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HAEMATOLOGICAL CHANGES IN CANINE PARVOVIRUS INFECTION

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Abstract

Canine parvovirus (CPV) infection is a highly contagious disease caused by canine parvovirus type 2 and commonly produce acute gastrointestinal illness. All dogs are susceptible to CPV, although some dogs are at greater risk than others, as puppies (between 6 weeks of age and 6 months), unvaccinated or incompletely vaccinated dogs. Due to the virus multiplication and effect on the bone marrow, severe haematological changes are reported, resulted also from the combination of severe inflammation, gastrointestinal bleeding and depletion of hematopoietic cell lines. In the present study, haematological changes in dogs diagnosed with CPV infection were analysed.

Keywords: dog, CPV, haematological changes.

INTRODUCTION

Canine parvovirus (CPV) is a highly contagious infectious disease produced by an DNA virus from family *Parvoviridae*, genus *Protoparvovirus.* Important pathogens in this genus include feline panleukopenia virus (FPV) and closely related mink and raccoon parvoviruses, which have existed for over 100 years, and canine parvovirus (CPV), which arose as a variant in the mid-1970s and in 1978 spread worldwide, causing a disease pandemic among dogs, wolves and coyotes (ICTV).

CPV commonly causes gastrointestinal disease in young and unvaccinated dogs. Young (6 weeks to 6 months old), unvaccinated or incompletely vaccinated dogs are considered to be the most susceptible (ICTV).

CPV preferentially infects and destroys rapidly dividing cells of the small-intestinal crypt epithelium, lymphopoietic tissue and bone marrow. Destruction of the intestinal crypt epithelium results in epithelial necrosis, villous atrophy, impaired absorptive capacity, and disrupted gut barrier function, with the potential for bacterial translocation and bacteraemia (MSD Veterinary Manual). Viral replication occurs initially in the lymphoid tissue of the oropharynx, with systemic illness resulting for subsequent haematogenous dissemination. In the present study, haematological changes in dogs diagnosed with CPV were analysed.

MATERIALS

In the present study were included 10 dogs (6 males and 4 females) diagnosed with CPV infection, at the Infectious Diseases Clinic, Faculty of Veterinary Medicine, January to October 2023. The age ranged between 4 and 8 months, mixed breed and without any history of vaccination. A complete history of the dogs included: the age, breed, sex and origins, as well the clinical examination (general body condition, weight, respiratory and heart rate, mucous membrane color and body temperature, capillary refilling time).

The most commonly observed clinical symptoms were represented by lethargy, loss of appetite, bloody diarrhea, vomiting and dehydration. In order to established the CPV diagnosis, rectal swabs were collected and tested

for the presence of antigen, for both CPV and canine corona virus (CCV), using a rapid quantitative immunoenzymatic test, on V-Check equipment. The coefficient of infection (COI) ranged between 2.6 and 57. As high the COI is, the more concentrated in virus a sample is considered to be. Besides rapid testing, cell blood count (CBC) analysis was performed, by venipuncture of the cephalic or jugular vein, for each dog. Haematological analysis was performed using the haematological analyser to determine the RBC, Total Leukocyte Count (TLC) and the Pack Cell Volume (PCV).

RESULTS

All the rapid tests were positive for CPV infection and none for CCV infection.

The haematological analysis values were different on each case. The most frequent imbalance was noticed at white blood cells ranging from 0 to 20.74 10^9/L (range 6-17 10^9/L) observed in 6 dogs, thrombocytes 10-123 10^9/L (range 165-500 10^9/L) observed in 6 dogs, red blood cells 2.23-8.59 10^12/L (range 5.5-8.5 10^9/L) in 5 dogs, haemoglobin 3.5- 21.1 g/dl (range 12-18 g/dl) observed in 5 dogs, haematocrit 11.5-60.98% (range 37-55%) in 5 dogs, lymphocyte 0.25-6.2 10^9/L (range 1-4.8 10^9/L) in 4 dogs and neutrophils 13.56-15.48 10^9/L (range 3-12 10^9/L) in 4 dogs.

After the therapeutic protocol (5-7 days) all the patient's recovered successfully.

No agent-specific treatment has proven effective, therefore treatment remains symptomatic and supportive. Even no specific drug is available against CPV infections, heterologous hyper immune immunoglobulins known as „CANGLOB P" were used. These immunoglobulins ensure passive immunization of dogs against CPV. Specific antibodies facilitate to prevent the development of disease or to alleviate its course. On intravenous administration, an immediate onset of the passive immunity is recorded and utilization of immunoglobulins is the highest. After intramuscular and subcutaneous administration, a slightly delayed onset of the passive immunity is recorded, with this immunity being lower as compared with the intravenous administration. The dose is of **0.4 ml / kg body weight (**irrespective of breed, age and sex), for 3-5 days.

The protocol implemented, included also intravenous fluid therapy, symptomatic and hygienic-dietary treatment. The main goals include restoration of fluid, electrolyte, and metabolic abnormalities and prevention of secondary bacterial infection. Correcting dehydration, replacing ongoing fluid losses and providing maintenance fluid needs are essential for effective treatment. Dogs must be monitored for development of hypokalaemia and hypoglycaemia. If electrolytes and serum blood glucose concentration cannot be routinely monitored, empirical supplementation of IV fluids with potassium and dextrose is appropriate.

Antibiotics are indicated because of the risk of bacterial translocation across the disrupted intestinal epithelium and the likelihood of concurrent neutropenia. A beta-lactam antibiotic will provide appropriate gram-positive and anaerobic coverage. Second- or third-generation cephalosporin's can also be considered for their relatively wide spectrum of activity against Gram-positive and negative bacteria. Antibiotic therapy is typically only needed for 5–7 days.

Antiemetic therapy as maropitant (1 mg/kg, IV or SC, every 24 hours) and ondansetron (0.5 mg/kg, slow IV, once; then 0.5 mg/kg, IV infusion, for 1 hour) appear to be equally effective at controlling vomiting. Metoclopramide (0.2–0.5 mg/kg, IM or SC, every 6–8 hours) may be considered as an antiemetic as well as for its prokinetic effects, particularly in dogs with significant gastric stasis. Other drugs, such as anti-haemorrhagic, analgesics, antacids and gastric mucosal protection and others, are used in the complex treatment of CPV.

DISCUSSIONS

Anemia, leukopenia and thrombocytopenia are commonly reported, due to the virus effect on the bone marrow, resulted from the combination of severe inflammation, gastrointestinal bleeding and depletion of hematopoietic cell lines (Urbani et al., 2022).

Most dogs develop a moderate to severe leukopenia characterized by lymphopenia and neutropenia. Leukopenia, lymphopenia and the absence of a band neutrophil response within 24 hours of starting treatment has been associated with a poor prognosis (MSD Veterinary Manual). Leukopenia is due to destruction of hematopoietic progenitor cells in the bone marrow, depletion of lymphoid tissues and consumption of peripheral neutrophils due to massive demand in the inflamed gastrointestinal tract (Corda et al., 2023). Thrombocytosis, pancytopenia, neutrophilic leukocytosis and monocytosis may also occur (Mylonakis et al., 2016).

In the study of Castro et al. (2013) on 50 puppies diagnosed with CPV infection, leukopenia, lymphopenia, thrombocytopenia, hypoglycaemia and

hyperproteinaemia were all correlated with this viral infectious disease. Leukopenia and hypoglycaemia were related to poor survival in CPV-infected puppies. Leukopenia, lymphopenia and thrombocytopenia were frequent among dogs infected with CPV compared with the control group.

In the study of Khare et al. (2020), the frequent haematological abnormalities observed in CPV was anaemia. Anaemia, but also leukopenia may be because the virus affects bone marrow and is cytotoxic for hematopoietic cell leading to myeloid and erythroid hypoplasia during acute stage of the disease. The haematological changes are widely accepted to be attributable to destruction of hematopoietic progenitor cells of the various leukocyte types in the bone marrow and other lymphoproliferative organs such as the thymus, lymph node and spleen.

In the study of Bhargavi et al. (2017), the haemato-biochemical alterations noticed in CPV affected dogs were represented by anemia (57.14%) leucopenia (42.86%), neutropenia (28.57%), lymphopenia (42.86%), thrombocytopenia (35.71%), elevated BUN (50%), hyperproteinemia (21.43%), hypoglycemia (21.43%), hypokalemia (35.71%) and hypochloremia (42.86 %).

In the study of Terzungwe (2018), the distribution by sex revealed that only male dog had lymphocytosis, while both female and male dogs had neutropenia. Both vaccinated and unvaccinated dogs shared neutropenia and monocytosis, with moderate lymphocytosis in the unvaccinated dogs. Neutropenia, monocytosis and lymphocytosis are among the consistent findings. Neutropenia and monocytosis were observed in dogs younger than 6 months, while lymphocytosis was observed in dogs younger than 6 months. There was a significant difference in red blood cell count and packed cell volume among age groups.

CONCLUSIONS

Leukopenia due to lymphopenia is the most consistent haemotological finding associated with CPV infection in dogs. Severe neutropenia often occurs due to virus induced myeloid degeneration of the bone marrow and the extensive loss of neutrophils through the damaged intestinal wall.

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