

Comparison between SNAP Canine Pancreas-Specific Lipase (cPL) Test Results and Pancreatic Ultrasonographic Findings in Dogs with Pancreatitis

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Abstract : The object of the present study was to compare abnormal serum canine pancreas-specific lipase results and pancreatic ultrasonographic findings in dogs with pancreatitis. Pancreatitis is a common disease in dogs that is difficult to diagnose. The noninvasive diagnostic procedures, including a serum canine pancreatic-specific lipase (cPL) test and ultrasonographic changes in the pancreas, can be considered for the diagnosis of canine pancreatitis in clinical practice. A retrospective study was performed to assess pancreatitis in dogs. Forty client-owned dogs were suspected to have pancreatitis, which was confirmed by abnormal serum SNAP cPL results. Abdominal ultrasound examinations were also performed. The present study investigated the distribution of clinical signs associated with pancreatitis, and the dogs were divided into two groups: group 1 (clinical signs compatible with pancreatitis; n = 30) and group 2 (no clinical signs; n = 10). Based on this study, an abnormal result on the SNAP cPL assay can still present as a normal pancreas through an ultrasonographic examination, and a normal health status can identify the status of pancreatic ultrasonographic abnormal lesions. Therefore, for dogs with suspected pancreatitis, it is important to repeat an ultrasonographic evaluation. There is no significant difference between clinical symptoms and ultrasonographic changes in the pancreas.

Key words : dog, pancreatitis, SNAP canine pancreas-specific lipase (cPL) test, abdominal ultrasound, pancreatic ultrasonographic findings.

Introduction

Pancreatitis is the most frequently occurring disease involving the exocrine pancreas in dogs. The clinical symptoms include anorexia, lethargy, abdominal pain, diarrhea, and vomiting, but some patients can remain asymptomatic. The symptoms vary depending on the severity of pancreatitis, ranging from subclinical to severe conditions (20). In veterinary medicine, pancreatitis is often considered idiopathic in dogs. However, some risk factors in dogs, including hyperlipidemia, obesity, endocrine disease, and drug reactions, have been identified. One study reported that a clinical diagnosis of pancreatitis is difficult due to nonspecific changes in the blood analysis (2,20). Serum amylase and lipase activity measurements are neither very specific nor very sensitive for detecting spontaneous pancreatitis in dogs (15). A histopathologic examination is the most accurate diagnostic method for a definitive diagnosis of pancreatitis, albeit the limitations associated with a pancreatic biopsy. Generally, a definitive diagnosis of pancreatitis is established based on history, physical examination findings, and a combination of clinical pathologic and imaging findings. Therefore, noninvasive diagnostic procedures, including a serum canine pancreatic-specific lipase (cPL) assay and ultrasonographic changes in the pancreas, can be considered for the diagnosis of canine pancreatitis in clinical practice (10,20).

As a laboratory examination, the pancreatic lipase immunoreactivity (PLI) assay is a valuable tool for the diagnosis of pancreatitis. Measuring PLI concentrations is currently considered to be the serum test for evaluating dogs with suspected pancreatitis because of its sensitivity and specificity in veterinary medicine (20,21). The serum SNAP cPL device has the potential to improve clinical approaches to canine pancreatitis in the clinic, as it serves as a rapid point-of-care, semi-quantitative method and can be easily visually evaluated for the assessment of canine pancreatic lipase (1,8,20). A recent multi-institutional study demonstrated that SNAP cPL has a 91 to 94% sensitivity and a 71 to 78% specificity for diagnoses of pancreatitis (8). There is no single, commonly accepted, noninvasive diagnostic examination in dogs with suspected pancreatitis. However, serum cPL appears to be the most sensitive test available (11,17,21).

Abdominal ultrasonography has been used for the diagnosis of pancreatitis as it can exclude other diseases that show similar clinical signs as pancreatitis (4,6,20). In previous reports, the sensitivity of abdominal ultrasonographic findings in canine acute pancreatitis is approximately 68% (5,20). Ultrasonographic findings of the pancreas show pancreatic echogenicity (hypoechoic, mixed-echoic, hyperechoic), pancreatic enlargement, hyperechoic surrounding mesentery and fat, dilation of the pancreatic or biliary ducts, and peritoneal effusion (4). Conversely, findings from an ultrasound may appear to be normal, yet pancreatitis cannot be completely ruled out (4,5). The changes associated with chronic or mild pancreatitis include mild lesions that are often undetected through ultrasound examinations. A study among dogs with

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mild or chronic pancreatitis revealed that ultrasound examinations only showed a 56% sensitivity for associated pancreatic alterations (19).

The aim of this retrospective study was to compare abnormal serum canine pancreas-specific lipase results and pancreatic ultrasonographic changes in dogs with pancreatitis.

Materials and Methods

Animals

From February 2014 through March 2017, a retrospective study was performed to assess pancreatitis in dogs at the Gyeongsang National University Veterinary Medical Teaching Hospital. Forty dogs of different breeds, genders, and ages were used in this study. All 40 dogs were suspected to have pancreatitis, which was confirmed by abnormal serum SNAP cPL results. Abdominal ultrasound examinations were also performed. Thirty dogs had clinical signs consistent with pancreatitis, such as vomiting, anorexia, abdominal pain, lethargy, and diarrhea. In contrast, 10 dogs showed no clinical symptoms.

SNAP Canine pancreas-specific lipase (cPL) test

Blood samples

Blood samples were collected from the jugular or cephalic vein of each dog with 3-mL syringes. A serum-separating tube (BD vacutainer®, Becton Dickinson and Co, UK) was used for the SNAP cPL test, and blood samples were centrifuged at 5,000 rpm for 5 minutes. The serum was separated using a centrifuge (Sigma, Sartorius AG, Germany) immediately after blood collection.

SNAP cPL Test

The SNAP cPL kit (Canine SNAP® cPL™; IDEXX Laboratories Inc., Westbrook, ME, USA) can immediately confirm pancreatitis in suspected dogs. After preparation of the SNAP cPL kit, the blood sample was mixed with the enclosed anti-chicken: HRPO/anti-cPL:HRPO conjugates. This mixture was then carefully placed on the device for reading. In this study, test results were read using the SNAPshot Dx analyzer (IDEXX SNAPshot Dx Analyzer; IDEXX Laboratories Inc., Westbrook, ME, USA). The SNAP cPL test only provides a dimorphic result, i.e., “normal” or “abnormal,” which allowed us to either confirm or rule out pancreatitis in these patients (20).

Groupings

All dogs were diagnosed as having pancreatitis based on the SNAP cPL test (Canine SNAP® cPL™; IDEXX Laboratories Inc., Westbrook, ME, USA) results. The dogs were divided into two groups: group 1 (clinical signs compatible with pancreatitis; n = 30) and group 2 (no clinical signs; n = 10). Dogs were included in group 2 if no clinical symptoms (i.e., vomiting, anorexia, diarrhea, lethargy, and abdominal pain) were observed during physical examination.

Diagnostic imaging examinations

All ultrasound examinations were performed with a Hitachi AREITTA 70 system (Hitachi Aloka Medical, Ltd. Tokyo, Japan) by veterinary medical imaging specialists after clipping. The following ultrasonographic findings were collected from the ultrasonography comments: pancreatic echogenicity (hypoechoic, mixed-echoic, hyperechoic), pancreatic enlargement, hyperechoic surrounding mesentery and fat, dilation of the pancreatic or biliary duct and peritoneal effusion (4) (Fig 1). In contrast, there were no significant abnormalities found surrounding the pancreas.

1. The severity from pancreatic ultrasonographic findings (Fig 1)

Pancreatic ultrasonographic abnormalities are as follows:

Mild = One ultrasonographic finding consistent with pancreatitis

Moderate = Two or three ultrasonographic findings consistent with pancreatitis

Severe = Four ultrasonographic findings consistent with pancreatitis

Statistical analysis

All data were expressed as mean values, mean ± standard deviation (SD), and the minimum and maximum values. The distribution was determined for each ultrasound finding in all dogs showing abnormal SNAP cPL results, which is indicative of pancreatitis. The Mann-Whitney U test was used to compare the severity of ultrasonographic characteristics and the presence of clinical symptoms. P values below 0.05 were considered statistically significant. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS version 23.0; SPSS Inc., IBM Corporation, USA).

Results

Baseline characteristics of the dogs

A total of 40 client-owned dogs were included in this ret-

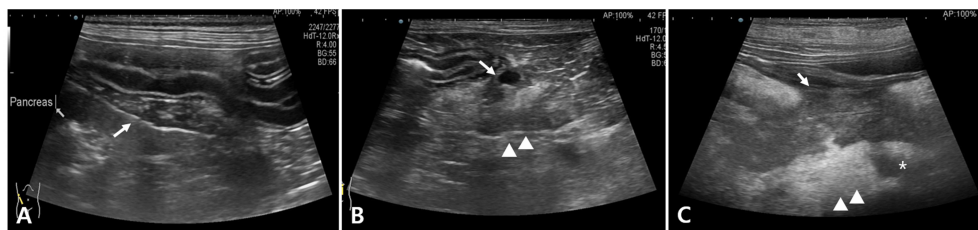


Fig 1. The severity of abnormal pancreatic ultrasonographic findings. (A) Mild pancreatitis: The pancreas appears hypoechoic parenchyma (arrow). (B) Moderate pancreatitis: Heterogeneous parenchyma of pancreas (arrowhead) and dilated pancreatic duct (arrow). (C) Severe pancreatitis: Enlarged and hypoechoic parenchyma of pancreas (arrow), hyperechoic surrounding mesenteric fat (arrowhead) and focal peritoneal effusion (asterisk).

respective study. The ages ranged between 1 year and 16 years with a median age of 10.3 years (standard deviation [SD], 4.2 years). The mean body weight was 6.9 kg (SD, 8.5 kg; range, 1.5-41 kg). Of the 40 dogs, there were 10 intact males, 11 neutered males, 10 intact females, and 9 spayed females. In group 1 (n = 30), the most frequently represented breeds were Maltese (11/30, 36.7%) and Yorkshire terriers (5/30, 16.7%). Maltese (4/10, 40%) was also the most common breed in group 2 (n = 10).

Agreement between pancreatic ultrasonography and SNAP cPL

All dogs were diagnosed as having pancreatitis using a canine pancreas-specific lipase SNAP cPL test. Pancreatic ultrasonography was performed within 2 hours after obtaining SNAP cPL results in the 40 dogs with suspected pancreatitis. In the ultrasonographic examination, evidence of pancreatitis was present in 27 of the 40 dogs (67.5%), while the remaining 13 of the 40 dogs (32.5%) were found to have normal pancreata (Table 1).

1. Distribution of each ultrasonographic characteristic

There was significant evidence of pancreatitis in 27 dogs. Eighteen dogs (66.7%) had hyperechoic peripancreatic fat, 14 (51.9%) had altered pancreatic echogenicity, 11 (40.7%) had increased pancreatic thickness, while 2 (7.4%) had a dilated pancreatic or biliary duct and accumulated peritoneal effusion (Table 2).

The ultrasonographic findings with the highest sensitivity towards an abnormal result from SNAP cPL were peripancreatic fat echogenicity and changes in the pancreatic parenchyma echogenicity, indicating that these characteristics were

Table 1. Distribution of abnormal results of SNAP cPL compared to ultrasonographic diagnosis

	Ultrasonographic Diagnosis of Pancreatitis (n = 27) (%)	Ultrasonographically Normal Pancreas (n = 13) (%)
Abnormal results of SNAP cPL (n = 40)	27/40 (67.5%)	13/40 (32.5%)

Table 2. Distribution of each ultrasonographic change on the basis of abnormal results of SNAP cPL

Abnormal results of SNAP cPL (n = 27)		
Pancreatic Thickness	Normal	16
	Increased	11
Pancreatic Echogenicity	Normal	13
	Change	14
Peripancreatic Fat Echogenicity	Normal	9
	Hyperechoic	18
Dilation of Pancreatic or Biliary duct	Absent	25
	Present	2
Peritoneal Effusion	Absent	25
	Present	2

more likely to be found in dogs with pancreatitis on the basis of an abnormal SNAP cPL result. Conversely, the dilation of the pancreatic or biliary duct and peritoneal effusion were less sensitive (Table 2).

Clinical symptom distribution with pancreatitis

The most common clinical symptoms compatible with pancreatitis were vomiting (19 of 30; 63.3%), anorexia (18 of 30; 60%), abdominal pain (6 of 30; 20%), and diarrhea (4 of 30; 13.3%). Based on the frequency of clinical symptoms, vomiting and anorexia were highly confirmed in this study. The mean value (\pm standard deviation) for the duration of clinical symptoms was 4.43 (\pm 4.006) days (range, 1-14 days).

Agreement between clinical symptoms and pancreatic ultrasonography

Of the 40 cases, 30 were included in group 1 (mean age, 9.93 years; mean body weight, 6.62 kg) while 10 were included in group 2 (mean age, 11.5 years; mean body weight, 7.57 kg).

Reports from ultrasonographic findings in the two groups

In group 1, abnormal pancreatic findings were present in 22 of the 30 dogs (73.3%), while the remaining 8 dogs (26.6%) were found to have normal pancreata. In group 2, abnormal pancreatic findings were present in 5 of the 10 dogs (50%), while the remaining 5 dogs (50%) were found to have normal pancreata (Table 3). More specifically, group 1 had 9/30 (30%) dogs with mild pancreatitis, 11/30 (36.6%) dogs with moderate pancreatitis and 2/30 (6.7%) dogs with severe pancreatitis. Group 2 included 2/10 (20%) dogs with mild pancreatitis and 3/10 (30%) dogs with moderate pancreatitis (Table 4).

Comparison of the severity of ultrasonographic characteristics with the presence of clinical symptoms

The mean value (\pm standard deviation) for the presence of

Table 3. Distribution of ultrasonographic characteristic between group 1 and group 2

Group	Ultrasonographic Diagnosis of Pancreatitis	Distribution
Group 1 (n = 30)	Ultrasonographically Normal Pancreas	22/30 (73.3%)
	Ultrasonographically Normal Pancreas	8/30 (26.6%)
Group 2 (n = 10)	Ultrasonographically Normal Pancreas	5/10 (50%)
	Ultrasonographically Normal Pancreas	5/10 (50%)

Table 4. The severity of ultrasonographic characteristic between group 1 and group 2

	Group 1	Group 2
Normal Pancreas	8/30 (26.6%)	5/10 (50%)
Mild	9/30 (30%)	2/10 (20%)
Moderate	11/30 (36.6%)	3/10 (30%)
Severe	2/30 (6.7%)	-

clinical symptoms is 1.33 (± 1.124), while the absence of clinical signs is 0.8 (± 0.919). There were no statistically significant differences in the severity of pancreatic ultrasonography between groups 1 and 2 ($p = 0.246$). Accordingly, with the presence of clinical symptoms, ultrasonography was able to differentiate between abnormal and normal pancreata in this study.

Discussion

Pancreatitis has nonspecific clinical symptoms, pathological findings, and imaging findings, thus making it difficult to arrive at a definitive diagnosis (5,8,20). The SNAP test for canine pancreatic-specific lipase has significantly higher sensitivity than measurement of serum amylase and lipase activity for the diagnosis of pancreatitis in veterinary medicine (8). In addition, it can provide results almost immediately. A previous study showed that the sensitivities of cPL assay and histopathologic analysis were similar. The sensitivity of cPL was 21% in dogs with mild pancreatitis and 71% in dogs with moderate to severe pancreatitis, as detected by macroscopic and histopathologic findings (16,18). For this reason, the results of a normal SNAP cPL assay can be predictive of the absence of pancreatic disease in the general population of dogs. An abdominal ultrasound is also helpful in ruling out other diseases that appear similar in clinical symptoms as pancreatitis (4,6). In this study, all dogs were confirmed with pancreatitis based on the SNAP cPL test. We then compared the results of the SNAP cPL assay to pancreatic ultrasonography and evaluated the agreement between clinical symptoms and pancreatic ultrasonographic changes.

The dogs in the study widely ranged in age at presentation, but none had any underlying disease nor was there any bias in the distribution of gender or breed.

Ultrasonographic examinations of the pancreas are always difficult to interpret and depend highly on the skill of the examiner (14). According to our ultrasonographic findings of dogs with pancreatitis, 32.5% were reported to be normal, while 67.5% were confirmed to be abnormal. Based on the results of this study, abnormal findings from a SNAP cPL test can still show a normal pancreas upon ultrasonographic examination. The sensitivity of abdominal ultrasonography in canine pancreatitis is approximately 68% (5). In one study, the pancreatic changes are mild such that chronic states were often not detected through abdominal ultrasound examinations. The sensitivity of abdominal ultrasonography reported in previous studies also indicated that it is insufficient to exclude pancreatitis in a normal pancreas (4,5,19). Thus, it should be noted that results from pancreatic ultrasonography and a SNAP cPL assay were weakly correlated in our study.

Ultrasonographic variables were evaluated in this study and are presented in Table 2. Particularly, hyperechoic peripancreatic fat and changes in pancreatic echogenicity were highly prevalent, which are proven markers for pancreatitis in dogs. In one previous study of 22 dogs with macroscopic evidence of pancreatitis, the most common gross manifestation of pancreatitis was peripancreatic fat necrosis (16). The highest histologic pancreatitis activity index was congruent with

ultrasonographic findings in this study. Therefore, the pancreatic abnormalities described in this study, particularly increased echogenicity of peripancreatic fat and the pancreas, prove to be excellent markers for pancreatitis in dogs with appropriate clinical signs. Ultrasonography is a reliable test and has non-invasive diagnostic utility for dogs with severe pancreatic pathologies.

Pancreatitis has various clinical symptoms. This study investigated the distribution of clinical signs associated with pancreatitis. A number of dogs presented with gastrointestinal signs such as vomiting and anorexia. No correlation was found between pancreatic ultrasonographic findings and the presence or absence of clinical symptoms ($p = 0.246$). No associations were also observed between clinical symptoms status and the status of pancreatic ultrasonographic findings. However, ultrasonography was recommended for the detection of pancreatic complications such as pseudocysts, acute fluid accumulation, or abscesses (5,9,13).

This study had several limitations. First, the population of dogs with pancreatitis was small compared to previous studies, and these dogs could have had other underlying diseases that are often associated with pancreatitis. These concurrent diseases include endocrine disease, gastrointestinal disease, and myxomatous degeneration (MMVD) (3,19), even though there is no sufficient information about other diseases associated with cPL concentrations in veterinary medicine. Second, all dogs diagnosed as having pancreatitis based on the SNAP cPL test findings never underwent a histopathologic examination such as a biopsy or necropsy. Third, the concentration of serum canine pancreatic lipases was not assessed. The definite PLI concentration test has a gray zone when the result is between 200 and 400 $\mu\text{g/L}$ and values $> 400 \mu\text{g/L}$ indicate pancreatitis. In contrast, the SNAP cPL kit results can only be differentiated as "normal" and "abnormal" (1). Dogs with acute decreased glomerular filtration have been shown to have increased serum total lipase concentrations (7,12). Thus, the SNAP cPL kit may show false positives. Additional studies are required to further elucidate the state of azotemia on cPL concentrations, especially in acute glomerular disease. For these reasons, a definitive diagnosis of pancreatitis should not be determined only by the results of the SNAP cPL test. In clinical practice, it is necessary to make a comprehensive diagnosis. Further studies should include a greater population of dogs diagnosed as having pancreatitis and measure serum canine pancreatic lipase levels with other diagnostic tests.

Conclusion

In conclusion, the present study reported a comparison of SNAP cPL results, pancreatic ultrasonographic findings, and clinical symptoms. Based on this study, an abnormal result on the SNAP cPL assay can still present as a normal pancreas through an ultrasonographic examination, and a normal health status can identify the status of pancreatic ultrasonographic abnormal lesions. For dogs with suspected pancreatitis, it is important to repeat an ultrasonographic evaluation. Therefore, there is no significant difference between clinical symptoms and ultrasonographic changes in the pancreas.

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