REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

A Comprehensive Investigation of the Causes and Mitigation of Dog Parvovirus Illness

Manju bargavi SK[1]*, Dr. Bindu Devi[2], Dr. Esha Rami[3]

*[1]Professor, Department of Computer Sceince and Information Technology, Jain (Deemed to be University), Bangalore, India, Email Id- b.manju@jainuniversity.ac.in, Orcid Id- 0000-0001-7112-5810

[2]Assistant Professor, School of Allied Science, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India, Email Id- soas.bindu@dbuu.ac.in.

[3]Assistant Professor, Department of Biotechnology, Parul University, PO Limda, Vadodara, Gujarat, India, Email Id: esha.rami82036@paruluniversity.ac.in

Abstract

Vaccination and rapid veterinarian treatment are crucial for the prevention and treatment of this highly infectious and sometimes fatal disease in dogs. Research focusing on particular regions is necessary to have a better understanding of the prevalence and related determinants of canine parvovirus (CPV), which continues to be a major global health problem for dogs. The dataset used in this study comes from Western India and includes 150 dog examinations. The variables that were examined include breed, age, sex, vaccination status and clinical symptoms. It is important to note that the frequency of CPV varied by breed, with Indigenous breeds showing the greatest prevalence at 43.33%. This highlights the need for breed-specific preventative interventions. One important consideration is the age of the dog. Puppies are especially at risk since there is a statistically significant correlation between CPV infection and dogs that are three months old or less (42.37%). The lack of statistical significance in the sex-based changes suggests that the risk of infection is similar in male and female dogs. The efficiency of vaccination in reducing CPV infection was highlighted by the much lower incidence of unvaccinated dogs at 18.46%, highlighting the crucial impact of vaccination status. An association between the severity of CPV and certain symptoms, such as vomiting and watery diarrhea with a bad smell, was found in an examination of clinical variables. To reduce the effect of CPV on dog populations, this research adds important new information to our understanding of the virus's epidemiology in Western India and highlights the significance of vaccination regimens and breed-specific factors.

Keywords: Canine Parvovirus (CPV), Breeds, Vaccination, Symptoms, Risk Factors

INTRODUCTION

Worldwide, canine parvovirus (CPV) is a leading cause of illness and death due to its high contagiousness and prevalence. Some of the symptoms include fever, acute enteritis and potential cardiac complications such as myocarditis and myocardial fibrosis (1). Plagued puppies between the ages of six weeks and six months have the most severe clinical signs of the illness, including sepsis and severe dehydration. Treatment determines the survival rate, which can be anywhere from 8% in areas without treatment to 82% to 92% in hospitals and other tertiary care facilities. The high cost of treatment in private practice settings can approach (USD), which raises the question of whether financial constraints are a factor in disease-related euthanasia (2). One major source of infectious gastrointestinal sickness in dogs is the CPV. By 1978, CPV had gone global, having originally appeared in the early to mid-1970s. Puppy risk factors for coronavirus infection include inadequate housing, overcrowding, poor sanitation, intestinal parasites and a lack of protective immunity (3). Feces can be a direct or indirect vector for the transmission of canine CPV from an infected dog to a vulnerable dog. Acute small intestine enteritis, which can be hemorrhagic and cause dehydration and leukopenia, is caused by the virus replicating in quickly dividing cells, such as the gastrointestinal epithelium, lymphoid tissue and bone marrow, after viremia (4). Hypovolemic shock and sepsis are the main causes of death in dogs infected with canine parvovirus. While some studies have shown a mortality rate of 4–48% with appropriate therapy, others have found a far higher incidence of up to 91% in the absence of treatment. Puppies between six months of age and susceptible breeds are particularly vulnerable to serious health complications and even death that can result from CPV infection (5). Disease severity and vulnerability are magnified in hereditary immunodeficiency and von

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

Willebrand's disease. In puppies older than 2 weeks, CPV infects lymphoid tissues, intestinal epithelium and bone marrow. Hemorrhagic diarrhea and a decrease in absorption capacity were consequences of the intestinal epithelium's collapse. Serious dehydration and hypovolemic shock can result from large fluid and protein losses in the gastrointestinal system (6). Animals that were at lower risk or had less severe symptoms have been treated subcutaneously (SQ), whereas those were more at risk or had more severe symptoms were treated intravenously (IV). Because healthy animals are more prone in removing their IV catheters, the IV procedure is more laborious and challenging to execute with these animals (7). Modifications to these treatments were required according to the animal's health throughout its stay. To assume that the animals were either unvaccinated, vaccinated wrongly, or had incomplete courses because didn't know whether they were vaccinated or not (8).

The study (9) examined how puppies suffer from CPV enteritis, which is a major cause of illness and death even with effective therapy. To assess the severity and length of hospital stay and forecast the clinical result of CPV enteritis, it is crucial to identify trustworthy biomarkers. The study (10) suggested that CPV is a major public health concern across the world. Despite vaccination's considerable effectiveness in illness prevention, cases continue to occur and vaccine failures have been recorded. The age of administration is a key determinant of vaccination failure, with interference with mother-produced antibodies that are the most prevalent cause. The article (11) showed ranks high among the major killers in newborn pups is canine parvovirus infection, a very dangerous infectious virus. The main reasons why canine parvovirus illness occurs in Nepal are because of insufficient immunization, poor management and pet owners' lack of understanding about the correct vaccine schedule. The study (12) suggested although canine parvovirus vaccines instill protective immunity in the majority of dogs, puppies can be more vulnerable to infection if vaccinated at an earlier age because they interfere with maternal antibodies. The study (13) tries to find out what causes CPV to happen in this city. The research comprised 132 canines younger than six months, with 44 (or 33.3% of the total) dogs identified as having canine parvovirus (as validated by a fast immuno-migration test) and 88 (or 66.7% of the total) pups classified as seeming to be in good health. The study (14) suggested assessing the hematological and serum biochemistry profile results at presentation as well as other clinic pathological prognostic factors linked to survival in dogs diagnosed. The secondary objectives were to determine whether patient characteristics were linked to better survival rates. The article (15) suggested that the frequency and existence of canine enter viruses provide light on the transmission of these illnesses in the Mediterranean area and highlight the need for regular immunization preventative measures. The development of successful immunizations against enter viruses relies heavily on molecular research of these viruses due to their reputation for frequent mutations. The study (16) examined to control canine parvovirus infections in shelters, it is necessary to treat each infected animal individually as well as manage the whole population of dogs that are at risk. Shelter dogs can have gastrointestinal diseases from a wide variety of enter pathogens, not only CPV. The study (17) examined that the worldwide; canines suffer from the devastating effects of canine viral diarrhea. Many Chinese physicians and dog owners are worried about the prevalence of canine viral diarrhea, which can be caused by CPV. The study (18) provided the treatment cost that correlated strongly with affordable euthanasia for diseases, emphasizing the significance of euthanasia without treatment. The study (19) suggested the most current findings on CPV-2's replication and characteristics, animal illness symptoms and diagnostic, preventative and control measures are detailed in the study.

This study prevents and cures this very contagious and sometimes deadly illness in dogs, vaccination and prompt veterinary care are of the utmost importance. CPV is a significant worldwide health concern for dogs and to understand its prevalence and associated factors, research that focuses on specific locations is required. The rest of the paper is divided into sections: The material and methods are defined in section 2. The result analysis and their discussion are shown in section 3. The end of the paper was concluded in section 4.

MATERIALS AND METHODS

Thorough information was gathered for the CPV investigation using test findings and medical records. To conduct a thorough statistical analysis and reveal important trends and patterns, inclusion and exclusion criteria were used to guarantee a representative sample. Figure (1) show the life cycle of CPV.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

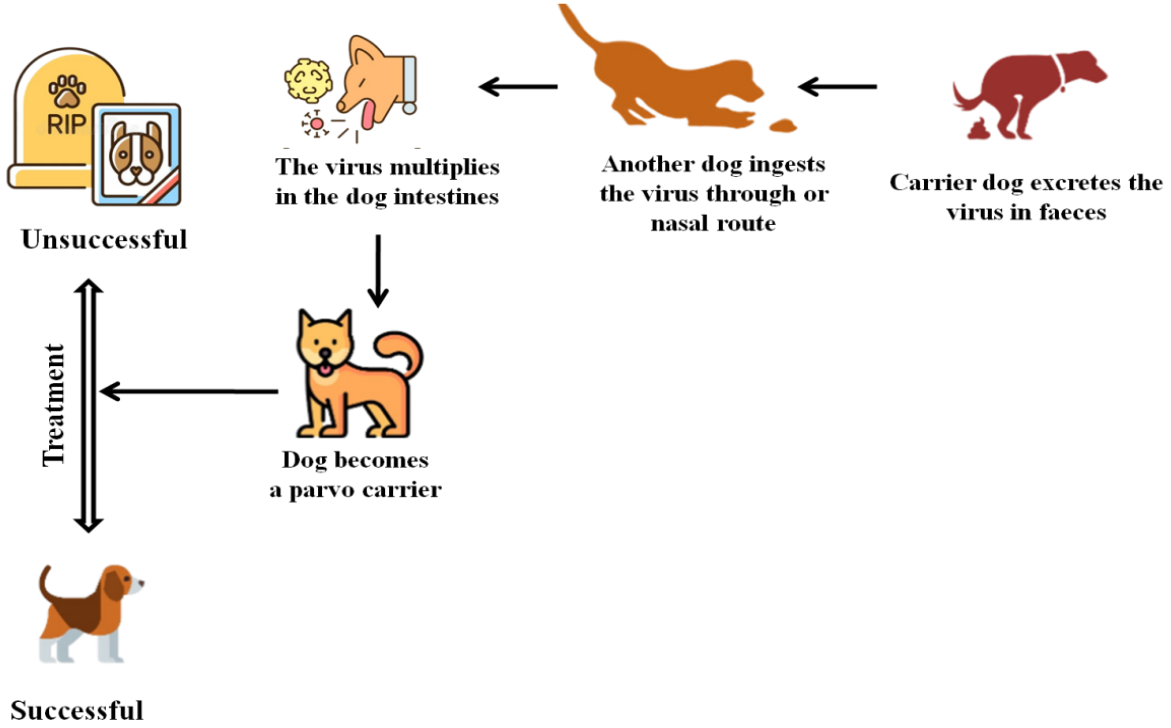

Figure (1). CPV lifecycle

(Source: https://www.azpetvet.com/canine-parvovirus-learning-how-to-prevent-is-the-key/)

Dataset

This study collected 150 feces samples from (20) six sites in western India. Samples were taken from dogs that were between 1 and 18 months old exhibited symptoms of the disease such as reddish-colored feces, vomiting, anorexia, high fever, depression as well as a rough coat. We took the samples transported on ice after being sterilized in advance. The samples were frozen at -20 °C for future use.

Inclusion Criteria

No dog was considered for inclusion if they did not meet the prior requirements or if they had any underlying conditions that could cause gastrointestinal symptoms. The sample size was 150 dogs. In terms of the results, 104 dogs (99.04%) were released from the facility, while 46 dogs (30.67%) passed away. The breakdown by gender was as follows: 87 male (0.667%) and 63 female (42%). A total of 85 dogs, or 56.67% of the total, were in the susceptible age bracket of six weeks to less than six months; 37 dogs, or 24.67%, were older than six months; 20 dogs, or 13.33%, were younger than six weeks and 8 dogs, or 5.33%, were of unknown age. Among the dogs examined, 70 (46.67%) had no record of vaccinations, 54 (36%) had an incomplete vaccination program, 19 (12.67%) had an unclear vaccination history and 7 (4.67%) were found to have a full record of vaccinations against parvovirus. Of the canines surveyed, 75 (or 50%) did not have a definitive breed.

Exclusion Criteria

To eliminate six dogs with multiple viral infectious diseases: one with distemper, two with infectious canine hepatitis and three with canine coronavirus. These illnesses are consistent with acute gastroenteritis. All nine canines (N = 19) with concurrent internal parasite illnesses were evaluated using the same criteria. Out of 125 dogs that were not included in the research, 24 did not have hemograms, biochemistry data, or results from certain clinical assessment criteria.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

Statistical analysis

Microsoft Office Excel 2010 contained all the data and statistical program STATA version-13/C was used to clean, code and analyze the data. The percentage of prevalence was determined in the same way. At the 95% confidence and 5% significance levels, To find out how closely related the category variables were to the results, a chi-square test was administered.

RESULT AND DISCUSSION

50 canines of the 150 that were clinically unwell tested positive for CPV infection. Table (1) provides a summary of the prevalence of several risk variables related to CPV "illness, including age, sex, breed, vaccination status, dehydration," etc.

Table (1). Risk factor-based CPV infection prevalence (Source: Author)

Factors	Type	No of Evaluation (N=150)	Positive (50)	Prevalence %	P value
Breed	Spitz	44	10	22.73	0.079
	Doberman	54	9	16.67	
	GS	28	11	39.28	
	Lhasa	54	7	12.96	
	Indigenous	30	13	43.33	
Age	3 months	59	25	42.37	0.004
	9 months	49	15	30.61	
	1 year	42	10	23.80	
Sex	Female	66	20	30.33	0.275
	Male	84	30	35.71	
Vaccination	No	65	12	18.46	0.001
	Yes	85	38	44.70	

An extensive analysis was conducted on a population of 150 participants to determine the variables impacting canine health. Several metrics were evaluated. With the associated assessment numbers (N=150), positive results, prevalence percentages and P values, the variables included breed categorization, age stratification, gender distribution and vaccination status. Spitz had a prevalence of 22.73% with a corresponding p-value of 0.079, which is deemed marginally significant, based on 44 examinations with 10 positive instances with the breed group. Indigenous breeds, Dobermans, German Shepherds (GS) as well as Lhasa's were examined yet they showed different prevalence rates and P values. Figure (2) shows the types of breeds and their percentage.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

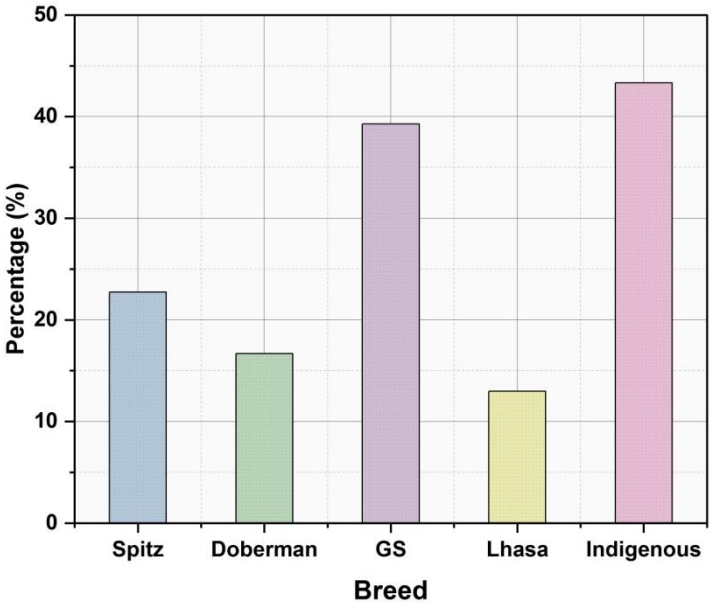

Figure (2). Types of breeds (Source: Author)

The results showed that age was a major factor: there were 59 assessments with 25 positive instances, a frequency of 42.37% and an impressive P value of 0.004 for children who were 3 months old. Different prevalence percentages and P values were observed in the 9-month and 1-year age groups. Subtle differences were shown by gender analysis; 66 assessments were conducted on female participants, 20 of those subjects tested positive and the prevalence was 30.33 percent; the P value was 0.275, which was not significant. Vaccination status was found to be a crucial factor in the study. Unvaccinated subjects had a low prevalence of 18.46% and a 0.001 P value, while vaccinated subjects had a higher prevalence of 44.70%.

The results of the comparative analysis of the risk variables linked with CPV are shown in Table (2). Various risk variables linked to CPV infections were shown to have an insignificant prevalence (P> 0.05).

Table (2). Clinical indications of CPV in dogs diffe**r** (Source: Author)

Factors	**Type**	**No of Evaluation (N=150)**	**Positive (50)**	**Percentage %**
Red colors faces	Mild	30	5	16.67
	Severe	70	30	42.86
	Moderate	50	15	30
Foul smelling watery diarrhea	No	100	35	35
	Yes	50	15	30
Vomitation	No	60	10	16.67
	Yes	90	40	44.44

When looking at the causes that might cause red face, found that moderate cases accounted for 30% of the cases, severe cases for 42.86% of the cases and light cases for 16.67% of the cases. Thirty percent of fifty cases with the symptom and 35 percent of one hundred cases without it had foul-smelling, watery diarrhea. Cases without vomiting accounted for 16.67% of 60 occurrences, whereas cases with vomiting totaled 44.44% of 90 instances. Fifty cases of red faces, thirty-five cases of offensive-smelling, watery diarrhea and forty cases of vomiting were shown to have favorable results in this extensive examination including one hundred fifty assessments. Here are

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 22 October 2023; Revised: 10 November 2023; Accepted: 29 December 2023

the comparable percentages: 16.67%, 35% and 44.44%. Figure (3) shows the types of symptoms and their percentage. These results provide insight into the complex interaction of variables impacting the health issues in question and highlight the wide variety and frequency of symptoms.

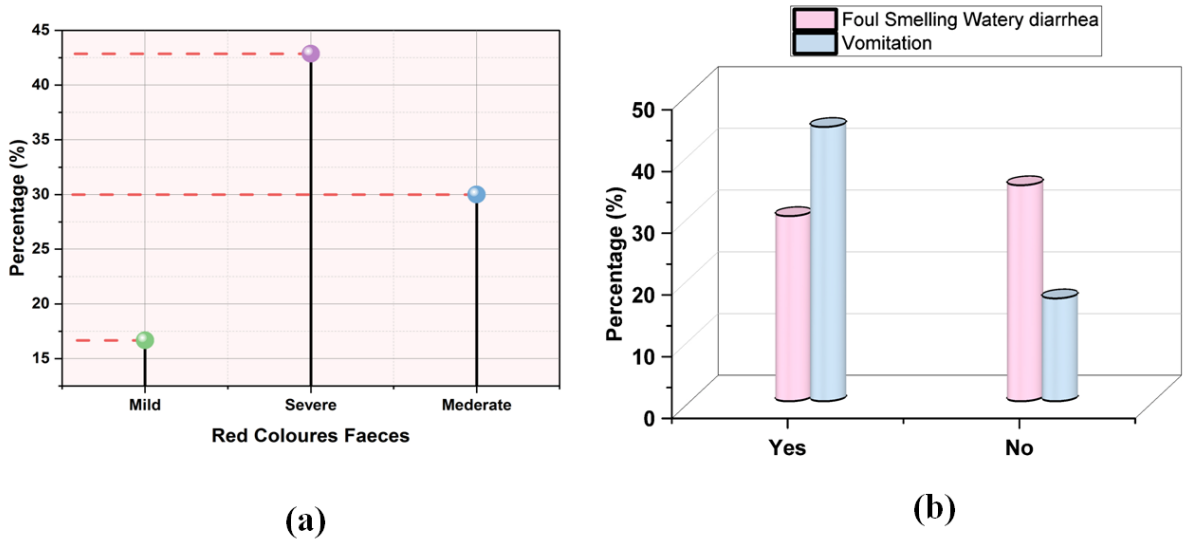

Figure (3). (a-b) Types of Symptoms in CPV (Source: Author)

CONCLUSION

For the most part throughout canine parvovirus's documented history, infected dogs have been seen as expendable due to the high expense and difficulty of treating the disease and the active euthanasia of infected animals by organizations concerned about the disease's potential to spread to humans. Despite widespread vaccination, CPV infections continue to be a leading cause of infectious disease mortality worldwide. In the very rare event that an immunization fails, it is due to interference by pups less than sixteen weeks. There has to be more research on the prevalence and underlying genetic variables of the non-responders. To ensure that the dog populations are vaccinated with CPV vaccines according to the current international standards and to test for antibodies to determine when pups and adults should be vaccinated, are techniques that are most helpful in preventing diseases. To get rid of diseases or at least make things better, the next natural step is to test antibodies to find out when they work best for adults and puppies. Ensuring the dog population is covered evenly should be a priority. The sensitivity of current diagnostic procedures is questionable, which can result in false negatives. There is a lack of treatment choices, with an emphasis on supportive care. Emerging strains provide difficulties and vaccine effectiveness varies. More effective vaccinations, better antiviral medications and more accurate diagnostics should be the focus of future research. Targeted medicines can be improved by gaining a better understanding of host-pathogen interactions. Vaccination and other preventative actions can be advanced via public awareness campaigns.

REFERENCES

1. Sayed-Ahmed, M. Z., Elbaz, E., Younis, E., & Khodier, M. (2020). Canine parvovirus infection in dogs: Prevalence and associated risk factors in Egypt. World's Veterinary Journal, 10(4), 571-577. DOI: https://doi.org/10.54203/scil.2020.wvj68
2. Pereira, K. H. N. P., da Mata Fuchs, K., Hibaru, V. Y., dos Santos Correia, L. E. C., Ferreira, J. C. P., de Souza, F. F., ... & Lourenço, M. L. G. (2022). Neonatal sepsis in dogs: Incidence, clinical aspects and mortality. Theriogenology, 177, 103-115. DOI: https://doi.org/10.1016/j.theriogenology.2021.10.015
3. Mia, M. M., & Hasan, M. (2021). Update on canine parvovirus infection: a review from the literature. Veterinary Sciences: Research and Reviews, 7(2), 92-100. DOI: https://dx.doi.org/10.17582/journal.vsrr/2021.7.2.92.100

4. Behdenna, A., Lembo, T., Calatayud, O., Cleaveland, S., Halliday, J. E., Packer, C., ... & Viana, M. (2019). Transmission ecology of canine parvovirus in a multi-host, multi-pathogen system. Proceedings of the Royal Society B, 286(1899), 20182772. DOI: https://doi.org/10.1098/rspb.2018.2772
5. dos Santos Alves, F., Barbosa, B. C., das Graças Coelho, N. D., de Oliveira Pinto, P. C., Campos, M. T. G., Horta, R. S., ... & de Oliveira Paes, P. R. (2019). Clinical and hematological prognostic factors in dogs with parvoviral enteritis and sepsis. Semina: Ciências Agrárias, 40(4), 1477-1488. DOI: https://doi.org/10.5433/1679-0359.2019v40n4p1477
6. Nurden, A. T., & Nurden, P. (2020). Inherited thrombocytopenias: history, advances and perspectives. Haematologica, 105(8), 2004. DOI: https://doi.org/10.3324%2Fhaematol.2019.233197
7. Song, Y., Zhang, M., Yin, L., Wang, K., Zhou, Y., Zhou, M., & Lu, Y. (2020). COVID-19 treatment: close to a cure? A rapid review of pharmacotherapies for the novel coronavirus (SARS-CoV-2). International journal of antimicrobial agents, 56(2), 106080. DOI: https://doi.org/10.1016/j.ijantimicag.2020.106080
8. Morgan, L., Protopopova, A., Birkler, R. I. D., Itin-Shwartz, B., Sutton, G. A., Gamliel, A., ... & Raz, T. (2020). Human–dog relationships during the COVID-19 pandemic: Booming dog adoption during social isolation. Humanities and Social Sciences Communications, 7(1). DOI: https://doi.org/10.1057/s41599-020-00649-x
9. Eregowda, C. G., De, U. K., Singh, M., Prasad, H., Sarma, K., Roychoudhury, P., ... & Behera, S. K. (2020). Assessment of certain biomarkers for predicting survival in response to treatment in dogs naturally infected with canine parvovirus. Microbial pathogenesis, 149, 104485. DOI: https://doi.org/10.1016/j.micpath.2020.104485
10. Kelman, M., Barrs, V. R., Norris, J. M., & Ward, M. P. (2020). Canine parvovirus prevention and prevalence: Veterinarian perceptions and behaviors. Preventive veterinary medicine, 174, 104817. DOI: https://doi.org/10.1016/j.prevetmed.2019.104817
11. Poudel, U., Dahal, U., & Aryal, A. (2020). Canine parvovirus infection in young German Shepherd dog: A Case Report. Hemoglobin, 8, 11-19. DOI: http://dx.doi.org/10.29322/IJSRP.10.03.2020.p9980
12. Mazzaferro, E. M. (2020). Update on canine parvoviral enteritis. Veterinary Clinics: Small Animal Practice, 50(6), 1307-1325. DOI: https://doi.org/10.1016/j.cvsm.2020.07.008
13. Le, T. H., Nguyen, H. D. M., Doan, H. P., Truong, P. L., Tu, T. K. L., Nguyen, H. Q., ... & Pornchai, P. (2020). Risk factors associated with canine parvovirus disease in dogs: A case-control study. The Journal of Agriculture and Development, 19(6), 32-38. DOI: https://doi.org/10.52997/jad.4.06.2020
14. Chalifoux, N. V., Parker, S. E., & Cosford, K. L. (2021). Prognostic indicators at presentation for canine parvoviral enteritis: 322 cases (2001-2018). Journal of Veterinary Emergency and Critical Care, 31(3), 402-413. DOI: https://doi.org/10.1111/vec.13052
15. Zobba, R., Visco, S., Sotgiu, F., Pinna Parpaglia, M. L., Pittau, M., & Alberti, A. (2021). Molecular survey of parvovirus, astrovirus, coronavirus, and calicivirus in symptomatic dogs. Veterinary Research Communications, 45, 31-40. DOI: https://doi.org/10.1007/s11259-020-09785-w
16. Doyle, E. (2021). Canine Parvovirus and Other Canine Enteropathogens. Infectious Disease Management in Animal Shelters, 321-336. DOI: https://doi.org/10.1002/9781119294382.ch14
17. Qi, S., Zhao, J., Guo, D., & Sun, D. (2020). A mini-review on the epidemiology of canine parvovirus in China. Frontiers in veterinary science, 7, 5. DOI: https://doi.org/10.3389/fvets.2020.00005
18. Kelman, M., Ward, M. P., Barrs, V. R., & Norris, J. M. (2019). The geographic distribution and financial impact of canine parvovirus in Australia. Transboundary and emerging diseases, 66(1), 299-311. DOI: https://doi.org/10.1111/tbed.13022
19. Singh, M., Manikandan, R., De, U. K., Chander, V., Paul, B. R., Ramakrishnan, S., & Maramreddy, D. (2022). Canine Parvovirus-2: An emerging threat to young pets. In Recent Advances in Canine Medicine. IntechOpen. DOI: 10.5772/intechopen.104846
20. Kulkarni, M. B., Deshpande, A. R., Gaikwad, S. S., Majee, S. B., Suryawanshi, P. R., & Awandkar, S. P. (2019). Molecular epidemiology of Canine parvovirus shows CPV-2a genotype circulating in dogs from western India. Infection, Genetics, and Evolution, 75, 103987. DOI: https://doi.org/10.1016/j.meegid.2019.103987