DIAGNOSIS & MANAGEMENT OF PARVOVIRAL OUTBREAKS

Cynda Crawford, DVM, PhD

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 presentation provides experience-based insights on diagnosis and management of CPV and FPV in the shelter environment using strategies that maximize life-saving, minimize disruption of shelter operations, and achieve the quickest possible resolution.

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 most puppies and kittens <6 months old do not have protective immunity to CPV and FPV. About 50% of young adult cats and dogs between 1 to 2 years old are also at risk for infection due to lack of immunity or partial immunity, but the clinical disease may be inapparent or mild. Most older cats and dogs that have spent time outdoors have protective immunity due to 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. Shelters that house all puppies or kittens together in one location are at highest risk for parvoviral outbreaks.

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 also significant risk factors for parvoviral outbreaks.

Epidemiology and Clinical Features

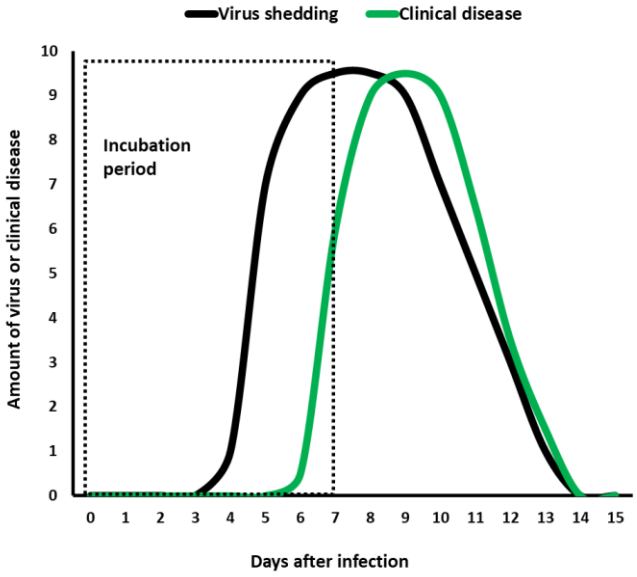
The primary route of exposure to CPV and FPV is oronasal exposure to virus-containing feces or contaminated surfaces. Exposure via contaminated environments and fomites (cages, food bowls, litter boxes, health care workers) is the most common route of transmission.

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 within 4-7 days. This viremic phase defines the pre-clinical incubation period of 5 to 7 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. Many, but not all, 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.

Parvovirus shedding in saliva and feces starts 3 to 4 days before onset of clinical signs (incubation period). Peak virus shedding occurs with 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 (1 week for incubation + 1 week for clinical resolution). Animals with subclinical infection or transient symptoms shed virus in much lower amounts and for a 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 is only 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 deciding on a guess, especially if animals suspected of having parvo or panleuk will be euthanized.

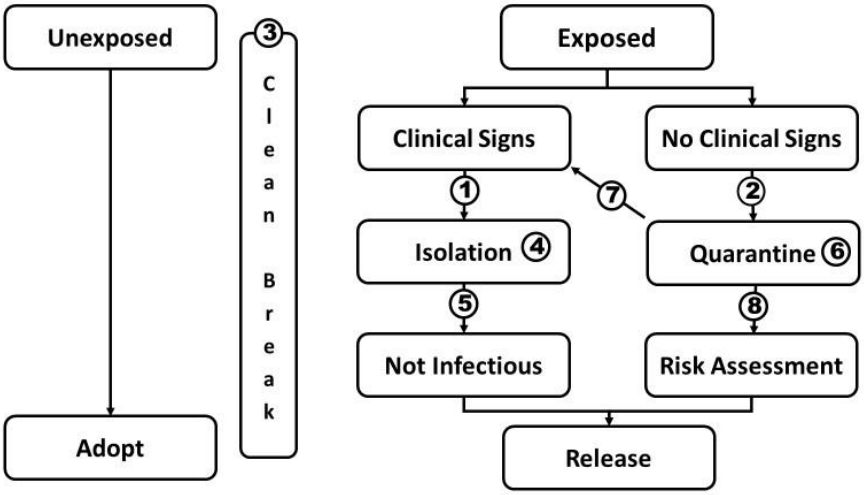
The point-of-care (POC) test kits for detection of parvovirus antigens in feces are a rapid and cost-effective diagnostic tool for dogs and cats in shelters. All animals with compatible clinical signs should be immediately tested in order to start proper containment strategies. The POC antigen tests have low sensitivity (about 80%), so false negative results can occur in 20% or

more of infected animals due to intermittent virus shedding very early or late in the course of disease and 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. Studies have shown that the IDEXX SNAP® Parvo (Westbrook ME) and Zoetis Witness® Parvo Rapid (Parsippany NJ) tests do not detect vaccine strains shed in the feces, but other brands may. A PCR test on feces may be helpful for cases suggestive of CPV or FPV in the face of negative fecal antigen tests. However, PCR detects vaccine strains in feces, producing a higher rate of false-positive test results. A strong positive PCR test in combination with compatible clinical signs or known contact with infected animals is supportive of true infection instead of a false positive from detection of a vaccine strain. A WBC count to detect leukopenia can also be performed to build evidence for a diagnosis of parvoviral infection, but not all infected animals are leukopenic.

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

Here is the basic management flow diagram. Numbers refer to action steps. The overarching goal is to create an effective break between the infected/exposed population and the unexposed population



1. **Isolation of sick animals**
   - The first and most important step to stop exposure of more animals and virus contamination of the environment.

- CPV or FPV infection confirmed by a POC fecal antigen test
- Isolation in a physically enclosed room provides best containment of the virus and prevention of spillover.
- For shelters without an isolation ward, parvoviral-infected animals can be housed in makeshift isolation runs or cages in the general housing areas since parvoviruses are spread by direct contact and not aerosols like respiratory pathogens. The run or cage doors can be covered by some impervious material to prevent contact with other animals and to remind staff that the animals are contagious so they can follow biosecurity practices necessary when providing care.
- Humane housing is essential for animal health and particularly so for sick animals. Sick animals should not be housed in plastic carriers or small crates in hallways, break rooms, or bathrooms in the shelter.

2. **Quarantine of exposed asymptomatic animals**
   - Animals in direct contact with infected animals or contaminated environments/staff should be considered an infectious risk and housed in a physically enclosed space separate from sick animals and unexposed animals.
   - Littermates of infected puppies or kittens must be quarantined because they are highest risk for infection and may be in the preclinical incubation period.
   - No animals should leave quarantine until expiration of the quarantine time or diagnostic testing determines they are not an infectious risk
   - Animals can be quarantined in foster homes without other dogs or cats or with well-vaccinated adults. They should not be placed in foster homes with juvenile animals.
   - Adoptions and transfers to rescue of quarantined animals should be temporarily stopped to avoid inadvertent transfer of disease by those incubating CPV or FPV.
3. **Provide a clean break**
   - In contrast to contagious respiratory diseases, shelters do not need to stop all admissions when parvoviral cases are confirmed. Most adult cats and dogs enter shelters with immunity to CPV and FPV, and those that do not typically respond within 7 days to intake vaccination.
   - Admission of more puppies and kittens should be stopped or diverted from the shelter. These animals are high risk for infection if exposed, most do not respond to one dose of vaccine, and an adequate response can take weeks. These highly susceptible animals can be diverted to foster homes or rescue groups before entering the shelter. Those that must come into the shelter must be housed in a separate, physically enclosed, clean area to shield them from exposure to infected animals or contaminated environments, and moved as quickly as possible back out of the shelter to adoption, foster homes, or rescue groups.
   - Ideally, staff or volunteers should be dedicated to caring for adults and any "clean" juveniles that must be in the shelter. They should use supplies dedicated to these areas.
4. **Isolation time**
   - Infected animals are isolated for the duration of clinical disease and parvovirus shedding.
   - Most infected animals recover from clinical disease within 7 days with proper treatment.
   - Staff must wear full PPE and use supplies dedicated to this area
5. **Release from Isolation**
   - Recent evidence suggests that infected animals stop shedding parvovirus shortly after clinical resolution; i.e., when the animals are eating and have formed stools.

- Virus shedding, as determined using the point-of-care fecal parvovirus antigen test, typically stops with emergence of a robust immune response at the time of recovery.
- New studies have shown that infected puppies treated with canine monoclonal parvoviral antibody (Elanco, Greenfield IN)) stop shedding virus around 4 days after treatment, as determined using the point-of-care fecal parvovirus antigen test.
- A practical rule-of-thumb is that clinically recovered animals with 2 consecutive negative point-of-care parvovirus antigen test results are safe for release from isolation.
- Animals should be bathed prior to release to physically remove virus residue from the fur.

6. **Quarantine time**
   - Exposed animals may not be sick because they are in the preclinical incubation period, have a subclinical infection, or are not infected due to immunity or lack of exposure.
   - Quarantine time is based on the parvoviral incubation period which is typically 7 days.
   - Monitor animals twice daily for clinical signs
   - Staff must wear full PPE and use supplies dedicated to this area
7. **Move new clinical cases from Quarantine to Isolation**
   - Re-start the 7-day clock for remaining animals in quarantine
   - Multiple re-starts with clinical breaks can extend quarantine for weeks, creating a strain on housing capacity and staff, and poor welfare for the animals, especially juveniles that are in their critical socialization periods.
8. **Release from Quarantine**
   - An alternative to waiting out the quarantine clock is to perform a risk assessment for potentially exposed adult dogs and cats at the start of quarantine. There are 2 approaches:
     1. Perform CPV or FPV antibody titer testing on adults using the point-of-care kits. Adults with protective titers can be released from quarantine. Those without titers should stay in quarantine and be re-vaccinated.
     2. Triage adults using vaccine status and time in-shelter.
        a. Adults that received 2 vaccine doses before exposure are low risk and can be released from quarantine.
        b. Adults that received 1 vaccine dose 7-10 days prior to exposure are likely low risk and can be released from quarantine
        c. Adults that received 1 vaccine dose <7 days prior to exposure are moderate risk and safer to stay in quarantine
   - Puppies and kittens <6 months old should be considered high risk and held in quarantine. Vaccine status and antibody titer cannot be reliably used for earlier release.

Other important steps for management of CPV or FPV outbreaks include:

1. Use of currently available disinfectants that reliably kill parvoviruses (Rescue®, Trifectant®, bleach, Wysiwash®)(no quaternary ammonium products).
2. Proactive transparent communication about the circumstances of the outbreak and the control strategy being used. This provides an opportunity to disseminate accurate information to shelter staff as well as community stakeholders such as adopters, rescue groups, veterinarians, and pet owners.
3. A written statement describing the disease, what animals are at risk, and the transmission modes should be provided to all shelter staff, including managers, directors, and public information officers. This can serve as a press release to inform the public.