

# Canine parvovirus infection and pet owner's perception: a case study in Cebu, Philippines

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**Abstract-** The highly infectious Canine Parvovirus (CPV) is globally known as the leading viral cause of enteritis in domestic dogs. In the Philippines, clinical signs of infected dogs and information on owner's perspective on CPV have not been reported. This study aimed to describe the clinical features of CPV cases, find significant associations, and qualitatively analyze owner responses on selected questions about CPV in Cebu, Philippines. A total of 45 CPV-suspected dogs were selected from different veterinary establishments. Presenting clinical signs were recorded. Hematological examinations, fecalysis and CPV fecal testing using a commercial immunochromatographic assay (ICA)-based antigen test kit were performed. Owners of CPV-positive dogs (70%) were subsequently interviewed. The median age of infected dogs was 4 months. Lethargy, inappetence and vomiting were the most observed clinical signs. Common hematological observations include panleukopenia, neutropenia, anemia and thrombocytopenia. Case fatality rate was 29%. Multivariate analysis revealed that neutrophil and total WBC counts, age category and vaccination status, and the presence of lethargy, inappetence and vomiting were found significantly associated. Absolute neutrophil count ( $p$ -value=0.009) was a significant predictor of ICA test result. Half of the owners (51%) claimed to be unaware of the disease and the vaccinations against it.

**Index Terms-** Key words: canine parvovirus, clinical signs, owners, Cebu, Philippines

## I. INTRODUCTION

Canine Parvovirus (CPV), which targets young mitotic cells, is the leading viral cause of enteritis in immature dogs (1). CPV infection is believed to occur worldwide, with reported cardinal signs manifested by vomiting, anorexia, lethargy, dehydration, pyrexia, tachycardia and a distinctively foul-smelling bloody or mucoid diarrhea (2,3,4).

Hematology is a useful parameter in diagnosing and prognosing CPV cases. The hematologic changes are marked and occur over the course of the illness. Most dogs develop a moderate to severe leukopenia characterized by lymphopenia, monocytopenia, and granulocytopenia with emphasis on neutropenia (4,5). CPV diagnostic tests may utilize blood samples to detect serum viral titers, but commercial test kits like immunochromatographic assay (ICA) can utilize fecal samples from CPV-suspected dogs as most clinically ill dogs shed large quantities of the virus in their feces (5). The use of ICA has also been shown to have no significant difference with PCR results (6,7).

In the Philippines, CPV cases are commonly encountered in the veterinary practice but actual disease prevalence is yet to be reported. Moreover, to the best of the author's knowledge, clinical signs of CPV cases in the country have not yet been officially published. On the other hand, dog owner's knowledge and opinion on the disease have not been also investigated. In this study, suspected CPV infected dogs were tested using commercial ICA-based CPV Antigen (Ag) test kits. Patient profile, clinical signs, and hematological changes and the presence of enteric parasites were assessed. In addition, respective owners of positive dogs were interviewed about the CPV infection for qualitative assessment. This study is the first to officially document clinical signs of CPV infected dogs serologically diagnosed using ICA fecal test, and the knowledge and opinions of the respective owners on the disease.

## II. MATERIALS AND METHODS

### Research design

The study employed a prospective, descriptive-analytical design. Suspected infected animals were tested using a commercial ICA-based Rapid Ag fecal test kit. Information about the infected patients were documented, while respective pet owners were interviewed about CPV and its prevention.

### Selection of veterinary establishments, research subjects and respondents

Participation from veterinary establishments in Cebu, Philippines was requested through a formal letter addressed to the owner. Only 5 out of 10 responded positively (SWU Veterinary Teaching Hospital at Basak, Cebu City, GPY Veterinare Animale at Tres de Abril, Cebu City, Cebu Dog and Cat Clinic at N. Bacalso Ave., Cebu City, Pet Doctor's Veterinary Center located at Talisay

City, and Pets in the City Veterinary Center located at Talamban, Cebu City). A total of 45 dogs suspected to be infected with CPV were selected regardless of age, gender, breed, and vaccination status in Cebu, Philippines. Inclusion criteria included manifestation of vomiting, hemorrhagic or mucoid diarrhea, inappetence, lethargy/depression, pyrexia, and/or tachycardia. The owners of the CPV-infected dogs were subsequently interviewed.

### Research instruments

Blood and fecal samples were collected in EDTA and plain tubes for complete blood count (CBC) and direct fecalysis, respectively. Peripheral blood was aseptically collected using a sterile 3 ml syringe. A commercial ICA-based CPV rapid Ag fecal test kit was utilized to detect CPV in the fecal samples of the research subjects. Relevant data, which include signalment, history, clinical signs and vaccination history, were obtained using a fixed survey form. For the owners, an individual interview schedule was utilized.

### Data processing and analysis

Obtained data were recorded into a tally sheet, and encoded into Microsoft Excel® using appropriate variable coding. Encoded data were imported into a SPSS version 23. Simple frequencies and percentages were obtained. Univariate analysis of variance, multivariate analysis (using general linear model) and logistic regression were performed. For the interview, answers were consolidated and tabulated accordingly.

## III. RESULTS AND DISCUSSION

A total of 35 out of the 45 dogs tested positive using the ICA-based test kit. Majority of these dogs (60%) were aged between 6 weeks to 6 months, with a median age of 4 months. This age range is considered very susceptible to CPV infection (1,5). Usually until 6 weeks, puppies from bitches with updated CPV vaccination can have the ability to resist infection due to the presence of antibodies passed through the milk (8). The maternally acquired antibody titer declines as the puppies grow older and susceptibility to viral infection increases. Most dogs more than 6 months old acquire natural resistance, and young dogs compared to adults are more likely to be diagnosed with CPV infection (9). However, this should not rule out CPV infection in older dogs, as the remaining 17.8% of CPV positive dogs were more than 6 months of age. There were more females and mixed bred dogs that were found infected with CPV (Table 1).

Most of the CPV-infected dogs also had no vaccination history (57.8%). However, some were also vaccinated, which may indicate the possibility of a more virulent or different CPV strain, weak immune status or vaccination failures. CPV enteritis in vaccinated dogs has been reported (10). However, vaccinated CPV infected dogs may have higher chances of recovery than those that did not receive vaccinations at all. On the other hand, there were more dogs that were never dewormed in the CPV-positive dogs (Table 1). Only 2 mortalities were associated with concurrent parasitic infection, specifically due to *Ancylostoma caninum* infection. Parasitism has been known to increase the severity of CPV enteritis (11).

Lethargy was the most common clinical manifestation of CPV, followed by inappetence, vomiting and dehydration (Table 1). Melena was only seen in 55.6% (25 of 35) of the CPV-positive dogs, implying that parvoviral infection should not be ruled out even when no diarrhea is exhibited. Detecting CPV in the fecal samples of both normal and diarrheic dogs is possible (12). Al-Tayib (13) detected CPV antigens using an ICA-based test kit from a group of unvaccinated puppies, and reported that all CPV positive puppies (diarrheic or apparently healthy pups) eventually died from the disease.

Hematologic analysis (Table 2) showed leukopenia in most of the CPV infected dogs. Poor prognosis has been associated with leukopenia (4,14). Neutropenia was observed in most of the infected dogs. Because neutrophils are the most abundant WBC in dog blood, severe neutropenia can serve as a contributing factor for leukopenia. Thus, neutrophils are the most important leukocyte to monitor during the course of the disease (14). The demand for WBC, particularly neutrophils, is high in the inflamed gastrointestinal tract, but due to hematopoietic cell destruction of leukocytes in lymphoproliferative organs like the bone marrow, there is an inadequate supply of leukocytes leading to several other hematological changes (15). Surprisingly, most of the infected dogs had normal ranges in their monocyte, lymphocyte, basophil and eosinophil counts. Similar to Shah et al. (3), anemia and thrombocytopenia (14 of 35) were also observed. This may be due to the cytotoxic effects of the virus leading to myeloid and erythroid hypoplasia.

Multivariate analysis revealed that neutrophil and total WBC counts, age category and vaccination status, and the presence of lethargy, inappetence and vomiting were found significant (Table 3). Although further analysis showed the absolute neutrophil count ( $p$ -value=0.009) as a predictor of ICA test result (table not shown), none of the parameters were shown to be significantly associated to the survivability of test-positive patients. Results indicate that absolute neutrophil counts can be used as a reliable marker in diagnosing CPV infections similar to the suggestions of Schoeman et al. (16), especially in the absence of available test kits and when clinical signs are suggestive of the disease. The said parameter has also been considered a valuable predictor of in-hospital mortality (17), hemodialysis (18) and hypertensive human patients (19). On the other hand, The CPV case fatality rate study was found to be 28.6%. The mortality rate of CPV enteritis may reach up to 91% in puppies while for adult dogs is around 10%. This can be affected

by the prompt detection of the presence of the disease, restoration of fluid and electrolyte balance and prevention of secondary bacterial infection (10).

Interview results revealed that 51.4% of owners of the CPV positive dogs have no knowledge of the disease, and the vaccinations available for it. It has been indicated that very few veterinarians discuss about infectious diseases to pet owners, and some only do so when asked. The lack of information makes owners less motivated to take the simple procedures necessary to protect their animals (20, 21, 22). Of the 42.9% of owners that are aware that there is a vaccine, only 8.6% plan to complete and update their dog's vaccination. Another 8.6% want their dogs vaccinated for rabies only. It appears that owners are more well-informed about rabies and its vaccination (20) than with CPV. The remaining 5.7% of owners could not complete all their dog's shots due to financial constraints. The monetary aspects of veterinary care have always been considered a challenge among veterinarians and pet owners (21,23). An important factor leading to disease is incomplete vaccination of the dog. Twenty-three percent (23%) of dog owners believed that 1 shot of the vaccine is all that is needed to for a lifetime of immunity. Meanwhile, 17.1% of dog owners do not know the exact age for a dog's first shot, 5.7% do not know about the interval between vaccination shots, and 11.4% prefer to vaccinate their dogs when they reach 3 months of age (Table 4). The recommended vaccination protocol using modified-live vaccines starts at 6-8 weeks, then 10-12, and 14-16 week of age, followed by a booster administered 1 year later and then every 3 years (5). In the Philippines, booster shots are usually given annually. Delays or discontinuation of the routine vaccination program will result to lack of sufficient seroconversion to the CPV vaccine (10).

Canine parvovirus infection remains to be a threat to dogs, especially to unvaccinated puppies in the Philippines. Veterinarians and pet owners must be aware of the clinical signs, and should manage the patient when initial signs are seen (even if only lethargy and inappetence is observed). Complete blood count remains very important in assessing the disease. In this study, absolute neutrophil count was found to be a good predictor of the disease, which indicates its potential use especially if in-clinic tests are unavailable. Veterinarians should play a greater role as educators and routinely inform owners about CPV and its prevention, including vaccination protocols, to safeguard the health of their pet dogs.

APPENDIX

Table 1. Profile and presenting clinical signs of dogs tested with Canine Parvovirus immunochromatographic assay (ICA) in Metro Cebu (n=45)

Parameter	CPV-ICA Test			
	Negative		Positive	
	Freq	%	Freq	%
<b>Sex</b>				
Male	4	8.89	16	35.56
Female	6	13.33	19	42.22
<b>Vaccination status</b>				
Unknown/none	5	11.11	26	57.78
Updated	0	0.00	6	13.33
Completed	5	11.11	3	6.67
<b>Age</b>				
Less than 6 weeks	1	2.22	0	0.00
6 weeks to 6 month	1	2.22	27	60.00
Above 6 months	8	17.78	8	17.78
<b>Deworming status</b>				
Unknown	4	8.89	21	46.67
Updated	3	6.67	12	26.67
Not updated	3	6.67	2	4.44
<b>Reproductive status</b>				
Intact	9	20.00	35	77.78
Neutered	1	2.22	0	0.00
<b>Fecalysirrsresults</b>				
Negative	5	11.11	24	53.33
with parasite	5	11.11	11	24.44
<b>Outcome after treatment</b>				
Dead	1	2.22	10	22.22
Alive	9	20.00	25	55.56
<b>Presenting clinical signs</b>				
Vomiting	6	13.33	31	68.89
Bloody diarrhea	9	20.00	25	55.56
Inappetence	7	15.56	33	73.33
Dehydration	10	22.22	30	66.67
Fever	2	4.44	8	17.78
Tachycardia	3	6.67	12	26.67
Lethargy	8	17.78	35	77.78

Table 2. Hematologic results of Canine Parvovirus immunochromatographic assay (ICA)-positive dogs in Metro Cebu (n=35)

Parameter	Freq (n)	Percentage (%)	Descriptive statistics
WBC Count (x 10 <sup>3</sup> /uL)			Range: 5.0-14.1 Mean: 7.0 Median: 6.3 SD: 4.9
Low	19	54.29	
Normal	14	40	
High	2	5.71	
RBC Count (x 10 <sup>6</sup> /uL)			Range: 5.0-7.9 Mean: 5.6 Median: 5.5 SD: 2.0
Low	13	37.14	
Normal	17	48.57	
High	5	14.29	
Pack Cell Volume (%)			Range: 35-57 Mean: 38.5 Median: 37 SD: 10.6
Low	14	40	
Normal	19	54.29	
High	2	5.71	
Platelets (x 10 <sup>3</sup> /uL)			Range: 211-621 Mean: 222.62 Median: 226 SD: 82.4
Low	14	40	
Normal	21	60	
High	0	0	
Neutrophils (x 10 <sup>3</sup> /uL)			Range: 2.9-12 Mean: 4.9 Median: 3.1 SD: 4.4
Low	18	51.43	
Normal	16	45.71	
High	1	2.86	
Monocytes (x 10 <sup>3</sup> /uL)			Range: 0.1-1.4 Mean: 0.5 Median: 0.4 SD: 0.4
Low	1	2.86	
Normal	32	91.43	
High	2	5.71	
Lymphocytes (x 10 <sup>3</sup> /uL)			Range: 0.4-2.9 Mean: 1.5 Median: 1 SD: 1.5
Low	2	5.71	
Normal	31	88.57	
High	2	5.71	
Basophils (x 10 <sup>3</sup> /uL)			Range: 0-0.1 Mean: 0.02 Median: 0 SD: 0.05
Normal	34	97.14	
High	1	2.86	
Eosinophils (x 10 <sup>3</sup> /uL)			Range: 0-1.3 Mean: 0.1 Median: 0 SD: 0.3
Normal	34	97.14	
High	1	2.86	

Table 3. Multivariate analyses of different parameters for CPV-ICA test positivity (n=45)

Parameter	F	p-value
Neutrophil count**	10.86	<b>0.002</b>
Total WBC count**	8.72	<b>0.005</b>
Lethargy*	8.36	<b>0.006</b>
Age category *	7.24	<b>0.010</b>
Vaccination status*	6.05	<b>0.018</b>
Inappetence*	4.95	<b>0.031</b>
Vomiting*	4.59	<b>0.038</b>
Reproductive status	3.72	0.061
Deworming status	3.35	0.074
Breed	2.370	0.131
Platelet count	1.62	0.210
Dehydration	1.59	0.214
Diarrhea	1.43	0.238
Outcome of treatment	1.43	0.238
Intestinal parasites	1.15	0.290
Eosinophil count	0.89	0.350
Red blood cell count	0.85	0.362
Monocyte count	0.60	0.442
Basophil count	0.17	0.686
Sex	0.10	0.755
Packed cell volume	0.09	0.763
Tachycardia	0.06	0.805
Lymphocyte count	0.05	0.817
Pyrexia	0.04	0.852

*Degrees of freedom: ICA=1, Error=34*

Table 4. Responses of dog owners on their knowledge and opinion on Canine Parvovirus

Question	Response	Interviewee	n (%)
Do you know what canine parvovirus ("PARVO") is?	"No. I don't know what it is. I didn't know that there are vaccines for dogs."	8, 10, 15, 18, 21, 23, 24, 25, 33, 34, 35, 36, 37, 38, 40, 42, 43, 44	18 (51.4)
	"Yes, I've heard of it but I'm not sure what it is."	1, 3, 4, 6, 11, 12, 13, 16, 19, 31, 41, 15	12 (34.3)
	"Yes, I know about it."	5, 7, 22, 29, 39	5 (14.3)
Were you aware about vaccinations against canine parvovirus ("PARVO")?	"No. The only vaccine I know is for Rabies!"	1, 15, 19	3 (8.6)
	"Yes, I know that there's a vaccine for Parvo."	3, 4, 5, 6, 7, 11, 12, 13, 16, 22, 29, 31, 39, 41, 45	15 (42.9)
How old should your dog be when you give its first shot for canine parvovirus ("PARVO")/DHPPLLPi?	"I want to vaccinate my dog but I don't know at what age to take them to the vet."	3, 11, 12, 16, 41, 45	6 (17.1)
	"I vaccinate my dogs when they reach 3 months (12 weeks) old."	7, 13, 22, 39	4 (11.4)
	"I vaccinate my dogs when they reach exactly 6-8 weeks old."	4, 5, 6, 29, 31	5 (14.3)
How many times should you vaccinate your dog for canine parvovirus ("PARVO"), and do you know the time interval between shots?"	"Only once. I thought one shot is enough."	3, 4, 6, 11, 12, 13, 16, 22, 41	8 (22.9)
	"I know my dog needs to complete 3 shots and an annual booster, but I could never afford to finish the shots."	29	1 (2.9)
	"I know my dog needs to complete 3 shots, but I didn't know the interval was only 2 weeks."	5, 31	2 (5.7)
	"I am aware of the 3 shots at 2 weeks interval each and annual booster."	7, 39, 25	3 (8.6)

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