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CLINICAL MANIFESTATIONS OF ACUTE PANCREATITIS IN DOGS - DIAGNOSTIC AND PROGNOSTIC VALUE

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Abstract

The clinical signs of acute pancreatitis depend largely on the severity of the disease, which can range from subclinical to life-threatening. The more common clinical signs are a direct result of inflammation of the pancreas or of the systemic effects of inflammation. The present study was performed in 83 dogs with spontaneous acute pancreatitis and 12 dogs with experimentally induced acute pancreatitis. The indicators general condition, appetite, vomiting, defecation, pain, mobility and reactivity were assessed. Both the frequency and the degree of manifestation of the individual clinical signs were taken into account. The most common symptoms were lethargy, anorexia, vomiting, diarrhea, and abdominal pain. There was a statistically significant difference between the experimental groups in the degree of manifestation of some of the signs, but not in the frequency of their manifestation.

Key words*: pancreatitis, dog, clinical signs, prognostic value.*

INTRODUCTION

Numerous studies have been conducted worldwide describing clinical or clinico-pathological abnormalities in dogs with acute pancreatitis (AP) (Thordal-Cristensen and Coffin, 1956; Anderson and Low, 1965; Williams, 1995; Morita et al., 1998; Krstic et al., 2001; Williams, 2005; Morozov, 2006; Watson et al., 2007). Most of the specialists working in this field agree that the clinical manifestation of AP is extremely diverse and non-specific (Thordal-Cristensen and Coffin, 1956; Schaer, 1979; Westermarck and Rimaila-Paranen, 1983; Watson et al., 2007). Acute pancreatitis, even as an independent disease, leads to a variety of functional and humoral, primary and secondary pathological effects in the patient's body, and its clinical manifestation depends a lot on the changes in the gland and on the involvement of other organs and systems in the inflammatory process (Morozov, 2006).

The main clinical signs are concentrated in Mondor's triad - pain, vomiting and flatulence (Morita et al., 1998; Krstic et al., 2001; Pápa et al., 2011). Usually, in human medicine, the first and most significant sign of AP is pain localized in the epigastrium, which can also cover other parts of the abdomen and even the chest girdle. In veterinary medicine, pain is not always recognizable and we have to judge it by indirect signs. One of them is vomiting, which in the absence of another etiology is taken as a manifestation of visceral pain.

Since the pancreas is located in the abdominal cavity, its examination is an indispensable part of the process of diagnosis of AP. The abdomen in severe cases is most often soft, pasty with flatulence in the initial part of the small intestine. Sometimes a defense in the epigastrium can also be found, known in human medicine as "Keurte's symptom" (Takov et al., 2004).

Clinical manifestations of organ failure, such as respiratory (acute respiratory distress syndrome), renal, cardio-circulatory, or severe metabolic or hemostatic disorders are indicative of rapid disease progression (Freudiger, 1991; Hofbauer and Saluja, 1998; Kondratenko et al., 2008; Mansfield et al., 2008; Sato et al., 2017; Lazarov, 2021).

MATERIALS AND METHODS

The study included 83 dogs with spontaneous acute pancreatitis divided into two groups (A and B), depending on the outcome of the disease, and 12 clinically healthy dogs in which experimental acute pancreatitis was reproduced. In group A, 22 animals (with a fatal outcome) were included. In group B, 61 animals (with a favorable outcome) were

included. Primary clinical examinations of the spontaneous cases were performed at the time of admission of the animals to the clinic. A total of 12 clinically healthy dogs, provided by the Stara Zagora municipality shelter, were used for experimental reproduction of acute pancreatitis. They were divided into two experimental groups (C and D) with 6 dogs each. In experimental group C, we induced acute pancreatitis by placing ligatures of the ductus pancreaticus, and in group D, acute pancreatitis was reproduced by introducing oleic acid into the ductus pancreaticus minor.

Before the start of the experiments, all animals were vaccinated and treated against endo- and ectoparasites. Daily clinical and periodic paraclinical (blood and urine) examinations were conducted for 14 days, which confirmed their good health. They were fed with dry pelleted food according to their type and weight, and they were provided with unlimited access to drinking water.

At the 0th, 24th, 48th, 72nd, and 96th hours from the start of the experiments, hematological, ultrasonographic, and clinical examinations were performed in all animals.

Figure 1. Ordinal rank scale for assessment of clinical signs

The complete clinical examination, including the parameters of Status Praesens (general and special part), as well as indicators such as: appetite, general behavior, mobility, sensitivity, reactivity, vomiting, pain, defecation, etc., was performed according to the routine methods of clinical diagnostics. The results of the study were recorded in an ethogram prepared for the purpose. The degree of manifestation of the individual clinical signs was transformed into a numerical expression using an ordinal rating scale from 0 to 4 (Figure 1). According to this scale, score 0 means no manifestation of the corresponding parameter, 1 - weak manifestation, 2 - moderate, 3 - strong, and 4 - extreme manifestation.

RESULTS AND DISCUSSIONS

As can be seen from the tables (Table 1 and Table 2), our studies in dogs with spontaneous and experimental AP showed extremely categorical values of the anorexia index. Bearing in mind Williams' statement (Williams and Steiner, 2005) that pain in AP worsens after feeding and/or supine and is relieved by fasting, we can hypothesize that anorexia in AP is partly caused by the presence of pain in the abdominal area. High-grade anorexia in AP, reaching anorexia, has been reported by many other authors (Van den Bossche, 2010; De Causmacker, 2009; Mansfield, 2008; Mix, 2006). In a review of the prevalence of clinical signs in AP in dogs and cats, Van den Bossche placed anorexia in the leading position with 91% in dogs and 63-100% in cats (Van den Bossche, 2010). Our studies in dogs with spontaneous and experimental AP showed even more definite values of this indicator. In all experimental groups, we reported anorexia in 100% of the animals. The difference was in the degree of manifestation in the different groups. Anorexia was the highest in experimental group A (non-survivors), which we attribute to multi-organ dysfunction and more serious damage in the structure of the pancreas.

In experimental group A, we observed vomiting in 91% of the dogs, in group B - 88%, and in groups C and D, all animals demonstrated vomiting. This largely confirms the literature sources, according to most of which vomiting is observed in about 85% of cases of AP. Vomiting in AP is usually painful and persistent and does not lead to relief of the patient's condition. Unlike intestinal obstruction in AP, there is never vomiting of fecal matter. It is mainly due to the increased excitability of the stomach and duodenum as a consequence of the irritation of the vagus by the inflamed pancreas (Filipenko, 2004; Filipenko, 2004 -1; Rau, 2004). According to the same authors, repeated and prolonged vomiting should be considered as an unfavorable prognostic sign.

Another important diagnostic and prognostic indicator in AP is the general condition of the individual. In most cases it is severely affected. The percentage of dogs with AP demonstrating weakness and/or lethargy varies around 80% (Van den Bossche, 2010). Most commonly, animals are lethargic, but in severe cases anxiety, fear and inappropriate behavior are present (Watson, 2003; Gruys, 1998). All these signs were present in the animals we studied, with the predominant manifestations being adynamia and lethargy. Our survey showed 100% occurrence of this indicator. Especially clearly, with a statistically significant difference in the severity of the manifestation $p<0.001$, the depressive states were expressed in the animals of group A. In a large part of the dogs of this group, severe apathy was observed, sometimes reaching somnolence, signs that completely coincide with the literature data. Takov (Takov et al., 2004) points out those neurological disorders in acute pancreatitis in humans are very diverse and are a sign of toxic encephalopathy and deepening metabolic disorders (metabolic acidosis, hyperglycemia, hypocalcemia). The correlation we found between high blood sugar levels and a high frequency of neurological abnormalities in experimental group A fully corresponds to this statement.

Pain localized in the epigastrium is usually indicated as the first and most significant sign of AP. However, the localization of the pain can cover other parts of the abdomen and even the chest girdle.

According to Dent (1991), abdominal pain syndrome is the leading clinical manifestation of most diseases of the digestive organs. Precisely the pain reaction was one of the first signs established by us, both in the course of the conducted experiments and during the examinations of the animals with spontaneous pancreatitis.

The characteristics of the pain syndrome observed by us, namely: not always defined localization and irregular rhythm (of indefinite duration and unrelated to food intake, time of day, the act of defecation or mechanical provocation), completely coincide with the literary description of visceral pain, characteristic of acute pancreatitis (Simpson, 2006). The immediate cause of visceral pain is the activation of pancreatic proteases and tissue necrosis leading to the release of inflammatory mediators (Nathens, 2004; Mayerle, 2004). They not only exacerbate the inflammatory process, but also affect the sensory fibers of the intestinal plexus (T5-T9), which leads to visceral pain. It usually occurs suddenly and can be very severe, sometimes leading to ileus or even loss of consciousness (Nathens, 2004; Mayerle, 2004). A similar nature of pain during the development of toxemic syndrome is explained by A.P. Popov (2001), and E.M. Drapeza (2002) through the impact of hydrolytic, proteolytic enzymes, kinins and other biologically active substances released in the bloodstream on organs remote from the pancreas. However, cases of AP have been described (and we have also observed such), which were asymptomatic and the diagnosis was established after performing an autopsy (Geyer, 1968). In the course of our study, a manifestation of visceral pain was found in 60% of the animals in group A, and in 67% of the animals in groups B and C. When quoting these figures, we should not overlook the fact that the determination of pain symptoms in the veterinary medicine is largely subjective. In this regard, it is perhaps more correct to define all animals with vomiting as demonstrating a pain response.

Table 1. Clinical signs in dogs with spontaneous acute pancreatitis from experimental groups A (non-survivors) and B (survivors)

Symptom	**Group A (n = 22)**		**Group B (n = 61)**	
	n	**%**	**n**	**%**
Anorexia ($p<0.001$)	22	**100 (3.7)**	61	**100 (2.3)**
Vomiting	20	**91**	54	**88**
Lethargy ($p<0.001$)	22	**100 (3.2)**	61	**100 (1.9)**
Pain	15	**68**	42	**67**
Diarrhea	10	**45**	15	**24**

Table 2. Clinical signs - percentage of involvement, degree of manifestation and statistical reliability compared to the 0-th hour in dogs with experimental AP from experimental groups C (ligatures) and D (oleic acid).

Symptom	0 h		24 h		48 h		72 h		96 h	
Group	C	D	C	D	C	D	C	D	C	D
Anorexia	0	0	83/**1**^{c}	100/**3**^{c}	100/**2**^{c}	100/**3**^{c}	100/**2**^{c}	100/**3**^{c}	100/**2**^{c}	100/**3**^{c}
Vomiting	0	0	50/**1**^{a}	50/**1**^{b}	100/**2**^{c}	100/**2**^{c}	100/**2**^{c}	100/**1**^{c}	100/**2**^{c}	100/**2**^{c}
Lethargy	0	0	100/**2**^{c}	83/**2**^{c}	100/**2**^{c}	100/**2**^{c}	100/**2**^{c}	100/**2**^{c}	100/**2**^{c}	100/**2**^{c}
Pain	0	0	50/**1**^{a}	67/**1**^{b}	100/**2**^{c}	67/**2**^{b}	100/**2**^{c}	100/**2**^{b}	83/**1**^{c}	100/**1**^{b}
Diarrhea	0	0	50/**1**	67/**1**^{a}	83/**2**^{b}	83/**1**^{b}	67/**1**^{a}	83/**1**^{b}	17/**2**	50/**1**

$^{a}P<0.05$; $^{b}P<0.01$; $^{c}P<0.001$

The percentage of dogs with AP demonstrating diarrhea typically ranges from 20 to 50 percent (R D Eddine et al., 2018; T. Sato et al., 2017; Watson P.J. et al., 2007). Our research on spontaneous cases of AP fully confirmed this statement. However, the results of the experimental setups showed that this indicator is too dynamic and unstable. In experimental groups C and D, the percentage of animals with diarrhea reached a peak of 83% at 48 hours from the start of the experiment. This high percentage is most likely also due to the mechanical trauma of the operative intervention on the wall of the duodenum, but fully confirms Simpson's opinion that diarrhea is a much more common sign in dogs with experimental pancreatitis (Simpson, 2006). Exocrine insufficiency of the pancreas as a result of destructive processes in the parenchyma or mechanical disorders in the outflow of pancreatic juice is indicated as the main cause of diarrhea in AP (Lazarov, 2021; Morozov, 2006; Dragiša, 1999). The ligatures placed by us on the pancreatic duct prevent not only the outflow of pancreatic juice, but also create conditions for biliary reflux in the pancreatic duct system. Regarding the type of diarrhea, there is complete agreement that the presence of bloody stools and melena are poor prognostic indicators and suggest a severe development of the disease (Sato et al., 2017; Mansfield et al., 2008).

CONCLUSIONS

In spontaneous acute pancreatitis, the severity of the course and the outcome of the disease depend to a large extent on the structural and functional changes both in the pancreas itself and in indirectly related organs and systems (heart, kidneys, liver, and central nervous system). Relying on clinical signs alone is not sufficient to make an accurate diagnosis, but could be useful in predicting the development of AP. For greater accuracy, it is necessary to make a complex assessment of the results of the patient's clinical, paraclinical and imaging examination.

Based on the results obtained in the course of our research, the following conclusions can be drawn:

1. Acute pancreatitis in dogs (induced and spontaneous) presents with lethargy, anorexia, vomiting, diarrhoea and abdominal pain.
2. In acute pancreatitis, structural and functional changes in cellular and tissue elements are of a phase nature, and the leading morphological component in its development is the appearance of necrotic foci. The degree of destructive phenomena in the parenchyma and stroma of the organ corresponds to the severity of the clinical picture.

REFERENCES

Anderson, N., Low, D. (1965). Diseases of the canine pancreas: a comparative summary of 103 cases. *Anim Hosp*, 1, 189-194.

De Causmacker, V., Daminet S., Paepe D. (2009). Diabetes ketoacidosis and diabetes ketosis in 54 dogs: a retrospective study. *Vlaams Diergeneeskundig Tijdschrift,* 78, 327-337.

Dent, G. (1991). Pharmacotherapy of gastrointestinal motor disorders. *Sydney*, 179.

Drapeza, E.M. (2002). The role of lysosomes in the mechanisms of damage and protection of the myocardium in pancreatogenic endotoxicosis: *dis. cand. honey. Sciences*, Stavropol.

Eddine, R. D. and Amine F. M. (2018). Analytical Study of Pancreatitis in Dogs. *Dairy and Vet Sci J* 6(2): JDVS.MS.ID.555681.

Filipenko, P., Titorenko M., Potapov G. (2004). Effect of emoxipin on processes of lipid peroxidation in

roasted dogs with acute pancreatitis. *Modern science-intensive technologies*, 3, 96-97. ISSN 1812-7320.

Filipenko, P., Titorenko M., Potapov G. (2004). Influence of ionol on the processes of lipid peroxidation in the liver of dogs with acute pancreatitis. *Modern science-intensive technologies,* 3, 95-96. ISSN 1812-7320.

Freudiger, U. (1991). Physiologie, Pathologie, Labor und Therapie der exokrinen Erkrankungen der Bauchspeicheldrüsse beim Hund. *Kleintierpraxis,* 36, 5-16.

Geyer, S., Bibrack Br. and Hanichen T. (1968). Zur Klinik und Pathologue von Pankreaserkrankungen beim Hund. *Kleintierpraxis*, 13, 17-24.

Gruys, E., M. Toussaint, W. Landman and L. van Veen. (1998). Infection, inflammanations and stress inhibit growth. Mechanisms and non specific assesment of the processes by acute phase. *Production diseases proteins in farm animals*, 72-88, Amsterdam.

Hofbauer, B, Saluja AK. (1998). Intraacinar cell activation of trypsinogen during caerulein induced pancreatitis in rats. *Am J Physiology*, 275, 352-362.

Kondratenko, P., A. Vasiliev, M. Konkova. (2008). Acute pancreatitis. *Monograph, Donetsk*.

Krstic, V., Knezevic, M., Trailovic, D., Bozic, T. (2001). The influence of superoxide-dismutase on biochemical manifestations in dogs with experimental pancreatitis. *Folia veterinaria*, 45(4), 34-36.

Lazarov, L. (2021). Markers for hepatocellular damage and affecting the biliary tract in the course of acute pancreatitis in dogs. *Tradition and Modernity in Veterinary Medicine*, vol.6, 1(10), 3-10, ISSN 2534-9333.

Mansfield, C.S., James F.E., Robertson I.D. (2008). Development of a clinical severity index for dogs with acute pancreatitis. *Journal of the American Veterinary Medical Association*, 233, 936-944.

Mayerle, J., Simon P., Lerch M.M. et al. (2004). Medical treatment of acute pancreatitis *Gastroenterol Clin N Am*, 33, 855-869.

Mix, K., Jones C. (2006). Diagnosing acute pancreatitis in dogs. *Compendium on Continuing Education for the Practicing Veterinarian*, 28, 226-234.

Morita, Y., Takigushi M., Yasuda J., Kitamura T., Siakalima M, and Hashimoto A. (1998). Endoscopic and transcutaneus ultrasonographic findings and grey-scale histogram analysis in dogs with caerulein-induced pancreatitis. *Vet Quart,* 20, 89-92.

Morozov, S. V. (2006). Clinical and pathogenetic substantiation of diagnosis, treatment and prognosis in acute pancreatitis and its complications. *Dissertation for the degree of Doctor of Medical Sciences, Omsk*.

Nathens, A, Curtis J., Beale R. et al. (2004). Management of the critically ill patient with severe acute pancreatitis. *Crit Care Med,* 32(12).

Pápa, K., Máthé A., Abonyi-Tóth Z. et al. (2011). Occurrence, clinical features and outcome of canine pancreatitis (80 cases). *Acta Veterinaria Hungarica*, 59, 37–52.

Popov, A.P. (2001). The role of lipid peroxidation in the mechanisms of protection and myocardial damage in acute pancreatitis. *Dis. cand. honey. Sciences*. Stavropol.

Rau, B., Beger H. and Schilling M. (2004). Biochemical Severity Stratification of Acute Pancreatitis: *Pathophysiological Aspects and Clinical Implication/J.-L.Vincent (ed). Year book of Intensive Care and Emergency Medicine. Springer,* 499-515.

Sato, T., Koichi O., Takashi T., Mariko O., Hideyuki K., Kenjiro F., Yuko Goto-Koshino, Masashi T. and Hajime T. (2017). Assesment of severity and changes in C-reactive protein concentration and various biomarkers in dogs with pancreatitis. *J Vet Med Sci*, 79(1), 35–40.

Schaer, M. (1979). A clinicopathologic survey of acute pancreatitis in 30 dogs and 5 cats. *J Am Anim Hosp Assoc*, 15, 681-687.

Simpson, K. W. (2006). Update on Pancreatitis in Dogs. *World Small Animal Veterinary Association World Congress Proceedings, 31st World Small Animal Veterinary Congress,* October 11-14, Prague, Czech Republic.

Takov, D., Vladov N., Mladenov N., Katsarov K., Ivanov A., Khandzhiev S., Ramsheva Z. (2004). Acute pancreatitis - diagnosis and treatment. *Marveda*, 45-56.

Thordal-Cristensen, A., Coffin D. L. (1956). Pancreatic diseases in the dog. *Nord Vet Med*, 8, 89-114.

Trailović, Dragiša R. (1999). Gastroenterologija pasa i maćaka. *Beograd,* 279-298.

Van den Bossche, D. Paepe, S. Daminet (2010). Acute pancreatitis in dogs and cats: pathogenesis, clinical signs and clinicopathologic findings *Vlaams Diergeneeskundig Tijdschrift*, 79, 13-22.

Watson, P.J. (2003). Exocrine pancreatic insufficiency as an end stage of pancreatitis in four dogs. *Journal of Small Animal Practice*, 44, 306-312.

Watson, P.J., Roulois A.J.A., Scase T., Johnston P.E.J., Thompson H., Herrtage M.E. (2007). Prevalence and breed distribution of chronic pancreatitis at post-mortem examination in first-opinion dogs. *Journal of Small Animal Practice*, 48, 609-618.

Westermarck, E., Rimaila-Paranen E. (1983). Serum phospholipase A2 in canine acute pancreatitis. *Acta Vet Scand,* 24, 477-487.

Williams, D. (1995). Exocrine pancreatic disease. *In: Ettinger SJ, Feldman EC, eds. Textbook of veterinary internal medicine. 4th ed. Philadelphia: WB Saunders Co*, 1372-1392.

Williams, D. and J. M. Steiner. (2005). Canine exocrine pancreatic diseases. *In: Ettinger, S. J., and E. C. Feldman (eds), Textbook of Veterinary Internal Medicine*, 6th ed., 1482–1488.