

The Virus that Never Dies?

Parvovirus is a persistent microscopic beast that can endure in the environment for months or even years. But there are ways to stop it in its tracks and keep it from infecting your shelter population.

BY KATE HURLEY, D.V.M., M.P.V.M.

I guess you could say I was lucky: I got through six years as an animal control officer without encountering an outbreak of parvo at my shelter. True, I was called out now and then to pick up a sick puppy, usually a sad little unvaccinated scrap of a creature for whom euthanasia was the only solace I could provide. Afterwards, I scrubbed and sprayed my truck until my throat was sore and my eyes watered from the disinfectant fumes. I was terrified by the tales I heard of past years when parvo had made its way into the shelter itself and total depopulation was required to bring the disease under control. I was determined not to be responsible for such a disaster.

My luck lasted almost six months into my employment as a shelter veterinarian, but it finally ran out one late Friday afternoon (after almost all the staff had gone home, of course). We had finished up spay/neuter surgery for the day and the last of our patients were groggily coming around, ready to be transported back to their kennels. Among our surgery patients was a litter of nine roly-poly rottweiler-mix puppies, transferred from another shel-

ter a couple of weeks earlier. I was writing up my records when a technician wandered in to tell me one of the puppies had broken with diarrhea. Just to be on the safe side, we decided to run a parvo “snap” test. The blue dot indicating a strong positive result was quick to appear, and I stared down at it in horror, thinking about all the places and people these puppies had had contact with during their brief stay at the shelter.

My veterinary education had not fully prepared me to deal with the questions that flooded my mind as I contemplated that dreaded blue dot: What should we do with the eight seemingly healthy littermates? What about all the dogs from the area where the puppies were housed, or those who had been in the adjacent surgery kennels that day? Were they at risk for infection, and if so, how long before we would know for sure whether they had contracted the disease? How could the areas where these puppies were housed be decontaminated? I wasn’t even sure if we were using the right disinfectant; although it was labeled effective against

parvovirus, I’d heard rumors that it wasn’t all that reliable. These puppies had even been out in our grassy play areas. Could those areas ever be made safe again? And what should we tell adopters who had taken home a puppy or dog from our shelter in the last few days? Was their new pet likely to get ill? Were their own pets at risk?

Somehow, I stumbled through that first “outbreak” with advice from the local veterinary school and the help of experienced shelter staff and zealous volunteers who were handy with bleach. None of the other animals in the shelter got sick, perhaps partly due to the precautions we instituted after the fact, but mostly because of standard careful vaccination and cleaning practices already in place. In the years since that nerve-wracking Friday afternoon, I’ve managed to hunt down at least partial answers to the questions that haunted me that day. In this article, I’ll share some background information about parvovirus, and in my next column I’ll answer some of my own questions about control of this troublesome disease, along with some of the many questions I’ve been asked since then.

BEFORE 1978, SHELTER WORKERS FACED MANY CHALLENGES, BUT AT LEAST CANINE PARVO WAS NOT ONE OF THEM.



What’s Your Question?

Kate Hurley’s next column in our March-April 2007 issue will address some of the finer points of parvovirus prevention and control, answering common questions she receives about the disease. If you have a question about parvovirus you’d like to ask Dr. Hurley for possible inclusion in the article, please send it to asm@hsus.org.

A bit of parvovirus history

Before 1978, shelter workers faced many challenges, but at least canine parvo was not one of them. Although parvoviruses in general have been around for a long time and infect many different species, it was not until the late ‘70s that canine parvovirus made its unwelcome appearance. It shares the dubious honor with canine influenza of being one of those viral mutants that have managed to jump species and establish themselves in a new population. Canine parvovirus (CPV) is closely related to another member of the problematic parvovirus family, feline pan-

leukopenia virus. In fact, these two viruses are so similar that some parvo tests will cross-react with panleukopenia virus—meaning that a test designed to detect one virus can also pick up on the presence of the other.

In the years since its first appearance, canine parvovirus has steadily continued to evolve. Although many strains of canine parvovirus are still capable of wreaking significant havoc, less severe strains have also emerged. This, combined with advances in treatment, means that survival after parvo infection is no longer uncommon when good supportive care is provided. In a less pleasing development, a few years ago some rogue strains of canine parvovirus acquired the ability to infect cats. While CPV infection in cats is not yet a widespread problem in the United States, it is prudent to keep shelter dogs and cats separated for this and many other reasons.

One piece of good news about canine parvovirus is that it seems to be relatively “antigenically stable.” This means that, although it has evolved over the years, this has not generally affected the ability of dogs’ immune systems to recognize and respond to the virus. Unlike the evolution of some viruses, the emergence of vaccine-resistant strains has not been a very significant problem with canine parvovirus; vaccination remains the cornerstone of control for this disease.

The course of the disease

It’s always a relief when the incubation period for a disease is fairly short; if you are wondering whether a dog got infected or not, at least the suspense ends quickly, and quarantine of exposed animals becomes a realistic option. Luckily, the incubation period for current strains of parvo is most often about four to seven



CARRIE ALLAN/HFHS

days, though in some cases it can stretch to as long as a couple of weeks.

Knowing the incubation period helps us understand and manage parvovirus. If a dog breaks with parvo within the first few days after intake, she most likely came in already infected. On the other hand, if a dog breaks with parvo after more than a week or so in the shelter, that should raise the concern that infection was acquired within the shelter itself.

The possibility that incubation could be as long as 14 days also tells us how long we need to quarantine exposed/at-risk dogs in order to be reasonably certain they are not going to break with disease. One tricky thing about parvovirus

is that infected dogs commonly shed virus in their feces for two to three days *before* developing symptoms. This means you need to count back three days from the date of diagnosis when considering who might have been exposed to a parvo case.

Another small piece of good news is that there is no carrier state for parvovirus. Although otherwise healthy, unvaccinated adult dogs may suffer from very mild or asymptomatic infections, chronic shedding does not occur. The vast majority of dogs stop shedding virus within two weeks of recovery and retain immunity to reinfection for years, if not for life. This means it is generally safe to reintroduce recovered dogs into the general population after

a two-week waiting period, with the caveat that they should be bathed if possible to remove any virus lingering on the fur. To be on the safe side, an in-house parvo test (as described in the next section) can be used to help confirm that the dog no longer poses a threat; a negative test result indicates the dog is not shedding virus in significant quantities.

Symptoms and diagnosis

Canine parvovirus causes disease by attacking rapidly dividing cells, especially in the gastrointestinal tract and immune system (including the white blood cells). Signs of illness range from non-existent to mild to severe; severe signs include vomiting, bloody diarrhea, and rapid death. The most severe disease tends to be seen in puppies because their growing bodies provide many rapidly dividing cells for the virus to invade. It will also be seen in any dog with concurrent intes-

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tinal infection: coccidia, hookworm, and the like all cause an increase in cell turnover, which the virus is quick to take advantage of. For this reason, treating dogs for intestinal parasites can be a helpful tool in fighting parvovirus infection.

In very young puppies, the virus can attack the still-developing heart cells, leading to sudden death or (less commonly) later heart failure. This is rare these days because most puppies are protected by immunity received through their mother's milk. However, some shelter pups may be born to unvaccinated moms who have no antibodies to offer, and parvo should be considered in all cases of sudden death

or heart problems in puppies less than 8 weeks old.

One belief that was fairly common when I was an animal control officer is the notion that it is possible to "smell parvo." This is untrue. The terrible aroma sometimes associated with parvo is caused by the presence of blood and dead gastrointestinal tissue in feces, but a number of other conditions—even ones as easily treatable as hookworms—can generate the same substances and smell. Conversely, not all parvo-induced diarrhea smells "like parvo," especially in dogs who have managed to acquire relatively mild infections.



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Signs of Parvovirus

- Lethargy
- Diarrhea, sometimes severe and/or bloody
- Vomiting
- Anorexia (refusal to eat)
- Fever (rectal temperature greater than 102.5)
- Organ damage due to systemic spread of blood clots or secondary bacterial infections
- Sudden death due to heart failure in puppies less than 8 weeks old

Note: Some dogs will show few or no signs of illness, especially when parvovirus infects adult dogs who are otherwise healthy. Diarrhea in a dog who is otherwise bright and alert and has no fever is much more likely due to any number of other causes common in shelters (stress, diet change, infection with parasites or bacteria).

Parvovirus: Who's at Risk?

Risk is LOW in dogs more than 4 months old who:

- are vaccinated at least one week prior to exposure.
- have a documented history of vaccination at more than 4 months old and within three years prior to exposure.

Risk is GREATER in puppies less than 4 months old even if vaccinated (due to maternal antibody interference).

Risk is GREATER in dogs vaccinated less than a week before exposure.

Risk is *GREATEST* in littermates of affected puppies, though some littermates may not get ill due to variation in maternal antibody levels. If possible, littermates can be bathed and quarantined for two weeks.

So how *do* we diagnose parvo? No doubt many of you are familiar with the in-house parvo test I used to diagnose the disease in my little rottweiler puppy so many years ago. It's a simple procedure: mix a little feces with a few drops of reagent, and look for a dot indicating the presence of virus in the sample. As tests go, the in-house parvo test is a pretty good one: both false negatives and false positives are rare when you're testing a dog who has just recently developed symptoms. Later in the course of the disease, it is fairly common for all the virus to be taken up by the dog's immune system,

There's also a small possibility that vaccination can lead to positive test results within two weeks after administration. It is unknown how commonly this occurs, but based on the frequency with which negative test results are seen in recently vaccinated dogs, it appears to be fairly rare. A recent study to test the impact of feline panleukopenia vaccination on parvo snap test results sheds some light on this (the two diseases are so similar, the same test can be used to detect both panleukopenia and parvo). In this study, only one out of 64 recently vaccinated kittens tested weakly positive on the IDEXX brand parvo snap test, and no strong positives were seen at all. Not all brands were equally accurate, however. The Synbiotics brand test was much more prone to false positives in this study, with 13 out of 64 kittens testing positive after vaccination, including some strong positives. Although this was done in kittens, it is reasonable to surmise that the closely related canine parvovirus may behave in a similar fashion.

So the bottom line is that the in-house parvo test is a very useful tool, but as with any disease, test results need to be taken in the context of the animal's symptoms and history. If it walks like a duck and quacks like a duck, it's probably a duck: my rottie pup was the right breed, the right age, had a high-risk history and symptoms consistent with parvo infection.

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leaving none for the test to detect. Therefore, negative results in a dog who has already been sick for more than a day or two should be viewed with suspicion, especially if the symptoms and history are all pointing toward parvo.

Although she had been vaccinated within the preceding two weeks, I had a lot of confidence that the test result was accurate, and I acted accordingly.

On the other hand, if it walks like a duck but clucks like a chicken, we need to move ahead a bit more cautiously. No matter what, it's smart to carefully isolate any dog with a positive test result or severe diarrhea. But when irreversible measures such as euthanasia are considered and the signs aren't all pointing in the same direction, confirmatory testing is ideal. Positive test results should be viewed with particular suspicion in a dog with a decent vaccination history (especially a dog over 4 months old) or with mild or no signs of illness.

When history, symptoms, and test results don't quite make sense, remember to consider other possible causes of diarrhea. A careful fecal smear and flotation can rule out many of the likely culprits, and laboratory testing for bacterial infections can rule out others. Another way to get a bit more information is to do a quick blood smear or send blood to a laboratory for a white blood cell count. The immune cells are one of parvo's favorite targets, so although some dogs with parvo will have a normal or increased white blood cell count, a decreased white blood cell count should increase your suspicion that you're dealing with the real thing.

Necropsy is another valuable tool. If affected dogs die or are euthanized, their sad fate can help us gain more information. A veterinarian can easily perform an in-house necropsy to look for inflammation of the intestines. Although not absolute proof one way or the other, the absence of intestinal inflammation suggests that another cause of death should be considered. Ultimately, laboratory examination of gastrointestinal tissue is the best way to get definitive information. Although not necessary in every case, if you're dealing with an unusual outbreak—in which symptoms are atypical or you're seeing disease in a surprising number of adult or well-vaccinated dogs—it's worthwhile to get a diagnostic laboratory to look at bowel specimens from a dog who has

Parvo Prevention and Control

Vaccinate, vaccinate, vaccinate: Vaccinate all dogs and puppies over 4 to 6 weeks old *immediately on intake* with a modified-live vaccine containing parvovirus, distemper, parainfluenza, and infectious hepatitis (DHPP or DA2PP). Revaccinate puppies every two to four weeks as long as they are in the shelter, and at least one week before they return from foster care. Err on the side of earlier vaccination and shorter intervals if parvovirus risk is high in your shelter.

Protect puppies: Remember, puppies under 4 months old can never be absolutely protected by vaccination. Prioritize placement of puppies in easily cleaned areas—if your shelter is in poor repair, consider investing in a bank of stainless steel cages or other easily cleaned holding area just for puppies. Keep puppies separate from adults of unknown background if possible. Remember, though, that puppies need socialization, too. Be sure that pups have plenty of exposure to a variety of experiences, including playtime with vaccinated dogs or puppies from a clean background.

Keep it clean: Following cleaning, use a proven disinfectant such as bleach or potassium peroxymonosulfate (Trifectant or Virkon-S). Help prevent contamination of hard-to-clean areas (grass yards, foster homes) by not allowing puppies free access until after a two-week quarantine.

Be on the lookout: Train staff and volunteers to be on the lookout for signs of parvo. Train selected staff members to administer the IDExx brand in-house parvo test. (See the parvo diagnostic testing cheat sheet at www.sheltermedicine.com). Consider testing puppies who are high-risk (either based on origin or because they are unthrifty-looking) upon intake.

Evaluate risk: When a case of parvo is identified in the shelter, count back three days and assess which dogs may have been exposed. Evaluate risk based on age, vaccine history, and degree of exposure, and quarantine at-risk/exposed dogs for two weeks (or euthanize them as a last resort if effective quarantine/isolation is not possible). See the box on p. 46 for an assessment of risk factors.

Document and communicate: Document all cases of parvovirus in a disease log; include origin of animal (location), date of intake, and date of diagnosis. Consider mapping the source of parvovirus cases and prioritizing testing on intake of puppies from identified high-risk neighborhoods.

Communicate in person and in writing with all staff and volunteers regarding what to do if parvovirus is suspected or identified: who can run a test, what to do with the puppy if the test is positive, how to clean contaminated areas, etc.

Communicate with adopters and the public in the case of an outbreak: What should adopters do if they suspect parvo in a recently adopted puppy? How can the public protect their own pets? Consider proactively contacting the media if a severe outbreak occurs at the shelter.



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died or been euthanized. This step may prevent the deaths of many more dogs.

Spread of parvovirus

According to my textbook on infectious diseases of the dog and cat, parvoviruses are spread “via oro-nasal exposure to contaminated feces.” That doesn’t sound so bad—it seems like it would be easy enough in most animal shelters to keep a dog from sticking its nose into a clump of parvo-infested poop.

Unfortunately, if you’ve worked in a shelter long, you already know it’s not that simple. Millions of viral particles can cling to even the tiniest speck of feces, and the simplest acts can transmit the virus. Picture what happens when we carry or restrain a puppy that turns out to have parvo. It’s safe to assume that every part of the puppy’s body is coated with virus; puppies aren’t known for their fastidious grooming habits. What parts of the hands, arms, and body will contact the pup’s contaminated fur? Even if we wash hands or change gloves afterwards, more than enough viral particles can remain on our arms or clothing to infect another vulnerable puppy.

Viral particles can also travel freely through the shelter on shoes, cleaning equipment, or exam tools (rectal ther-

mometers are an especially common culprit). They can splash from one cage to another in the course of zealous cleaning. They can make their way in mop buckets from one ward to another and lurk in dank corners, on scratched plastic beds, in animal control vehicle cages, or even

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on the exam surface where puppies are first admitted, examined, and vaccinated. Some people have even speculated that virus can be transmitted by flies or rats wandering through the shelter.

To make matters worse, parvoviruses fall into the troublesome category of “un-enveloped” viruses, which are notoriously persistent and are among the most durable microorganisms. The fatty envelope that surrounds most viruses renders them more susceptible to the effects of environmental exposure and vulnerable to disinfectants that can dismantle a virus’s ability to replicate by penetrating the envelope. Without an envelope to attack, many

disinfectants simply don’t work. And if you don’t inactivate the virus with one of the handful of products that *are* effective, it can persist in the environment for months or even years. Even the best disinfectants can be compromised by dirt or organic matter, leading to particular dif-

ficulty in clearing the virus from homes, outdoor areas, or shelters where the floors or other parts of the facility are in poor repair and hard to clean.

The good (?) news

Well, all that is pretty depressing. Luckily, we do have plenty of tools to prevent parvovirus or at least control the damage when the worst happens. Most importantly, we can give dogs the best chance of protection by vaccinating all those over 4 to 6 weeks old immediately on intake. We can be sure puppies are kept in a clean, parvo-free environment. We can train staff to efficiently recognize and remove infected dogs, and identify and isolate exposed animals who may be at risk of infection. Although it may be challenging, with some elbow grease and the right disinfectants, we can generally make the environment safe again. And with care and a reasonable amount of resources, we can usually avoid the total depopulation I so dreaded as an animal control officer. The sidebar on page 47 outlines the basics for parvovirus control; in my next column, I will go over some of the finer points in the form of the most frequently asked questions regarding this disease. 🌟

FOR MORE INFORMATION ...

- For more information on **maternal antibodies, vaccination timing**, and other topics key to the prevention and control of parvo, see “Vaccination Station,” an FAQ compiled by Kate Hurley in the July-August 2006 issue of *Animal Sheltering*, available at www.AnimalSheltering.org.
- To learn more about **nonenveloped viruses, effective disinfectants**, and **proper cleaning protocols**, see “Disinfection Connection” in the July-August 2003 issue of *Animal Sheltering*, available at www.AnimalSheltering.org.
- View a **parvo diagnostic testing cheat sheet** at www.sheltermedicine.com (click on “Shelter Health Portal” and “Information Sheets”).
- To read about shelters’ experiences in preventing the spread of a similar disease, **feline panleukopenia**, read “Keeping Your Cats Healthy: Guarding Against Panleukopenia” in the May-June 2001 issue of *Animal Sheltering*, available at www.AnimalSheltering.org.