



Natural History of Epidemiology of Canine Parvovirus and Associated Risk Factors in Brazil

Ruthele Camata Menezes, Isabela Gonçalves da Silva, Samantha
Cristine Balduino, Kethlen Tainah Xavier Ribeiro, Nathalia Bruna,
Rafaella Ferreira Rodrigues and Sérgio Eustáquio Lemos da Silva*

Triângulo University Center, UNITRI, Brazil

*Corresponding Author: Sérgio Eustáquio Lemos da Silva, Triângulo University
Center, UNITRI, Brazil.

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Lemos da Silva, *et al.*

Abstract

Canine Parvovirus is one of the most well-known and contagious viral infections among domestic dogs, with a high prevalence in young animals, while it occurs less frequently in older animals due to their natural immunity to the virus. There are several strains that can lead to the death of the animal. Considering the importance of the disease in veterinary clinical practice, this study aims to analyze epidemiological aspects (incidence, morbidity, mortality, and lethality) of parvovirus over the last 10 years, correlating the epidemiological indicators with the risk factors of the disease and its epidemiological chain. Thus, the relevance of the disease is evidenced by the high potential for virus spread and its severity, which can present a high rate of mortality and morbidity. It is worth noting that the proper diagnosis and treatment are essential for the animal to restore its health, so the study of epidemiological aspects aids in taking measures that prioritize the prevention and control of this disease, justifying its management. It has been highlighted that despite the prevalence of the disease and the high overall mortality rate, there are few reports of the disease in the literature, necessitating greater attention in order to properly outline the epidemiological profile of parvovirus infection.

Keywords: Mortality; Morbidity; Lethality; Pathogenic Period; Prevention

Introduction

According to Flores [7], parvovirus is one of the most well-known and contagious viral infections among domestic dogs, with a high prevalence in young animals, while it occurs less frequently in older animals due to their natural immunity to the virus.

The virus causing the infection is the Canine Parvovirus, from the Parvoviridae family, small, non-enveloped, with a single-stranded DNA surrounded by a protein coat, differentiated into Canine Parvovirus Type 1 (CPV-1) and Canine Parvovirus Type 2

(CPV-2), where CPV-2 has the highest pathogenicity, causing classic parvoviral enteritis, and the former only causing gastroenteritis or myocarditis in animals up to 3 weeks of age.

The pathogenic variant has three genetic subtypes (a, b, c) that show clinical signs in the animal 5 to 12 days after infection, having a tropism for dividing cells. According to Paes [15], type C causes a more severe clinical disease, with a high mortality rate and the ability to generate infection in animals previously vaccinated against the CPV-2 variant.

Regarding its transmission, it occurs through contact with contaminated secretions and excretions, with animals in the acute phase of the disease potentially excreting ten viral particles per gram of feces, which can also be carried by fomites.

As mentioned by Flores [7], the virus enters the organism and replicates in the lymphatic tissue of the oropharynx and the thymus, being widely disseminated in the animal's bloodstream, causing viremia, and its severity depends on the host's immune status and the infectious dose.

The microorganism reaches essential tissues for its replication, such as the bone marrow, lymphoid tissue, and intestinal epithelium, primarily due to its mitotic potential. When this enters the intestinal epithelium, it flattens the villi, causes necrosis, and leads to the collapse of the epithelium, resulting in the exposure of the lamina propria of the mucosa, making the animal vulnerable to new infections [19].

Breeds such as Labrador Retrievers, American Pit Bull Terriers, German Shepherds, Staffordshire Terriers, Rottweilers, Doberman Pinschers, show a high predisposition, with even more severe clinical signs occurring in the last three.

The clinical signs are anorexia, depression, fever, vomiting, severe diarrhea, and rapidly progressing dehydration. In patients with bacterial sepsis or endotoxemia, they may ultimately develop hypothermia, jaundice, or hemorrhagic diathesis (disseminated intravascular coagulation), and in severe cases, this can lead to the death of the animal [16].

Thus, the diagnosis should be made based on clinical signs, findings of leukopenia in the blood count, and definitive identification of the virus through Enzyme Linked Immunosorbent Assay (ELISA) in stool samples, hemagglutination, paired serology by immunohistochemistry, immunochromatography (IC), and histopathology (jejunum, spleen, ileum, and mesenteric lymph nodes), with the Polymerase Chain Reaction (PCR) being fundamental and sensitive.

In terms of treatment, the hydroelectrolytic and energy balance must be corrected, vomiting must be stopped, and the mechanisms of shock must be controlled. This fact is mainly due to the lack

of effective antivirals; thus, the use of fluid therapy, antiemetics, gastric protectants, and shock therapy is essential, which can be septic or hypovolemic, as well as antimicrobials and maintenance of consumption. Prophylaxis is essential, ensuring the immunization of the animal, which is done through the ingestion of colostrum in the case of puppies, and vaccination starting at 6 weeks of age, with annual boosters.

Considering the importance of the disease in veterinary clinical practice, the present study aimed to analyze epidemiological aspects (incidence, morbidity, mortality, and lethality) of parvovirus over the last 10 years, correlating the epidemiological indicators with the risk factors of the disease within its epidemiological chain. Thus, the relevance of the disease is evidenced by the high potential for the virus to spread and its severity, which can present a high rate of mortality and morbidity. It is important to highlight that proper diagnosis and treatment are essential for the animal to regain its health, so the study of epidemiological aspects helps in taking measures that prioritize the prevention and control of this disease, justifying its management.

Methodology

For the development of the research, concepts of fundamental importance in epidemiology were initially established, which are directly associated with its objective, namely prevalence, incidence, morbidity, mortality, and lethality. Considering that describing the health conditions of a population requires measurements of the frequencies of the problems that may affect them, the terms described above are essential for gaining such understanding [22].

In terms of incidence, it is responsible for defining the frequency with which new cases of the disease arise within a specific time frame, with its formula comprising the relationship between the number of new cases in a given period and the number of individuals exposed to risk during the same period. It is necessary for each individual involved in the analysis to be observed at least twice, or for the date of diagnosis to be known.

Prevalence refers to the number of existing cases of a specific disease at a given moment, being a static measure that is classified into three distinct types: point or instantaneous, where it is measured at a specific moment in time; period, or lifetime, where individuals have experienced at least one episode of the disease in their lifetime, measured only once.

According to Nepead [12], lethality refers to the severity of the disease and is defined by the proportion of deaths among patients with a specific cause within a certain time frame, marking the transition between morbidity and mortality indicators, assisting in the analysis of the quality of care provided, while mortality represents the intensity with which deaths from a particular disease occur in a certain population. Finally, morbidity is a generic term used to refer to the total cases of a given disease or the sum of health impairments affecting a group of individuals.

After establishing the important concepts for the study, the disease to be analyzed was determined through consensus among the research members, since parvovirus is caused by a highly resistant virus that can last for months in a contaminated environment and has a high mortality rate for dogs that develop the infection, with a fatality rate between 10 and 90%, influenced by factors such as age, stress, genetic aspects, and the presence of concurrent infections [5]. Antunes [2] also mentions that it is a pathogen with unique properties that make it an emerging and re-emerging agent worldwide.

For the conduct of the research on the proposed topic, a literature review was initially carried out regarding the disease to enable a better understanding of it, generating greater reliability in the concepts discussed later. During the review, epidemiological investigations were raised across the national territory, in journals, websites, and academic periodicals dated in the last 10 years, using the date, theme aligned with the objective of this study, locality, and presence of epidemiological data as inclusion criteria, with the keywords: parvovirus, viral infection, incidence, prevalence, morbidity, mortality, lethality, epidemiology, data collection, epidemiological aspects. As exclusion criteria, the fact that they were literature reviews, dates prior to 2013, lack of data collection, and research not published in an academic context were used.

A total of twenty-five articles were found that met the inclusion criteria, which were then reanalyzed for the accuracy of the data regarding dates and the presence of epidemiological indicators. Thus, at the end of the selection process, eleven articles fit the needs of the work, listed in Table 1, distributed throughout the national territory. From these, they were grouped and compared for the development of this research.

Author (S)	Region
Oravec., <i>et al.</i> (2021)	Cuiabanos – SC
Jaune (2017)	Cuiabá-MT
Oliveira (2019)	Rio Grande do Sul
Campos e Dantas (2013)	Patos – PB
Santos e Leseux (2019)	Capanema – PR
Martins (2021)	Uberlândia – MG
Biezus., <i>et al.</i> (2018)	Planalto – SC
Santos (2022)	São Luís – MA
Silveira (2015)	Cuiabá – MT
Mariga (2022)	Santa Maria – RS
Antunes (2013)	Caráter Nacional

Table 1: Selected research.

Source: the authors (2023).

Results

According to the findings of Oravec [14], when analyzing the epidemiological profile of canine parvovirus infections in the municipality of Cuiabanos – SC during the period from January to May 2018, 10 cases were found within the analyzed sample, of which 90% were aged two to five months, corresponding to the period of highest incidence of the disease, with 100% of the sample lacking a complete vaccination protocol.

Jaune [8], aiming to identify the circulation of parvovirus in Cuiabá – MT, identified the intense exposure of canines in the region to CPV, as well as the fact that young animals tended to have anti-CPV antibodies.

According to Oliveira [13], upon identifying 24 cases of gastroenteritis in cities in Rio Grande do Sul, it was found that in 14 of them the virus was identified in cell culture, characterizing a 58.3% occurrence of the disease. At another time, the author analyzed the presence of strains corresponding to infection in 20 animals, of which 4 animals were properly vaccinated, suggesting that there is a possibility of re-emergence and genetic evolution of the virus in vaccinated animals, since the lack of vaccination in the others allows for mutations.

Campos and Dantas [4], when analyzing the histological slides present in the Animal Pathology Laboratory of UFCG from 2003 to 2011, identified that out of 740 animals necropsied, 37 had parvovirus, indicating a prevalence of 5% of the disease in the canine population of the municipality of Patos – PB, occurring mainly in young and unvaccinated animals.

In conducting a study in the city of Capanema – PR, Santos and Leseux [18] analyzed 50 animals, of which 33 tested positive for the disease through rapid testing, from January to August 2018, identifying that 10.9% of the animals had an updated vaccination protocol, reinforcing the findings of Oliveira [13]. As for mortality, it was 23%, which aligns with findings in the literature such as those by Aiello [1], who mentions a mortality rate of 16 to 35%.

Martins [11], in conducting a retrospective study of animals affected by parvovirus at the Veterinary Hospital of the Federal University of Uberlândia from 2017 to 2020, identified a prevalence of 54.69%. He also found that puppies, with greater contact with other animals and low vaccination coverage, are more prone to developing the disease.

Bieuz [3], when analyzing the occurrence of parvovirus in dogs in the Santa Catarina Highlands, evaluated the records of 3,198 dogs treated at the Veterinary Clinical Hospital (HCV) of the State University of Santa Catarina (UDESC) and found 145 (4.53%) cases of canine parvovirus, identifying it as high, with a greater number in young, unvaccinated animals that had free access to the streets. It is worth noting that the study conducted was comparative with canine distemper, a disease that also has a viral nature and showed a low occurrence in relation to parvovirus.

In the period from January to December 2021, Santos [17] identified 197 cases of canine parvovirus out of 7,758 cases treated at the Francisco Edilberto Uchoa Lopes Veterinary Hospital in São Luís – MA, representing a prevalence of 2.53%. In more than half of the cases (54.3%), the animals were not vaccinated against canine parvovirus, and only 28.9% had an overdue vaccination schedule for the disease. It is known that vaccinating dogs against CPV-2 is the main form of prevention. In addition, 245 animals were tested for canine parvovirus, of which 115 were positive, representing a seroprevalence of 46.93%. A similar result was reported by Silveira [20] in his study conducted at the Veterinary Hospital of the

Federal University of Mato Grosso with 285 animals, where a total of 155 animals were found to be positive for the disease (54.38%) through immunochromatographic testing.

Mariga [10] in a study conducted at the Veterinary University Hospital of the Federal University of Santa Maria - RS, analyzed the occurrence of the disease in relation to the seasons of the year, where they found a higher occurrence of the disease in summer (39.7%), followed by autumn (26.9%), winter (19.2%), and spring (14.1%). This was justified by the increase in outdoor activities, leading to greater contact with other animals and consequent susceptibility to diseases.

In a study conducted by Antunes [2] in 20 municipalities across the country, aimed at national-level analysis, a prevalence of 29.2% of cases of parvovirus was identified, which is considered high. This underscores the necessity of monitoring the spread and outbreaks of the disease for the epidemiological characterization of the problem.

Conclusion

After the analysis, it was possible to conclude that parvovirus, despite its significant importance in veterinary practice, is still neglected by pet owners, who do not carry out the appropriate vaccination of their animals. In general, regardless of the study region, the animals most affected are young and have incomplete vaccination protocols. Furthermore, it has been observed that there is extensive coverage of studies regarding the epidemiology of the disease, with the exception of the Northern Region of the country, which requires greater attention. Brazil has a high prevalence of the disease, but there are not many significant findings in the literature regarding mortality and lethality, indicating a possible underreporting of cases or a lack of focused studies on these specific rates, which are essential for implementing measures that promote prevention. This work further reinforces the fact that raising public awareness and carrying out actions that assist in the prevention of the disease are essential.

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