. primary sclerosing cholangitis, primary biliary cirrhosis, rheumatoid arthritis, SLE, Crohn's Disease
- Drugs, e.g. azathioprine, frusemide, methanol, metronidazole, oestrogen (OCP), salicylates, steroids, sulfamethoxazole-trimethoprim, sodium valproate, thiazide diuretics.
- Toxins, e.g. scorpion venom, methanol, zinc
- Idiopathic
- Hypertensive sphincter or microlithiasis
- Emboli or Ischaemia
- Tumours: pancreatobiliary

Box 1

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the duodenum. Trypsinogen is the precursor enzyme, produced by the pancreas and activated to trypsin in the duodenum. A small proportion of trypsinogen is activated in the acinar cells spontaneously. However, pathologically high levels of these enzymes within the pancreas can lead to autodigestion of the gland. To protect against this, the pancreas forms protective enzymes (antitrypsins: trypsin inhibitor, serine protease inhibitor Kazal type 1 (SPINK1), mesotrypsin, enzyme Y, α1-antitrypsin, α2-macroglobulin). In AP, these protective mechanisms are inadequate or fail.

There are many factors that can lead to pathological levels of digestive enzymes. An obstruction to the outflow of enzymes (i.e. stone, tumour, oedema) can lead to pancreatic duct hypertension, rupturing the small pancreatic ducts. Alcohol, high fat diet, bilary duct stones, surgery or endoscopic retrograde cholangiopancreatography (ERCP) can promote duodenal pancreatic reflux leading to damage. Rarely, an excessive muscarinic stimulant can lead to hypersecretion of enzymes (i.e. organophosphate poisoning or scorpion venom).

Recent work has suggested that there are three genes that play a critical role in pancreatic function. These are: PPSSI (prototype susceptibility cationic trypsinogen gene), SPINK1 (serine protease inhibitor Kazal type 1) and CFTR (cystic fibrosis transmembrane conductance regulator gene). Recurrent acute pancreatitis and chronic pancreatitis are associated with multiple variants in these genes together with the above environmental factors.[3]

Furthermore, the local release of trypsin also activates the complement, coagulation and fibrinolysis pathways outside the gland, causing alterations in the interstitium and vascular endothelium. This microcirculation damage increases the vascular permeability and releases free radicals, cytokines, arachidonic acid metabolites, lipolytic and proteolytic enzymes, inducing thrombosis, haemorrhage and finally tissue necrosis. Cytokines and enzymes released into the systemic circulation can cause a systemic inflammatory response syndrome (SIRS) and lead to multiple organ dysfunction syndrome (MODS).

Diagnosis and classification

For the diagnosis of AP, two of the following three features must be present:

1. Abdominal pain (typical of AP: acute onset, persistent, severe, epigastric, most commonly radiating to the back).
2. Serum lipase (or amylase) level three times the upper limit of normal.
3. Characteristic pancreatic findings on contrast enhanced computer tomography (CECT) or less commonly on magnetic resonance imaging (MRI) or transabdominal ultrasound.

In 2012, the Atlanta Symposium revised the classification of AP and included a clinical assessment of severity (Table 1).[4] It classified AP into two phases of the disease: early and late. The early phase, which occurs within the first week, is characterized by SIRS and MODS. The late phase, which occurs after 1 week, is characterized by local and systemic complications.

Local complications are defined as peripancreatic fluid collections, pancreatic pseudocyst, pancreatic and peripancreatic necrosis (sterile or infected) and walled-off necrosis.

The severity of AP is now classified as mild, moderate or severe based on the presence or absence of organ failures and local or systemic complications.

Revised Atlanta classification 2012[4]

Grade of severity	
Mild	No organ failure No local or systemic complications
Moderate	Transient organ failure (resolves within 48 hours) Local or systemic complications without persistent organ failure
Severe	Persistent organ failure (persists >48 hours) Single or multiple organ failure

Table 1

1. Mild: Pancreatitis with no organ failure and absence of local or systemic complications.
2. Moderate: Pancreatitis and transient (resolves within 48 hours) organ failure or local or systemic complications.
3. Severe: Pancreatitis and persistent (>48 hours) organ failure.

Organ failure is defined by the modified Marshall scoring system as a score of 2 or more for any of these organ systems (Table 2).[4]

Clinical presentation

The main feature of AP is severe, constant epigastric, umbilical or left upper quadrant pain, often radiating to the back, chest or flanks. The intensity of the pain can be variable and does not correlate with severity.[2] It is frequently accompanied by nausea and vomiting. If jaundice is present, this is suggestive of a biliary tract obstruction, which may be secondary to a gall stone or a tumour in the head of the pancreas. Signs of shock may commonly be present, including tachycardia, hypotension, cool peripheries, oliguria, and require prompt detection and resuscitation. Retroperitoneal or intra-abdominal haemorrhage causing cutaneous discoloration in the umbilical area (Cullen's sign) or flanks (Grey-Turner's sign) frequently reflect a critically unwell patient.

Investigations

Laboratory

An elevated serum lipase is the preferred biochemical indicator for acute pancreatitis. It is more specific than amylase, which

Modified Marshall score

	Score				
Organ system	**0**	**1**	**2**	**3**	**4**
Respiratory PaO_2/FiO_2 ratio	>53.3	>40	>26.6	>13.3	<13.3
Renal creatinine (micromole/L)	<134	134–169	170–310	311–439	>439
Cardiovascular systolic BP	>90	<90 fluid responsive	<90 non fluid responsive	<90 with pH < 7.3	<90 with pH < 7.2

Table 2

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