Compared to ultrasound imaging CT has the development and/or progress of complications [5]. Conditions CT is useful in assessing the patient presents with rapidly deteriorating clinical pancreas role of CT in imaging of the patterns of the disease. This article discusses the etiology and pathology of abdominal structures as well as developments of complications and death [6].

Role of contrast media in CT imaging of the pancreas

Contrast media for abdominal CT imaging are used to enhance blood vessels and vascular organs, for example, the liver and spleen, as well as pathological structures such as tumours, abscesses and inflammatory structures/organs. Inflammatory processes have a higher vasculature therefore display a higher than usual uptake of contrast media thus a higher attenuation of contrast media compared to normal structures [10]. A normal pancreas enhances after intravenous contrast medium administration depicting an homogenous granular pattern of the internal structure of the organ. Pancreatic enhancement is further improved due to opacification of larger vessels surrounding it compared to un-enhanced fluid within the pancreatic ducts [10].

Etiology of acute necrotizing pancreatitis

In Western countries over 80% of acute necrotising pancreatitis cases are associated with excessive alcohol abuse or the presence of biliary calculi which damage the pancreatic excretory ducts leading to APN [11]. Contrast enhanced CT has proved to be of primary importance in both the diagnosis and grading of ANP and should be performed as a first line investigation since no other diagnostic imaging modality has such a decisive and sensitive characteristic [9]. For optimal imaging of the pancreas a dynamic scan can be performed at a desired bed position where visualization of perfusion patterns of the pancreatic parenchyma is possible. This aids in staging the severity of the pancreatitis as well as detecting secondary changes. Due to potential aspiration in the event of surgery oral contrast is not recommended for use in CT imaging of patients with suspected ANP [9].

Other causes of ANP include mumps, glandular fever, abdominal trauma, surgery, complications secondary to endoscopic retrograde cholangiopancreatography, hypercalcemia, hyperparathyroidism, hyperlipidemia, certain drugs and polyarteritis [5]. In 25% of all cases the cause of acute necrotising pancreatitis is idiopathic [10].

Figure 1: Unenhanced CT demonstrating an enlarged pancreas extending to the anterior abdominal cavity (black arrows).
Pathogenesis

Microscopically the parenchymal network, acinar cells and pancreatic ductal system appear damaged and there is necrosis of the peri-lobular fat. Areas of necrosis are often multi-focal, rarely involve the whole gland, and, may be confined to the periphery with preservation of the core [6]. Necrosis causes release of digestive enzymes into the pancreas parenchyma. These enzymes further damage the parenchymal cells and blood vessels by a process called autodigestion. Necrotic blood vessels, especially veins, are prone to thrombosis, causing ischaemic damage to areas of the pancreas, initiating a vicious cycle of more release of enzyme release which leads to extensive coagulative necrosis of lobules, intervening ducts and blood vessels [11]. This has a snowball effect by causing internal breakdown of pancreatic tissue. Necrosis develops early in the course of severe ANP; it is usually well established approximately 96 hours post onset of clinical symptoms [12].

One in four patients with APN has organ dysfunction. Other complications include hypoxia, hypotension and renal insufficiency [2]. Multiple organ failure is often a syndrome pertinent to APN. This is a progressive but potentially reversible condition involving two or more systems remote from the original insult. Bacterial contamination of necrosis is deemed to be a serious event which occurs in 40 to 70% of patients and is associated with an increased mortality [13].

CT appearance of acute necrotizing pancreatitis

Features of ANP include:
- Excessive swelling of the pancreas.
- Ascites might be present in variable amounts.
- Infection from necrosis or exudates may lead to complications.
- Exudate fluid which may permeate into the retro-peritoneal space can become encapsulated [10].
- Pancreatic oedema which may be focal or diffuse.

- Pancreatic necrosis and haemorrhage within the pancreas and surrounding tissue [5].

The severity of the clinical picture is determined by the extent of the necrosis which can cover the greatly enlarged organ like a mantle. Pancreatic necrosis will show an area of low, or absent, enhancement on rapid bolus contrast enhanced CT [10]. In a study done by Balthazer al [14] two clinical features are identified as the main prognostic indicators of the severity of ANP, namely:
  - Pancreatic necrosis,
  - Peri-pancreatic inflammatory collections.

In other words if these two conditions are visible on CT images the extent of the disease is classified as severe, which is often associated with a poor outcome.

Prognosis

Necrosis of the pancreatic head has a poor outcome compared to necrosis of the entire pancreas. Patients with necrosis in only the distal portion of the gland usually have a favorable outcome with few complications [6]. The mortality rate of ANP is reported to be between 27 to 45% and is often determined by the extent of pancreatic necrosis and degree of peri-pancreatic necrosis [6]. This is arguably a high mortality that does not bode well for patients with this disease. Elderly patients have a higher mortality rate because of the high frequency of inter-current disease and reduced functional reserve. Mortality amongst persons over 55 years of age is reported to be as high as 11% compared to 2% amongst those patients younger than 55 years. Obese patients are also considered to have a higher mortality risk compared to thin patients [2]. The two phases of mortality recognized in ANP are:
- Death, which may occur early, often within 7 to 10 days after onset of the disease, due to acute shock complicated by renal, respiratory or cardiovascular failure.
- Patients may succumb later in the course of the disease due to local complications of pancreatic necrosis and sepsis [15].

Patients with necrosis are reported to have a mortality rate of 23% and 82% complication rate. There is a zero mortality rate in patients without pancreatic necrosis but a 6% morbidity rate [12]. Treatment of pancreatic necrosis often requires patients to spend long periods in hospital ranging from a maximum of 300 days to 68 days or less [2].

Concluding remarks

ANP may be a fatal disease with a high mortality rate. Other serious potential complications, for example, ascites, local sepsis and or peri-pancreatic suppuration of exudates, could occur as soon as 96 hours after the onset of the disease.

CT with its a high sensitivity and specificity allows for the depiction of pancreatic anatomy, necrosis and/or pancreatic enlargement as well as other complications. Contrast media administration for pancreatic enhancement is pivotal in CT imaging because the diseased pancreas and necrotic areas are distinguishable from normal enhancing pancreatic tissue.

References