Canine and Feline Parvovirus Infections in Shelters

Overview

Canine parvovirus (CPV) and feline parvovirus (FPV) (aka panleukopenia virus) are highly contagious viral diseases that commonly cause life-threatening illness in dogs and cats in animal shelters. Every shelter is a high risk environment for exposure to CPV and FPV and most have been affected by outbreaks that are very costly with regard to animal suffering and death, reallocation of resources to management and eradication, staff morale, and resultant negative public image.

This document provides a basic overview of: 1) populations at risk; 2) incubation times, clinical disease, duration of virus shedding, and modes of transmission; 3) diagnosis; and 4) strategies for management and prevention in shelters.

Populations at risk

Kittens and puppies are the most susceptible to parvoviral infection due to waning levels of protective immunity from maternally derived antibodies and ineffective responses to vaccination. They typically enter shelters at an age when maternally derived immunity has decreased to a level that does not protect against infection, but still interferes with responses to vaccination. Studies have shown that two-thirds of puppies and kittens <6 months old do not have protective immunity to CPV and FPV. Unvaccinated young adult cats and dogs between 1 to 2 years old are also at risk for infection, but the clinical disease may be inapparent or mild. Older cats and dogs that have spent time outdoors eventually develop immunity by natural exposure to virus in the environment.

Panleukopenia outbreaks due to FPV commonly occur in the summer and fall ("kitten season") when large numbers of kittens are admitted to shelters. Since dogs are not seasonal breeders like cats, there is no consistent seasonal pattern to parvovirus outbreaks in dogs in shelters. Failure of shelters and rescue groups to vaccinate all dogs and cats against CPV and FPV on admission with repeated vaccination 2 weeks later, poor infection control practices, and longer lengths of stay in high risk environments are significant risk factors for parvoviral outbreaks.

Clinical features

The primary route of exposure to CPV and FPV is nasal or oral contamination with virus-containing feces or contaminated surfaces. Exposure via contaminated environments and fomites (cages, food bowls, litter boxes, health care workers) is the most common route of transmission.

Viral replication in oropharyngeal lymphoid tissue occurs within 24 hours of infection, followed by systemic spread to the intestines, bone marrow, and other lymphoid tissues during the preclinical incubation period. The incubation period is typically 5 to 7 days but may stretch out to 10 days. Because the infection cannot be detected during the incubation period, apparently healthy but infected animals may be adopted out only to become ill a few days later in their new home.

Following systemic spread, the virus replicates to high levels in rapidly dividing epithelial cells in the intestines and immature white blood cells in the bone marrow and other lymphoid tissues causing cell death. The resultant clinical signs include fever, hypersalivation from nausea, vomiting, diarrhea, dehydration, leukopenia, and death from hypovolemic shock and sepsis caused by translocation of intestinal bacteria into the bloodstream. Many dogs have hemorrhagic diarrhea but this is not typically seen in cats. Most dogs and cats have panleukopenia consisting of neutropenia and lymphopenia and sometimes thrombocytopenia and anemia. The mortality rate is 90-100% in untreated kittens and puppies. Adult cats and dogs may have subclinical infection or mild transient diarrhea

The most common cause of sudden death in kittens and cats in shelters is peracute septic shock due to FPV! Both age groups can progress in hours to a moribund state without having any gastrointestinal signs.

FPV infection of neonatal kittens <4 weeks old causes cerebellar hypoplasia due to virus destruction of rapidly dividing Purkinje cells. Survivors have permanent ataxia and head tremors. CPV infection of neonatal puppies <4 weeks old causes myocarditis due to viral destruction of actively dividing cardiac cells. Disease is characterized by cardiac arrhythmias, tachypnea and dyspnea from pulmonary edema caused by heart failure and high mortality in 3 to 8 weeks. These puppies do not display the gastroenteritis syndrome seen in older puppies and young adults.

Parvovirus shedding in saliva and feces starts 3 to 4 days before onset of clinical signs. Virus shedding continues throughout the disease phase and typically stops in conjunction with clinical recovery due to elimination of virus by the systemic and local intestinal immune responses. The total shedding period from initial infection to clinical recovery is typically 2 weeks. Animals with subclinical infection or transient symptoms shed virus in much lower amounts and for shorter period of time

Diagnosis

Not all cases of vomiting or diarrhea in juveniles and young adults are due to CPV or FPV, especially in animals that are debilitated, parasitized, co-infected with other pathogens, and stressed from entering the shelter environment. Diagnosis based on history, age, and clinical signs only are correct about 50% of the time Therefore, ***parvovirus infection cannot be reliably diagnosed based on the age of the dog or cat and the clinical signs***. Since other diseases mimic parvo and panleuk, ***diagnostic testing should be performed on all dogs and cats with compatible clinical signs*** instead of making a decision on a guess, especially if animals suspected of having parvo or panleuk are euthanized.

The point-of-care (POC) test kits (IDEXX SNAP, Zoetis Witness) for detection of parvovirus antigens in feces are a rapid and cost-effective diagnostic tool for dogs and cats in shelters. All animals with compatible clinical signs should be immediately tested in order to start proper containment strategies. The POC antigen tests have low sensitivity (about 80%), so false negative results can occur in 25% or more of infected animals due to intermittent virus shedding very early or late in the course of disease when virus quantities in feces are below the level of detection. Test results are most accurate if the test is performed within 3 days of onset of clinical signs. Negative tests should be repeated on the following day for cats and dogs suspected to have parvo based on clinical presentation. A PCR test on feces may be helpful for cases suggestive of CPV or FPV in the face of negative fecal antigen tests. A WBC count to detect leukopenia can also be performed to build evidence for a diagnosis of parvoviral infection.

Recent vaccination with modified-live parvovirus vaccines results in transient fecal shedding of vaccine virus that can cause weak fasle- positive reactions in the parvo antigen POC tests for the first 7 to 14 days post-vaccination. Studies have shown that the IDEXX SNAP Parvo and Zoetis Witness tests do not detect vaccine strains in the feces but other brands may. Testing of feces by PCR will result in a higher rate of vaccine-induced false positive test results due to the high sensitivity of PCR. However, a strong positive antigen test result in combination with compatible clinical signs or known contact with infected animals is most likely due to true infection instead of a false positive from detection of a vaccine strain.

Although it is a common practice, there is no compelling medical evidence to use the parvovirus antigen POC test kits for routine screening of dogs and cats in the shelter that don't have compatible clinical signs– resources would be better allocated for control and preventive strategies. The sensitivity of the parvoviral antigen POC tests is too low for screening apparently healthy animals for infection..

Necropsies should be performed on animals with unexplained deaths, particularly when there are unusual numbers of deaths of puppies and kittens in the shelter, foster homes, or adoptive homes. This is especially important for sudden death of kittens during "kitten season". Intestinal mucosal scrapings can be tested with the parvovirus antigen POC tests. Jejunal tissue samples should be fixed in formalin and submitted for histopathological evidence for parvovirus infection as this is the gold standard for confirming diagnosis.

Disease Management

The most effective strategy for limiting transmission of CPV or FPV in the shelter is the prompt isolation of sick dogs and cats with positive test results. This reduces the infectious dose in the general population. The sick animals should be housed in a physically contained isolation room if treatment is being considered. The decision to treat CPV or FPV should be carefully considered based on shelter resources, including whether there is an appropriate isolation room to contain infection, enough staff to dedicate to treatment, costs for aggressive supportive treatment, and costs of personal protection equipment (PPE) which must be worn by staff. The most important consideration is whether the shelter can provide proper treatment without contaminating the entire facility and putting healthy animals at risk, resulting in spread of shelter-acquired disease. If this is not possible, then sick animals should be transferred to a veterinary hospital or other facility for treatment or euthanized to relieve suffering and curtail disease transmission. Recovered animals with a negative parvovirus antigen POC test may be moved to adoption or rescue with relatively low risk for spreading virus. They should be bathed first to remove virus from the fur.

Since infected animals shed infectious virus for 3 to 4 days before onset of clinical disease, all others exposed to the sick animals either by direct contact or fomite contact should be quarantined for at least 10 days (maximum incubation period). The infection status of exposed animals is unknown – they may be infected and in the pre-clinical incubation period, have subclinical infection with shedding, or not infected due to immunity. Quarantined animals should be monitored twice daily for clinical signs. If clinical signs occur, the animal should be moved to isolation to help reduce the infectious dose of virus in the environment. The 10-day quarantine clock must be re-started for the remaining animals.

Unexposed resident animals and newly admitted animals must be protected from exposure to infected and quarantined animals. This group should be housed in a separate ward or ideally, a separate building. Staff should care for these “clean” animals first to avoid contamination of the environment and should not backtrack into this housing area after working with animals in isolation and quarantine unless they wear full PPE.

Sanitation

Parvoviruses are very durable, can persist in the environment for years, and are resistant to inactivation by quaternary ammonium disinfectants, including Roccal, Parvosol, Triple Two, Broadcide, and A33. Only 4 disinfectants reliably kill parvoviruses – sodium hypochlorite (bleach), calcium hypochlorite (WysiWash), potassium peroxymonosulfate (Trifectant), and accelerated hydrogen peroxide (Accel/Rescue). Environmental surfaces contaminated with feces, urine, vomit, blood, and other organic material must first be cleaned with a detergent before applying the disinfectant solution.The minimum contact time for the working dilutions of these disinfectants is 10 minutes (5 minutes for Rescue diluted 1:16). Air drying is preferred if possible, but if the animal needs to be returned to the same run or cage, the area should be rinsed and dried using a squeegee or towel.

Daily cleaning and disinfection with any of the 4 products that kill parvoviruses should include food and water bowls, litterpans, animal transport vehicles, transport cages, and hallways to reduce the risk for environmental transmission of any infectious disease. Mop buckets should not be used for cleaning and disinfection of kennel runs. High pressure hoses and power washers should also not be used in dog kennels unless all dogs are removed because the force sprays feces on all surfaces and can even aerosolize fecal matter. Cleaning and disinfection supplies should be dedicated to each room and not removed for use in other areas in order to minimize cross contamination.

Litters of puppies and kittens should not co-mingle in exercise pens or play areas with surfaces that cannot be properly disinfected between different litters.

Prevention

Vaccination of all dogs and cats on intake is the cornerstone for prevention of parvoviral transmission in shelters. All dogs and cats 4 weeks of age and older must receive a vaccine containing modified-live parvovirus on intake, regardless of intake status (stray, owner surrender, community cats for TNR, rabies quarantine, cruelty case, pregnant, lactating, injured, ill). A delay of even a day can significantly increase the risk for infection. The vaccine should be repeated in all dogs and cats 2 weeks later. Modified-live CPV and FPV vaccines will induce sterilizing immunity that prevents infection in properly vaccinated animals.

Puppies and kittens should be re-vaccinated every 2 weeks while in the shelter until they are 5 months old. The potential for maternally derived antibodies to interfere with vaccination in puppies and kittens <5 months old is the reason they should be re-vaccinated every 2 weeks to successfully induce protective antibody titers. Restricting vaccinations to adoptable animals only creates a large pool of susceptible animals that can make parvovirus infections an endemic problem in the shelter.

In addition to vaccination, another strategy to prevent parvovirus infection is to move puppies and kittens from the shelter into foster or adoption homes as soon as possible after intake. All efforts to shorten length of stay in the shelter for puppies and kittens should be pursued through sound population management practices.

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