Detection of Pancreatitis and Clinical Application of Pancreatic Lipase in Canines and Felines

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Introduction

The pancreas has both exocrine and endocrine functions. It is the second largest exocrine organ in the body after the liver. It mainly secretes digestive enzymes produced by acinar cells and ductal cells. The fluid enters the duodenum through the pancreatic duct and participates in the digestion of food.

It is also the largest endocrine organ in the body. The endocrine part of the pancreas is the islets which are produced by islet cells. It acts on multiple target organs and allows hormones such as insulin and glucagon to pass through the blood circulation.

The pancreas has complex functions due to its special location which affects digestion and metabolism when a disease occurs. Therefore, the clinical symptoms and physiological function changes that appear lack specificity meaning it is an elusive disease.

Introduction

Pancreatitis is one of the most common digestive system diseases in dogs and cats. It is mainly divided into two types, acute and chronic, and pancreatic tumours.

Whether it is acute pancreatitis or chronic pancreatitis, the clinical manifestations are more complicated, and the diagnosis and classification are sometimes difficult to unify, especially for chronic pancreatitis, clinical diagnosis and treatment is more difficult.

The diagnosis and treatment of pancreatic tumours is very difficult due to the lack of specific early symptoms and laboratory test data and the cure rate is extremely low. Therefore, the diagnosis and treatment of pancreatitis in dogs and cats has been paid more attention by veterinarians and has important significance in veterinary clinics.

Introduction

The incidence of pancreatitis due to incorrect feeding is increasing.

Some acute pancreatitis is often neglected and mistaken for ‘gastritis’ due to its mild clinical symptoms, leading to the development of chronic pancreatitis.

In recent years, the incidence of severe acute pancreatitis has also increased significantly, and its diagnosis and treatment are also very difficult. Although clinical veterinarians have made a lot of efforts, the mortality rate and complications are relatively high.

Causes

Acute pancreatitis usually refers to an acute disease of pancreatic oedema or haemorrhage and necrosis. It is a chemical inflammation that causes pancreatic digestive enzymes to be activated in the pancreas due to various reasons and then the pancreas self-digests chemical inflammation.

The severity of pancreatitis symptoms varies greatly with the severity of the disease.

Mild patients (interstitial type) have a good prognosis whereas for patients with severe type (necrotic type), the condition is serious. Various organ failures can occur and local complications such as pancreatic necrosis and abscess etc., have a high mortality rate.

Causes

1. After overeating, a large amount of chyme enters the duodenum in a short time, causing papillary oedema, hepatopancreatic ampullary sphincter spasm and increasing the secretion of pancreatic juice.

2. An improper diet can cause duodenal disease and cause acute pancreatitis, such as duodenal ulcer penetrating the pancreas, duodenal diverticulitis around the hepatopancreas ampulla etc., and can make the intestinal fluid reverse flow into the pancreatic duct and activate pancreatin.

3. Pancreatic duct stones, bile duct inflammation, pancreatic head and body tumours, hepatopancreatic ampullary sphincter spasm, duodenal papillary inflammation and oedema can all cause pancreatic duct obstruction and block the outflow of pancreatic juice, the rupture of the pancreatic acinar, and cause pancreatic juice to spill into the interstitium and cause acute pancreatitis.

4. Surgery and trauma can also induce acute pancreatitis.

Causes

5. Acute pancreatitis caused by drugs, such as azathioprine, thiazide diuretics, tetracycline, adrenal cortex hormones, etc. Drug-induced damage produces in situ activation of pancreatin. The direct toxic effect of the drug, thereby starting the pancreas's own digestive mechanism, causing acute pancreatitis. However, different drugs have different pathogenic links. Even if the same drug is in different individuals, the process and degree of pathogenicity are very different.

6. Acute pancreatitis has a great relationship with metabolism. Since there are both endocrine and exocrine glands in the pancreas, there are many functional connections between them and they are also affected by gastrointestinal hormones and other hormones in the body. Therefore, in the pathogenesis of acute pancreatitis, there may be a variety of hormone metabolism disorders or some endocrine disorders.

Causes

Dogs and cats with pancreatitis are often in a state of high metabolism. Their body consumption increases and catabolism is vigorous, which causes metabolic disorders in dogs and cats. If the correct nutritional treatment is not taken in time, the course of pancreatitis may be prolonged, even repeated and worsening conditions. The energy and metabolic changes of dogs and cats suffering from acute pancreatitis mainly include three aspects:

1. High Metabolic State – Stress state induced by acute pancreatitis. It can cause an increase in energy demand and total metabolic demand, as well as an increase in the secretion of cortisol and catecholamines. It can lead to an increase in the glucagon/insulin ratio, impaired B cell function and insulin resistance, an increase in gluconeogenesis, a decrease in glucose utilisation and oxidation, an increase in blood sugar levels and an increase in serum lactic acid levels.

2. Enhanced Catabolism – Due to increased secretion of cortisol and catecholamines, increased decomposition and oxidation of adipose tissue, sick animals have hyperlipidaemia, especially hypertriglyceridemia. In addition to fat catabolism, protein catabolism in sick animals is enhanced which results in increased plasma aromatic amino acid levels and decreased branched chain amino acid levels.

3. High Power Cycle – Can cause increased oxygen consumption and oxygen utilisation disorder at the cellular level (oxygen uptake disorder).

Causes

Acute pancreatitis, especially severe acute pancreatitis in dogs and cats due to haemorrhage and necrosis of the pancreas itself and surrounding tissues, resulting in a large amount of fluid build up in the abdominal cavity.

Common clinical complications such as vomiting, abdominal distension and shock, respiratory insufficiency and renal failure, various treatments such as fasting, gastric juice aspiration and abdominal lavage are the main causes of abnormal electrolyte metabolism.

Causes

Pancreatitis has transient glucose metabolism abnormalities during the onset of pancreatitis which is usually called pancreatic diabetes. The cause may be due to pancreatitis causing damage to the exocrine function of the pancreas which in turn causes endocrine dysfunction. It is clinically manifested as hyperglycemia and urine glucose positive.

Abnormal fat metabolism can cause pancreatitis and pancreatitis can cause abnormal fat metabolism. That is to say, hyperlipidemia is one of the pathogenic factors of acute pancreatitis. However, temporary hyperlipidemia can occur in acute pancreatitis and hyperlipidemia is a complication of acute pancreatitis.

Causes

Under normal circumstances there is a large amount of pancreatic lipase in the capillaries and intercellular substance of the pancreas.

When the blood triglyceride concentration increases, it can provide sufficient substrate for pancrelipase. Under the catalysis of lipase, a large amount of toxic free fatty acids are released which damages the capillary endothelium and causes the continuous release of pancreatic enzymes, forming a vicious circle.

The pancreatic lipase that enters the blood acts on the chylomicrons to promote their agglutination and increase the blood viscosity. It can cause pancreatic capillary congestion and microthrombosis which in turn causes blood circulation disorders in the pancreas.

Causes

Hypocalcaemia is another common metabolic abnormality in acute pancreatitis and it is closely related to the development of the disease and poor prognosis. Persistent hypocalcaemia often indicates pancreatic necrosis and poor prognosis.

Hormonal Changes in Acute Pancreatitis – Long-term administration of a large amount of glucocorticoids can cause hyperacidity, elevated blood lipids and change the composition of pancreatic juice, which ultimately induces acute pancreatitis.

In acute pancreatitis, there may be excessive secretion of glucocorticoids and catecholamines. On the other hand, the use of appropriate glucocorticoids is conducive to the stability and recovery of acute pancreatitis.

Symptoms

The clinical diagnosis of acute pancreatitis in dogs and cats is not difficult.

Sick animals usually show symptoms of acute upper abdominal pain (but a considerable number of cases do not show symptoms of abdominal pain), accompanied by elevated serum and urine amylase.

Clinical Symptoms of Pancreatitis

Canine (70PCS)

Symptom	Anorexia	Vomit	Weak	Stomach Ache	Dehydration	Diarrhoea
Probability	91%	90%	79%	58%	46%	33%

Feline (40 PCS)

Symptom	Lethargy	Anorexia	Dehydration	Hypothermia	Vomit	Stomach Ache	Abdominal Mass	Difficulty Breathing	Ataxia	Diarrhoea
Probability	100%	97%	92%	68%	35%	25%	23%	20%	15%	15%

Clinical Symptoms of Pancreatitis

Canine

Clinical Symptoms (Non-Specific):

- ❑ Vomiting
- ❑ Front abdominal pain

If these symptoms appear, you should evaluate whether there is pancreatitis.

Severe cases also show systemic symptoms:

- ❑ Fever
- ❑ Respiratory distress
- ❑ Cardiovascular shock

Clinical Symptoms of Pancreatitis

Feline

Severe Pancreatitis – Symptoms are also less than that of dogs

Mild Pancreatitis – Often present in a subclinical state

Impact on Other Systems

- ❑ Gastrointestinal tract
- ❑ Hepatobiliary system
- ❑ Cardiovascular system
- ❑ Blood system

Symptoms

The main clinical symptoms of acute pancreatitis in **canines** are:

- ❑ Loss of appetite
- ❑ Front abdominal pain, abdominal wall tension, sensitivity
- ❑ Nausea, vomiting, gastrointestinal bleeding
- ❑ Sometimes diarrhoea and blood
- ❑ Jaundice
- ❑ Intestinal paralysis, intestinal obstruction
- ❑ Symptoms such as peritonitis

Symptoms

Felines suffering from acute pancreatitis in most cases manifest as:

- ❑ Arched back
- ❑ Abdominal pain
- ❑ Tight abdominal wall
- ❑ Sensitive
- ❑ Mostly caused by pancreatic oedema and inflammation that cause the pancreatic capsule to be stretched and pulled

Symptoms

- Nausea and vomiting occur almost simultaneously in acute pancreatitis
- Vomiting is more frequent at the beginning of the illness but gradually decreases over time
- Vomiting may be related to abdominal pain and flatulence (although some dogs have clinically not obvious symptoms of acute abdominal pain)
- When the degree of vomiting is not serious, the vomit is mostly food and water ingested
- When vomiting violently, bile and blood are often vomited
- Mild cases are only retching and hiccups
- Severe patients may have obvious abdominal distension and persistent vomiting due to intestinal paralysis

Symptoms

Acute pancreatitis causes upper gastrointestinal bleeding due to severe vomiting, gastric mucosal disease, pancreatic juice leakage, corrosion of gastrointestinal mucosa or involvement of the biliary tract.

Symptoms of jaundice sometimes appear in the first few days after the onset of acute pancreatitis. This is due to bile duct stones (usually caused by tiny stones and sand-like stones in the bile duct), biliary roundworms or biliary tract infections that cause hepatopancreatic ampullary sphincter spasm, obstructed bile secretion and cause reflux, resulting in obstructive jaundice.

Symptoms

- Acute pancreatitis often has transient intestinal paralysis and intestinal obstruction
- Mild cases can be regarded as one of the symptoms of acute pancreatitis
- Severe intestinal obstruction can be listed as one of the complications
- The reason is intestinal palsy is mostly caused by inflammatory reaction caused by fat necrosis and bleeding. Intestinal obstruction is mostly caused by inflammation and ischemia
- In terms of physical signs, intestinal paralysis and intestinal obstruction are manifested as abdominal distension, increased intestinal gas, and weakened or disappeared bowel sounds

Symptoms

- Pancreatic juice overflow can cause peritoneal and mesenteric bleeding and eventually lead to localised or diffuse peritonitis

- Ascites is mostly bloody exudate and the content of amylase in ascites is high

Laboratory Diagnosis

Blood Routine Examination

- White Blood Cell Count – Most dogs and cats with acute pancreatitis have an increased white blood cell count in the early stages of onset, usually as high as 5×10^{10}/L
- Neutrophils increased significantly and the nucleus shifted to the left
- The white blood cell count rises more obviously when there is a biliary tract infection

Laboratory Diagnosis

Red Blood Cells and Haemoglobin

- Some dogs and cats with acute pancreatitis have low red blood cell counts and haemoglobin, and anaemia may occur

Blood Glucose

- Temporary hyperglycaemia often occurs in the early stages of acute pancreatitis
- Long-lasting fasting blood glucose higher than 10 mmol/L reflects severe pancreatic necrosis, a wide range of necrosis and a poor prognosis

Laboratory Diagnosis

Blood Fat

- Serum lipoproteins may increase in acute pancreatitis, mainly due to elevated serum triglycerides

Liver Function

- In Canines with mild clinical symptoms, the increase in bilirubin is often characteristic of obstructive jaundice and the increase is not large. It usually returns to normal after a few days

- If total bilirubin continues to increase significantly, it indicates that there is choledochal obstruction. In dogs with severe acute pancreatitis, once liver damage occurs, various laboratory results of hepatocellular jaundice may appear. At this time, a decrease in albumin content often indicates a poor prognosis

Laboratory Diagnosis

Enzyme Determination

Amylase is currently the basic item used to diagnose acute pancreatitis.

Except for a few dogs with severe acute pancreatitis, serum amylase can be normal or lower than normal and serum amylase is almost all elevated in acute pancreatitis.

Therefore, as long as the clinical symptoms are consistent with the disease and the amylase is elevated, and exceeds 2-3 times the normal value, the diagnosis can be confirmed.

Laboratory Diagnosis

Serum Amylase

Generally, it starts to rise 6-12 hours after the onset of the disease, and it starts to fall in 48-72 hours and returns to normal in 4-5 days. However, the duration of severe cases is relatively long and the level of serum amylase detected is not consistent with the severity of the disease.

The pathological changes of acute pancreatitis are mild but the serum amylase is generally increased. In severe acute pancreatitis, the serum amylase is not necessarily increased due to excessive destruction of the pancreatic acinar and sometimes significantly decreased.

If serum amylase continues to rise or rises after falling, it often indicates that pancreatic disease has progressed, expanded, recurred or has complications. Elevated serum amylase can also be seen in other diseases, such as abdominal trauma, gastrointestinal perforation, intestinal obstruction, renal failure etc.

Laboratory Diagnosis

Urine Amylase

Urinary amylase begins to increase 12-24 hours after the onset of the disease but the rate of decline is slower and the maintenance time is longer. It returns to normal after 1-2 weeks.

This determination is suitable for patients who see a doctor late and whose serum amylase is only slightly elevated or have returned to normal but its reliability is not as good as that of serum amylase.

Amylase in Ascites

The concentration of amylase in ascites in pancreatitis caused by pancreatic juice overflow is very high and its value is significantly higher than that of serum amylase.

It is generally believed that when the amylase in the ascites is lower than the serum amylase, the presence of acute pancreatitis can be ruled out.

Laboratory Diagnosis

Imaging Examination

Clinical imaging examination plays a great role in the diagnosis of acute pancreatitis.

For example, various causes of acute pancreatitis cause pathological extravasation of pancreatic juice, leading to pathological changes such as oedema, effusion, necrosis, and haemorrhage of the pancreas and its surrounding tissues.

These pathological changes can be accurately reflected by imaging examination.

Laboratory Diagnosis

X-Ray Inspection

- ❑ X-rays show an increase in the density of the upper right abdomen

Wireless Ultrasound

B-ultrasound is currently the most commonly used imaging method for diagnosing pancreatic diseases.

Its purpose is to determine whether there is acute pancreatitis, estimate the severity of acute pancreatitis, whether there are local complications and observe whether there are biliary stones, biliary roundworms and biliary tract infections.

Laboratory Diagnosis

When suffering from acute pancreatitis, the pancreas is enlarged and thickened. B-ultrasound can show some changes in the pancreas such as:

- It is universal, uniformity is increased, boundaries are blurred and there are rare spots of light reflection inside
- For pseudocysts, liquid dark areas are shown. If there are spaces or necrotic tissues, band-like or scattered light spots will appear at the bottom of the cystic dark areas
- B-ultrasound is of great clinical value for the diagnosis of cholelithiasis and biliary roundworms related to acute pancreatitis
- However, B-ultrasound examination of the pancreas is also affected by many factors, the most common being the interference of small intestine gas
- The accuracy of B-ultrasound in the early diagnosis of acute pancreatitis is only about 30%
- The appearance of a hypoechoic area in the pancreas indicates the possibility of pancreatic oedema, effusion, necrosis etc., but it is difficult to determine this with B-ultrasound

Therapy

The ultimate goal of acute pancreatitis treatment is to reduce the secretion of pancreatic juice, inhibit pancreatic enzyme activity and reduce the occurrence of complications.

The treatment measures are based on the "pancreas self-digestion" theory, based on the physiological changes of the pancreas and the pathogenesis of acute pancreatitis, supportive therapy, suppression of pancreatic exocrine secretion, suppression of pancreatic enzyme activity, improvement of pancreatic blood circulation, and control of infection.

Acute pancreatitis is due to lack of strong evidence to support typical clinical symptoms and reliable laboratory test data. Therefore, there is no special treatment to change the clinical course of acute pancreatitis.

New Clinical Pathology – Pancreatic Lipase Tests

The diagnosis of pancreatitis in dogs and cats can be challenging. Quantitative diagnostic tests have been developed to accurately detect concentrations of cPL and fPL. Quick, low cost, easy to use systems such as the InSight V-IA Immunoassay Analyser can be utilised and tests can be performed patient side in the clinic.

cPL

- ❑ Sensitivity >80%

cPLI can still be used to diagnose pancreatitis in renal failure

cPLI – The specificity of canine suffering from gastritis can still be as high as 96%

fPL

- ❑ Sensitivity – Around 97%
- ❑ Specificity - Around 91%

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Canine Pancreatic Lipase (cPL) Rapid Quantitative Test

Woodley have developed a rapid, accurate and reliable, highly sensitive detection method for Canine Pancreatic Lipase.

The InSight V-IA cPL Rapid Quantitative Test is a fluorescence immunoassay used with the InSight V-IA Veterinary Immunoassay Analyser for quantitative determination of cPL concentration in canine serum or plasma.

The test is used as an indicator for diagnosis of pancreatitis.

It can be stored at room temperature.

InSight V-IA®

Feline Pancreatic Lipase (fPL) Rapid Quantitative Test

Woodley have developed a rapid, accurate and reliable, highly sensitive detection method for Feline Pancreatic Lipase.

The InSight V-IA fPL Rapid Quantitative Test is a fluorescence immunoassay used with the InSight V-IA Veterinary Immunoassay Analyser for quantitative determination of fPL concentration in feline serum or plasma.

The test is used as an indicator for diagnosis of pancreatitis.

It can be stored at room temperature.

Thank You

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