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# Positive rate of canine pancreatic lipase immunoreactivity (SNAP cPL) in relationship with severity of clinical signs and concurrent disorders: a retrospective study

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## Abstract

Acute pancreatitis (AP) is a common disorder characterized by the inflammation of the exocrine pancreas in dogs, and the severity of the clinical signs of pancreatitis varies greatly. Therefore, the diagnosis of pancreatitis is challenging. The canine pancreatic lipase immunoreactivity test (SNAP cPL; IDEXX Laboratories Inc., USA) is rapid and relatively accurate in diagnosing pancreatitis. The purpose of this study was to evaluate the positivity rate of the SNAP cPL test in dogs regarding the severity of gastrointestinal (GI) signs and concurrent diseases. Electronic medical records of dogs were reviewed. For retrospective classification, 80 dogs with GI signs who underwent the SNAP cPL test were enrolled. Additionally, concurrent diseases on the day of the SNAP cPL test were reviewed. A positive SNAP cPL test result was observed in 26 of the 80 dogs (32.5%) with GI signs. The severity of GI signs using a scoring system and the positivity rate of SNAP cPL were statistically related. Furthermore, dogs with concurrent chronic kidney disease had a significantly higher positivity rate of SNAP cPL than those without chronic kidney disease. This information might help clinicians to decide whether a SNAP cPL test is needed.

**Keywords:** pancreatitis; dogs; chronic renal insufficiency; gastrointestinal sign; point-of-care systems

## Introduction

Acute pancreatitis is a common inflammatory disorder of the exocrine pancreas [1,2]. The etiology and pathogenesis of acute pancreatitis are poorly understood and clinical signs are non-specific [3]. Although histological examination is the golden standard for diagnosing acute pancreatitis, it is not widely performed due to its invasive nature and may not alter treatment and outcome [1,4]. Therefore, in conjunction with histology, clinical signs, diagnostic imaging, and serum pancreatic lipase concentration is needed to establish a clinical diagnosis of acute pancreatitis [1,4]. SNAP cPL (IDEXX Laboratories Inc., USA) test was developed to permit a more rapid return of results than the Spec cPL test (IDEXX Laboratories

Inc.). Because of high sensitivity, the SNAP cPL test is used to rapidly rule out pancreatitis, and it is recommended that a positive result be followed by a quantitative immunoassay, such as SPec cPL [4].

However, there is no specific indication of performing SNAP cPL test. Thus, the purpose of this study is to refine the indication for the SNAP cPL test by evaluating the positive rate of SNAP cPL and the relationship between signalment, age, severity of clinical symptoms, and concurrent diseases.

## Materials and Methods

### Animals

Medical records of dogs that were presented to the internal medicine department of Jeju National Teaching Hospital between November 2022 and June 2023 were reviewed. Electronic medical records were used to obtain data, including breed, age, sex, neuter status, weight, body temperature, chief complaint, laboratory tests, and final diagnosis. The study was conducted with caregivers' informed consent.

### Inclusion criteria

Dogs that underwent the SNAP cPL test in at least one gastrointestinal (GI) session, including those with lethargy, anorexia, diarrhea, and vomiting, were enrolled. All patients had a medical history and underwent a physical examination and SNAP cPL test. Some patients underwent laboratory tests, including complete blood count (CBC) and serum chemistry panels, on the day of the SNAP cPL test. Patients with concurrent diseases were also classified.

### Clinical sign scoring system

Clinical signs presented included lethargy, appetite, diarrhea, vomiting, and hyperthermia. When evaluating the severity of clinical signs, absent signs were assigned a score of 0, and present signs were assigned a score of 1 (Table 1). Moreover, appetite was scored as normal appetite, eating little food or snacks, or anorexia; all scored on a scale of 0 to 2 (Table 2).

### Laboratory findings

CBC and serum chemistry panels were performed using routine methods at the diagnostic laboratories of Jeju National

Teaching Hospital. The SNAP cPL test was performed at Jeju National Teaching Hospital according to the manufacturer's instructions using the SNAP Pro Analyzer (IDEXX Laboratories Inc.), and only trained technicians performed the test.

### Concurrent disease

Concurrent diseases were classified as chronic kidney disease (CKD), myxomatous mitral valve disease (MMVD), and endocrinopathy, including hyperadrenocorticism (HAC), hypothyroidism, and diabetes mellitus (DM). CKD was diagnosed based on the guidelines of the International Renal Interest Society (IRIS). MMVD was diagnosed based on the 2019 American College of Veterinary Internal Medicine (ACVIM) consensus. HAC was diagnosed based on the 2012 ACVIM consensus guidelines. Hypothyroidism was diagnosed according to the 2001 Veterinary Clinics of North America guidelines. The diagnosis of DM was based on the 2018 American Animal Hospital Association Diabetes Management guidelines [5–8].

### Statistical analysis

Statistical analyses were conducted using Microsoft Excel ver. 16.80 (Microsoft, USA). Age and clinical signs were using a two-tailed unpaired Student t-test. The presence of concurrent diseases was compared using a chi-square test. Statistical significance was set at  $p < 0.05$ .

## Results

The final study population comprised 80 dogs, with a nearly equal gender distribution: 43 males (38 castrated) and 37 females (33 spayed). The mean age of the dogs at the time of the SNAP cPL test was 9 years (ranging from 8 months to 17 years), and the standard deviation age was 3.7 years. The mean weight of the dogs at the time of the SNAP cPL test performed was 9.37 kg (range, 1.5 kg to 44.4 kg), and the standard deviation weight was 9.1 kg. There were 22 Maltese, 8 poodles, 7 mixed breeds, 7 Shih Tzus, and 6 Pomeranians. The remaining 30 dogs represented a variety of breeds, including Italian Greyhound, Jindo dog, Chihuahua, Labrador retriever, Bernese Mountain, Welsh Corgis, Golden Retriever, French bulldog, Bichon Frise, Alas-

**Table 1.** Scoring system of clinical signs used in this study

	Vomiting	Diarrhea	Lethargy	Hyperthermia
Non-existence	0	0	0	0
Existence	1	1	1	1

**Table 2.** Scoring system of appetite used in this study

	Appetite
Non-anorexia	0
Eat a little bit of food	1
Only eat snack	2
Anorexia	3

kan Malamute, Sptiz, Minipin, Cocker Spaniel, Malinois, and Dachshund (Table 3).

Dogs in the SNAP-cPL test-positive group (n = 26) were significantly older than those in the SNAP-cPL test-negative group (n = 54) (10.46 versus 8.32,  $p < 0.05$ ) (Fig. 1). Dogs in the SNAP-cPL test-positive group (n = 26) had a significantly greater number of clinical signs, including lethargy, appetite, di-

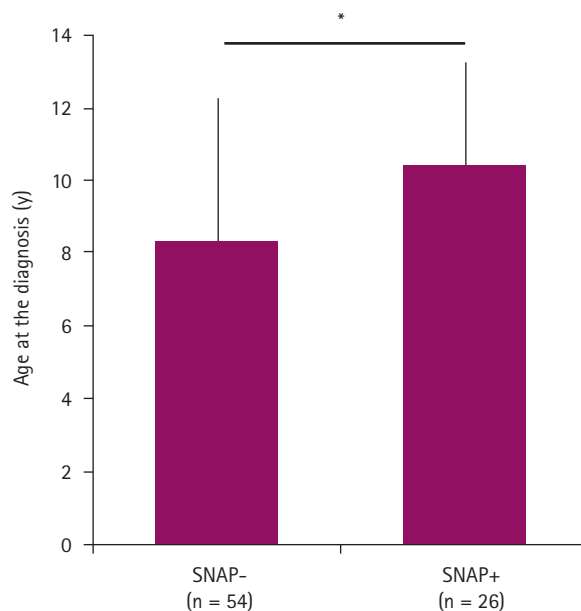
arrhea, vomiting, and hyperthermia, than those in the SNAP-cPL test-negative group (n = 54) (2.52 versus 1.32,  $p < 0.01$ ) (Fig. 2A). Moreover, the SNAP-cPL test-positive group (n = 26) had significantly higher clinical sign scores using the scoring system than the SNAP-cPL test-negative group (n = 54) (3.38 versus 2.64,  $p < 0.05$ ) (Fig. 2B).

Dogs in the CKD group (n = 10) had a significantly higher

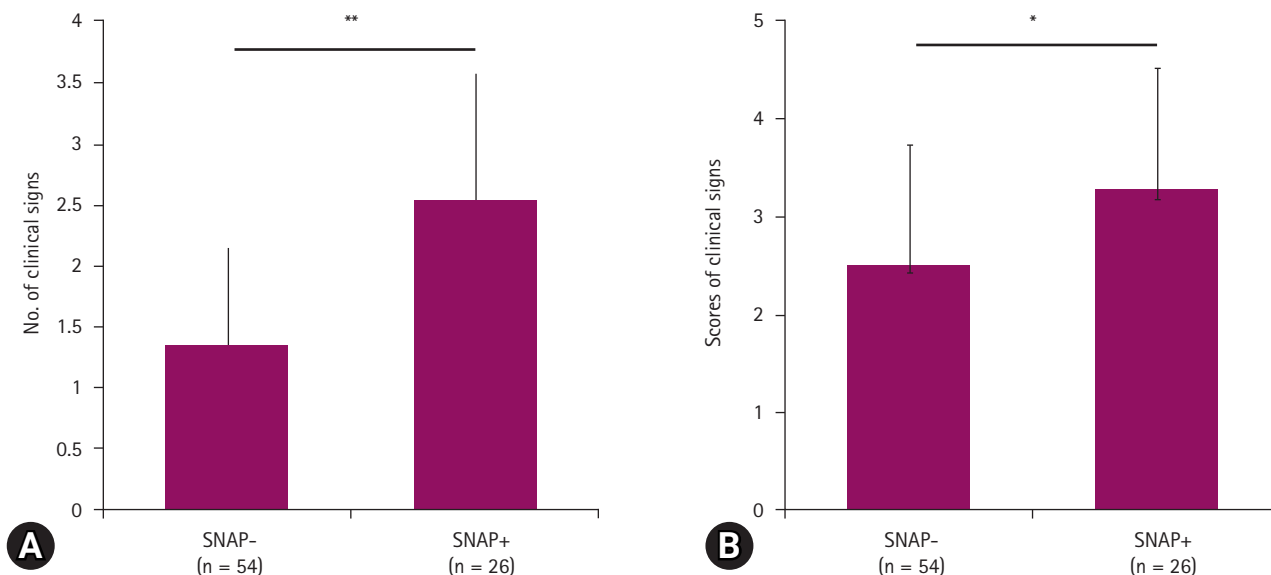
**Table 3.** Signalment of dogs enrolled in this study

Characteristics of dogs	Value
Sex	
Male	5
Castrated male	38
Female	4
Spayed female	33
Breed	
Maltese	22
Poodle	8
Mixed	7
Shih tzu	7
Pomeranian	6
Others	30
Age	
Average (range)	9 y (8 mo–17 y)
SD (y)	9 ± 3.7
Weight	
Average (range, kg)	9.37 (1.5–44.4)
SD (y)	9.37 ± 9.1

SD, standard deviation.



**Fig. 1.** Dogs in the SNAP cPL test-positive group were significantly older than those in the SNAP cPL test-negative group. \* $p < 0.05$ .



**Fig. 2.** Relationship between positive rate of SNAP cPL test and severity of gastrointestinal signs. (A) Dogs in the SNAP cPL test-positive group had a significantly greater number of clinical signs than those in the SNAP cPL test-negative group. (B) Dogs in the SNAP cPL test-positive group had higher clinical sign scores using the scoring system than those in the SNAP cPL test-negative group. \* $p < 0.05$ , \*\* $p < 0.01$ .

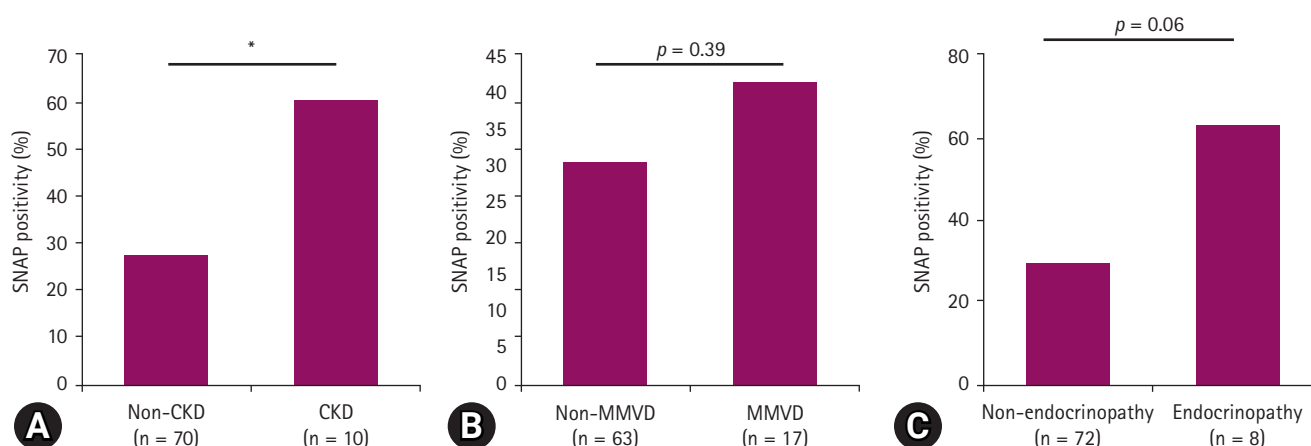
SNAP cPL test-positive rate than those in the non-CKD group ( $n = 70$ ) (60% vs. 27.53,  $p < 0.05$ ) (Fig. 3A). However, the MMVD group ( $n = 17$ ) showed a difference from the non-MMVD group ( $n = 63$ ) in the SNAP cPL test-positive rate, but the difference was not statistically significant (41.17 versus 30.15,  $p = 0.39$ ) (Fig. 3B). Dogs in the endocrinopathy group ( $n = 8$ ) had a higher SNAP cPL test-positivity rate than those in the non-endocrinopathy group; however, these differences were not statistically significant. ( $n = 72$ ) (62.5 versus 29.16,  $p = 0.06$ ) (Fig. 3C).

## Discussion

This study showed that the mean age of the SNAP-cPL test-positive group was significantly higher than that of the SNAP-cPL test-negative group, which may have been due to the incidence of chronic pancreatitis. The prevalence of chronic pancreatitis increases with age. Watson et al. [9,10] suggested that the mean age of patients with chronic pancreatitis was 9.1 years. Moreover, chronic pancreatitis may have high pancreatic lipase immunoreactivity; therefore, chronic pancreatitis itself can increase pancreatic lipase levels, resulting in a positive SNAP cPL test [9]. Furthermore, chronic pancreatitis can cause acute pancreatitis [9]. Dogs show an age-related increase in the prevalence of chronic pancreatitis. Since cases of chronic pancreatitis can also have acute episodes, they may trigger a positive SNAP cPL test result. Thus, based on the previous study, it can be assumed that the higher average age of the SNAP cPL test-positive group compared to the negative group in this study suggests a potential link to chronic pancreatitis.

This study also showed a relationship between concurrent diseases, including CKD and endocrinopathy, and SNAP cPL test-positivity rate. In humans, several concurrent conditions, such as heart disease and CKD are recognized as risk factors for acute pancreatitis [11,12]. Additionally, Cridge et al. [13] identified the risk factors for pancreatitis in dogs, including endocrinopathy. While Cridge et al. [13] did not specifically propose CKD as a potential risk factor for pancreatitis in dogs, our study revealed an association between CKD and SNAP cPL test positivity. Furthermore, existing research has explored the relationship between acute pancreatitis and various concurrent diseases, including hepatobiliary abnormalities, kidney disease, hypothyroidism, HAC, and DM [14]. However, it is important to note that the identified risk factors may not consistently indicate a causative relationship. In some cases, they could be coincidental or simply markers for shared underlying risks [14]. Consequently, comprehensive research is required to elucidate the association between multiple concurrent diseases across diverse populations. Previous studies have confirmed that age and many concurrent diseases can act as risk factors for acute pancreatitis [3,13,14]. The findings of this study that the average age of the SNAP cPL test-positive group was higher than that of the negative group and that CKD and endocrinopathy appear to be associated with elevated SNAP cPL levels are consistent with those of previous studies. Thus, the SNAP cPL test should be performed more actively in patients with GI symptoms who are over 10 years old and have CKD and endocrine diseases.

Although histopathology of the pancreas is the gold standard for diagnosing acute pancreatitis, its progression is difficult [1]. Therefore, the diagnosis of acute pancreatitis relies on clinical



**Fig. 3.** Relationship between positive rate of SNAP cPL test and concurrent disorders. (A) Dogs with chronic kidney disease (CKD) had a significantly higher positive rate of SNAP cPL test than those without CKD. (B) Dogs with or without myxomatous mitral valve disease (MMVD) were not significantly different in the positive rate of the SNAP cPL test. (C) Dogs with or without endocrinopathy were not significantly different in the positive rate of the SNAP cPL test. \* $p < 0.05$ .

signs, serological tests, and ultrasonographic findings [1,3]. Similarly, for the diagnosis of acute pancreatitis in humans, at least 2 of the following symptoms must be present: abdominal pain; serum lipase or amylase activity; and detection by ultrasonography, computed tomography, or magnetic resonance imaging [15]. Notably, abdominal pain is a crucial factor in diagnosing acute pancreatitis [15]. However, diagnosing abdominal pain in dogs remains challenging [14]. Cridge et al. [14]. observed that abdominal pain occurred at a relatively low rate (32%) in patients with acute pancreatitis. Anorexia was the most common symptom, followed by diarrhea and vomiting [14]. This could be due to the difficulty localizing abdominal pain in pets. Moreover, due to various patient factors, ultrasonography can be subjective and difficult to perform in veterinary medicine. Thus, the SNAP cPL test and clinical signs are commonly used for diagnosing acute pancreatitis [14].

Additionally, a recent study suggests that lethargy and anorexia, common symptoms in Cridge et al.'s study [4], can also be associated with pain [16]. Therefore, dividing the assessment into more objective clinical signs, including anorexia, lethargy, vomiting, diarrhea, and hyperthermia, rather than relying solely on abdominal pain, may aid in identifying the indications for the SNAP cPL test based on human diagnostic standards. Therefore, in this study, a scoring system based on clinical signs was employed. It was suggested that when more than 2 of the 5 clinical signs or a score of more than 3 on the scoring system is present, the SNAP cPL test should be considered.

This study has several limitations. First, the sample size was relatively small. Additionally, acute pancreatitis was suspected based on the SNAP cPL test and clinical signs; however, not all patients underwent the quantitative immunoassay, such as the Spec cPL test. Furthermore, CKD was not categorized according to the IRIS stage, and MMVD was not classified according to the ACVIM stage. Additionally, chronic pancreatitis was not specifically classified. Finally, variations among clinicians may have introduced subjective factors into the analysis. Therefore, further studies are needed to evaluate the cPL results in healthy control dogs, to determine the appropriate cut-off value for the score of clinical symptoms when performing the cPL test, and to investigate the association between various underlying diseases and acute pancreatitis.

In conclusion, this study suggests that the SNAP cPL test should be more actively considered when the patient is 10 years or older, the number of GI clinical signs is 3 or more, the clinical scoring system is 2.5 points or higher, or concurrent diseases, such as CKD and endocrine disorders are present.

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