2 Pancreatitis: Clinical Aspects of Inflammatory Phenotypes

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Abstract

Pancreatitis is a condition in which the pancreas becomes inflamed and gets damaged when the digestive enzymes are activated before they are released into the small intestine and attacks the pancreas. When these activated digestive enzymes are activated still in the pancreas, irritating the cells of our pancreas causes inflammation. These cause complications such as the formation of the pseudocyst, breathing problem, failure in the kidney, diabetes and pancreatic cancer. Two forms of pancreatitis include acute and chronic. Acute pancreatitis is a condition in which inflammation lasts for short time, while chronic pancreatitis is a condition in which inflammation lasts for a longer time. Gallstones and the gallbladder in the pancreas can be removed by surgical treatment. The probability of developing pancreatitis can be reduced by alcohol cessation and preventing gallstone complication. Risk factors include hereditary, hyperlipidaemia, smoking, cystic fibrosis and usage of certain medicines such as oestrogen and tetracycline. The tests to detect pancreatitis include enzymes of the pancreas, liver and kidney. Signs of infection include fever/fatigue, anaemia and decreased electrolyte and calcium level. In acute pancreatitis, the patient's diet consists of bowel rest, and for chronic pancreatitis, it includes low-fat diet and high carbohydrates.

Keywords

Acinar cell injury · Acute pancreatitis · Chronic pancreatitis · Secretin-enhanced MR cholangiography · Fluid therapy

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Abbreviations

AP	Acute pancreatitis
CP	Chronic pancreatitis
CRP	C-reactive protein
ERCP	Endoscopic retrograde cholangiopancreatography
FAIMS	Field asymmetric waveform ion mobility spectrometry
RDW	Red cell distribution width
VOC	Volatile organic compounds

2.1 Introduction

Acute pancreatitis accounts for approximately 56 cases per one-tenth million persons per year in the United Kingdom, while in the United States over 220 thousand are hospitalised per year. Formation of gallstones is the common cause for acute pancreatitis, about 25 per hundred of acute pancreatitis cases were due to alcohol. Gallstones of patients smaller than 5 mm in size are thought to have higher risk of gallstone pancreatitis. Obstruction at sphincter of Oddi leads to injured pancreatic ducts. Acute pancreatitis includes improper release and activation of pancreatic enzymes, and trypsin plays a role in activating these proenzymes. Its inappropriate activation leads to pancreatic inflammation and triggers the release of IL-1, IL-6 and IL-8; TNF-α; and platelet-activating factor [24]. Advancement in magnetic resonance imaging had allowed the identification and characterisation of pancreatic disorders [25]. Chronic pancreatitis leads to pancreatogenic diabetes mellitus which also occurs secondary to pancreatic cancer [10]. The first category study of chronic pancreatitis (CP) in the United States is Prospective Evaluation of Chronic Pancreatitis for Epidemiologic and Translational Studies [27], and to better understand the pathophysiology and mechanisms, biorepositories are needed [8]. Research in pancreatic cancer, chronic pancreatitis (CP) and pancreatogenic diabetes mellitus were impeded due to inability in obtaining pancreatic tissue for study, genetic testing and biomarker development [23]. Genetic testing has been increasing clinical practice for the identification of susceptible genes for diseases [11]. The treatment of chronic pancreatitis includes pancreatectomy with autologous islet cell transplantation which is offered only in selected centres worldwide [22].

2.2 Causes

The factors responsible for chronic pancreatitis include smoking, autoimmune responses, genetics, alcohol, obstructive mechanisms, metabolic abnormalities and idiopathic mechanisms, whereas for acute pancreatitis, it includes autoimmune responses, use of alcohol, hypertriglyceridaemia, biliary hypercalcaemia and hereditary/genetic abnormalities.

2.3 Acute Pancreatitis

Amongst gastrointestinal system diseases, one of the major forms is acute pancreatitis (AP) [28]. It is a serious disease possessing a guarded prognosis and aetiology which involves either the bladder or alcohol; it leads to trauma which is extremely rare and is often associated with intra-abdominal lesions [12]. Paediatric pancreatitis is understudied and an emerging field with an increasing incidence of disease and therefore extrapolated from adults [1]. A patient suffering from shortness of breath and acute pulmonary oedema upon admission at third day of hospitalisation was diagnosed with takotsubo cardiomyopathy [15]. Acute myocardial infarction incidence in acute pancreatitis is rare, and recognition and diagnosis of such may be clinically challenging [20]. Autoimmune systemic disease of IgG4-related disease defined as infiltration of IgG4-positive plasma cells in the affected organs leads to tissue inflammation which is rare and involves every organ [5]. Type I autoimmune pancreatitis is an IgG4-related systemic disease which exhibits as a pancreatic disorder, whereas type II is characterised by absence of IgG4-positive cells [3]. Toll like receptors initiate the excessive inflammatory reaction which makes the immune function unbalanced and also damages the function of many organs. Studies show TLR-4 is closely related to the occurrence and development of acute pancreatitis [5]. Acute pancreatitis is a necro-inflammatory disease diagnosed by elevated lipase levels and distinct imaging findings. One of the strategies to prevent recurrent attacks involves providing alcohol cessation counselling to patient [14]. Recent reports on fluid therapy, antibiotics, analgesics and the management of AP have led to improvements in clinical care [7]. Pancreatitis and Wilson's disease were taken as examples in the study of ER stress in liver and pancreatic diseases [16]. Acute pancreatitis is caused by acinar cell injury, defective intracellular transport and duct obstruction. In acinar cell injury, agents such as alcohol, drugs, trauma and ischaemia cause activation of digestive enzymes through release of intracellular proenzymes and lysosomal hydrolases. In defective intracellular transport and metabolic injury, alcohol intake leads to acinar cell injury through delivery of proenzymes to lysosomal compartment and intracellular activation of enzymes. In duct obstruction and ampullary obstruction, chronic alcoholism, ductal concentration and intestinal oedema lead to impaired blood flow and ischemia and finally to acinar cell injury. This acinar cell injury leads to lesions such as intestinal inflammation, proteolysis, necrosis and haemorrhage (Fig. 2.1).

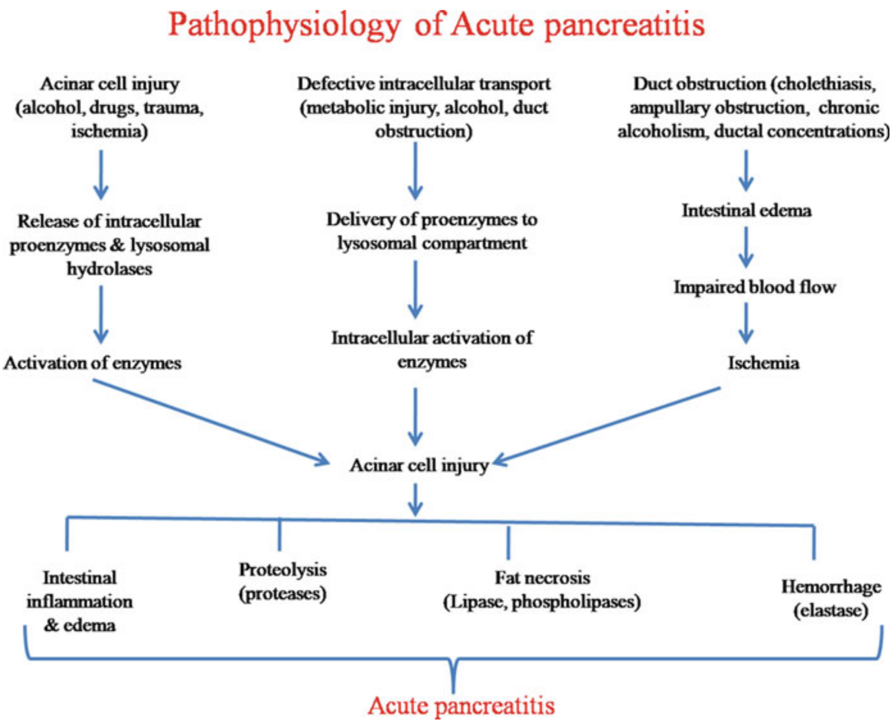

Fig. 2.1 Acute pancreatitis is mainly due to acinar cell injury which is caused by alcohol, smoking, metabolic injury and duct obstruction

2.4 Chronic Pancreatitis

Pancreatic inflammation with progressive loss of exocrine and endocrine gland compartments leading to atrophy or replacement with fibrous tissue in the affected area is known as chronic pancreatitis. Consequences of chronic pancreatitis include recurrent abdominal pain or constant abdominal pain, maldigestion and diabetes mellitus [13]. Characteristic features of chronic pancreatitis (CP) include pancreatic inflammation, scarring and fibrosis [17]. Clinical manifestations include pain in the abdominal region and insufficiency in exocrine and endocrine glands [18]. Even though acute pancreatitis and chronic pancreatitis were distinct [26], reports state that acute pancreatitis, recurrent acute pancreatitis and chronic pancreatitis represent a disease continuum [2, 21]. The risk factors include idiopathic, hereditary, autoimmune, severe, acute, pancreatitis-associated, chronic and obstructive pancreatitis [6]. This classification was based on individual's risk of developing chronic pancreatitis [4] (Fig. 2.2).

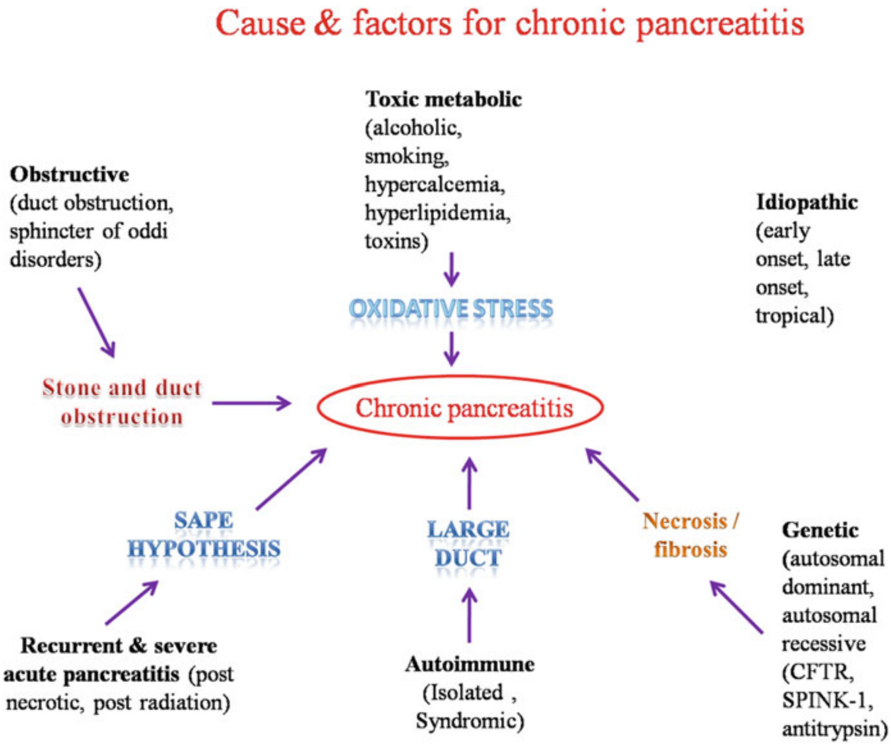

Fig. 2.2 Chronic pancreatitis is caused by factors such as idiopathic, hereditary, autoimmune, severe, acute and obstructive pancreatitis

2.5 Diagnosis

Primary onset of acute pancreatitis was not detected till symptoms appear, while later stages were detected by fibrosis, distortion of the pancreatic ducts, pseudocyst and portal vein thrombosis or splenic vein thrombosis [13]. Patients with a long-standing history of alcohol or tobacco use are at risk for chronic pancreatitis which helps in diagnosis, and management involves reduced usage of alcohol and tobacco, modifications in diet and treatment of pancreatic insufficiency. Pancreatic neoplasms of acute, chronic and autoimmune pancreatitis were detected using diffusion-weighted imaging. Ductal anomalies and characterisation of pancreatic cystic lesions were evaluated in acute and chronic pancreatitis using secretin-enhanced MR chol-angiography [25]. Volatile organic compounds (VOC) were detected using field asymmetric waveform ion mobility spectrometry (FAIMS) by comparing healthy controls with pancreatic cancer from a urine sample [19]. RDW was not specific, but the CRP/albumin ratio is an inexpensive and reliable marker in prognosis of AP [28]. Amongst coronary imaging techniques, optimal cohesion tomography helps us to observe coronary thrombus, inflammatory processes and presence of acute myocardial infarction. Intravascular imaging delineates details of intracoronary pathology which cannot be clearly predicted on standard fluoroscopy [20].

2.6 Treatment

Treatment includes medical, radiological, endoscopic and surgical [13]. Fluid therapy is used for acute pancreatitis. Endotherapy serves to achieve symptom remission and also reduces rates of recurrence, abdominal pain, hospitalisation and surgical arbitration [9].

2.7 Conclusion

Management of acute pancreatitis by fluid therapy yields better outcome. Acute pancreatitis complications can be prevented with limited usage of antibiotics as prophylaxis which shows beneficial effects. Severe acute pancreatitis benefits from ERCP, while mild patients are recommended to undergo single-stage laparoscopic cholecystectomy as they get benefit from single-stage and bile duct exploration which reduces length of hospitalisation and need for recurrent admissions. Acute pancreatitis is intent by alcohol, smoking and duct obstruction which proceeds to chronic pancreatitis which is caused by alcohol, obstruction of the pancreatic duct and hyperlipidemia. Progressive understanding of this disease had enhanced and changed the approach to management. Management of chronic pancreatitis involves counselling the patient regarding alcohol and tobacco and addressing the problems of malnutrition and osteoporosis.

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