Feline: Panleukopenia

Although panleukopenia can be a scary and potentially devastating disease in a shelter, reliable vaccination on intake, effective routine cleaning with a parvocidal disinfectant, and housing that minimizes fomite transmission will greatly reduce the risk of spread. With new tools for diagnosis and risk assessment, even outbreaks can generally be managed without resorting to depopulation.

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Background Information

Feline panleukopenia virus (FPV) causes vomiting, diarrhea, and can cause sudden death in cats. The virus is transmitted primarily by the fecal-oral route (including through exposure to objects/clothing/hands contaminated with virus from feces). FPV is very durable and can persist in the environment for months or even years unless inactivated by an effective disinfectant.

The incubation period of FPV is generally less than 14 days, and cats may shed infectious virus for two to three days before clinical signs are observed. Kittens are at highest risk for this disease, and adult cats with current vaccinations are at very low risk. If multiple vaccinated adult cats are infected, panleukopenia is very unlikely to be the cause. Salmonella is the most common alternative diagnosis, as it can cause similar symptoms and can spread to vaccinated adult cats.

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assessment, even outbreaks can generally be managed without resorting to depopulation.

> *Control is dependent on effective vaccination, keeping cats separate during the time they may be incubating the disease, and careful cleaning and disinfection of all areas in which cats are housed.*

Vaccination

Vaccination for FPV is highly effective if performed correctly. Modified live subcutaneous vaccination will provide more rapid protection than killed vaccine, which requires a booster to be effective.

All cats 4 weeks of age and older should receive a modified live panleukopenia vaccine immediately upon shelter entry. Cats begin mounting an immune response to panleukopenia immediately and develop full immunity in as little as three days [1]. A delay of even a few hours renders the vaccine far less useful. Even injured and mildly ill cats should be vaccinated.

For pregnant cats expected to carry kittens to term, balance the risk of inducing abortion or birth defects (reportedly very uncommon with currently available vaccines) against the risk of death of mom and kittens from virulent disease. Additionally, vaccinating the queen for the respiratory viruses contained in the 3 way vaccine can confer some protection to the kittens by generating maternal antibodies. In most cases, the benefits outweigh the risk of vaccination. However, for pregnant cats seized as part of a legal case or cats in a shelter where the risk of panleukopenia is extremely low, a killed vaccine may be preferable.

Vaccination recommendation summary:

- Vaccinate all cats > 4 weeks old (including injured and mildly ill) immediately upon intake with a modified live subcutaneous FVRCP vaccine
- Vaccinate pregnant cats unless part of a legal case or where the risk is extremely low
- Re-vaccinate all cats under 18-20 weeks every two weeks while in shelter
- Re-vaccinate all cats in foster care at least one week prior to shelter return
- House unvaccinated cats, if any, off site or in an area carefully segregated from at-risk populations

Recognition/diagnosis

Clinical Signs include:

- Vomiting
- Diarrhea
- Dehydration
- Lethargy
- Sudden death/found dead in cage

Diagnosis may include:

- Clinical signs and exposure history
- Positive results on an IDEXX brand Parvo SNAP test
    - False negatives may occur more commonly than when using these tests for canine parvo (one small study found 20-50% false negatives on various brands)[2]
    - False positives were rare in this same study, occurring 0-6% of tested samples depending on brand of test[2]
    - Vaccine induced positives were rare on the IDEXX brand test (only 1/64 recently vaccinated kittens tested positive on an IDEXX brand test; other brands had a higher rate of positive results following vaccination[3])
- Low white blood cell count on CBC or blood smear (negative prognostic factor if present)
- Segmental enteritis observed on necropsy
- PCR at a diagnostic laboratory (1-3 day turnaround time often possible)
    - Can be useful to confirm or rule out infection when results of the above tests are giving mixed results
    - Negative results in correctly collected and transported samples are reliable to rule out infection
    - Positive results may occur in recently vaccinated cats; laboratories (e.g. Idexx) may provide quantitative results to help distinguish probable vaccine from true infection
- During an outbreak, log all test results in a central location, including age, date of shelter entry, date of test, and location of cat

Population monitoring:

Although diagnostic tests are quite effective to confirm or rule out FPV infection, this must go hand in hand with daily or more frequent monitoring of the population. If an unthrifty animal goes undetected for hours or days, the opportunity for spread is hugely magnified.

- Noticing, isolating and testing sick cats ASAP will help stop spread
- During an outbreak, have trained, designated staff check all cats at least twice daily
- Provide written instructions detailing what to do when a possible case is recognized:
    - Whom to contact
    - What diagnostics to perform (SNAP test, blood smear, etc.)
    - What to do with the cat
    - How to clean the cage and other areas the cat accessed and possibly contaminated
    - What to do with exposed cats
- In addition to the daily walk-throughs, ALL staff and volunteers should be trained to recognize possible signs of FPV and what to do when they see any of the clinical signs
- It is particularly important that staff look over all cats for clinical signs of FPV prior to cage cleaning, to prevent spread during cleaning

Quarantine/Removal of Exposed Cats

Risk assessment:

When one animal from a population is diagnosed with FPV, the question arises: what do you do about others in the environment? Are they all likely to get sick? Will widespread quarantine be necessary? Or is it okay to simply carry on business as usual, or somewhere in between? The answers to these questions are dependent on several factors.

Not all exposed cats will become infected. Due to varying levels of maternal antibody, it is not even uncommon for only some members of a litter to develop disease. The risk of infection depends on the animal's individual immune and vaccination status, the overall cleanliness of the environment, and the level of proximity between the exposed and infected animal.

The most important factor in disease risk is vaccination: a "fully" vaccinated cat over 5 months old is at very low risk of infection (vaccinated at least 3 days prior to exposure, keeping in mind that shedding may occur up to 3 days before clinical signs become apparent). However, even incompletely vaccinated animals can survive an exposure if health is good and dose is low.

Risk due to environmental spread is reduced if:

- The shelter is not crowded

- Cats are housed in double compartment units and handling during cleaning is minimized
- A proven parvocidal disinfect (e.g. Accel/Rescue®, Trifectant®) is used daily to disinfect all animal housing areas, including transport vehicles, exam surfaces and common rooms
- Cleaning staff have time and ability to evaluate each cat before cleaning and use gloves between unthrifty and high risk individuals
- Separate tools and equipment are used for each area of the shelter
- Common rooms, exam surfaces and carriers are cleaned and disinfected between each use

Risk due to cat immune status is reduced if:

- All cats are vaccinated immediately upon intake as described above
- Risk is very low in cats four months and older that are either:
    - Vaccinated with an MLV SC FVRCP vaccine at least one week prior to exposure, or
    - Have a documented history of vaccination at or after 18-20 weeks of age at least two weeks and within three years prior to exposure
- Risk is greater in kittens under four months old even if vaccinated (due to maternal antibody interference)
- Risk is greater in cats vaccinated less than a week before exposure, or vaccinated with a killed or intranasal vaccine
- Risk is greatest in closely exposed, unvaccinated cats
- All ages should be considered at risk if unprotected by vaccines. FPV is regularly documented in adult cats in shelters, both strays and those surrendered by their owners.

Serology may be a useful tool to identify cats at low risk and limit the number of cats requiring quarantine. Serological tests for panleukopenia are available from several laboratories. Not all laboratories have been validated; consult with your local veterinary school.

There is also a panleukopenia titer kit (VacciCheck ImmunoCombTM by Biogal) available for in-house use. One study found the sensitivity and specificity to be up to 89% (meaning that there is a ~ 1 in 10 risk of false positive results [calling a cat protected when really not]). Combined with rectal temperature and careful physical exam revealing no abnormalities, healthy adult cats with a protective IgG titer at the time of exposure can be considered at very low risk – moving these cats along as usual, with no quarantine, is a reasonable choice.

If a single case occurs in an area where all animals have been vaccinated

and environmental spread risk is deemed low based on the above-listed factors, quarantine may not be necessary. If spread is observed or few of the above precautions are in place, the whole ward or even the whole shelter may need to be considered at risk/exposed. An intermediate response is to assess risk for immediately adjacent cages only – this is logical only if exposure is likely much lower in cats elsewhere in the ward.

Quarantine:

Cats that are both meaningfully exposed and at-risk must be strictly quarantined to prevent continued spread of disease. If a full ward has been exposed and all cats are considered at risk, it may be most efficient to simply shut down that ward to new admissions for the quarantine period. If exposed/at-risk cats are scattered throughout the building, gather them together into an area of the shelter that can be easily cleaned, allows individual cat monitoring (one litter or cat per cage), and can be effectively segregated from the rest of the building.

If there is no separate place to quarantine cats within the shelter, consider closing the shelter to new intakes during the quarantine period and quarantining cats on site. It may be easier to set up an off site location or short term agreement with a local veterinary facility to permit emergency admissions to continue during this time. Well-informed foster homes with the ability to adequately monitor and segregate cats may also be an option, especially when the risk of illness is considered relatively low.

Any area where cats are quarantined must be able to be thoroughly cleaned and disinfected - no carpet, furniture, wood, grass, etc. Foster parents should be counseled carefully about the need to prevent contamination of their homes, as well as the serious prognosis should the cats become ill.

Precautions for quarantine:

- Minimize handling of cats during quarantine – ideally provide compartmentalized housing in quarantine areas
    - If this is not possible, assign one carrier per cat in quarantine areas
- Wear appropriate personal protective equipment aka PPE (lab coats or smocks, boots or shoe covers, and gloves)
- Use shoe covers or dedicated boots. Foot baths are not effective.
- Use supplies (brooms, feeding carts, scrub brushes, etc.) dedicated to quarantine and used only in that room
- Change gloves or thoroughly wash hands between handling quarantine cats
- Handle cats in quarantine after caring for healthy cats or have

separate staff dedicated to care for the cats in quarantine
- Quarantine precautions should be maintained for 14 days. Although most cases will become evident within the first 7-10 days, it is very sad to go through all the effort of a ten day quarantine, only to have a cat break with signs on day 11 and have to start all over again!

Serum for exposed/unvaccinated cats

For kittens and cats that were *not vaccinated prior to the time of exposure*, vaccination after exposure will likely have little benefit. However, vaccination will not harm the kittens, and vaccine schedules should be maintained as usual in exposed kittens that are not ill.

Passive protection from serum transfusion has been shown in puppies exposed to canine parvovirus. Therefore, it may be that in *exposed, unvaccinated* kittens, 2 mls of serum from an immune cat given SC or intraperitoneal soon after exposure may provide some protection[4]. Serum donors should be cats from a known source and free of infectious disease; ideally, serum donors should be blood typed. If not using serum from known specific pathogen free cats, the risk of transmitting FeLV from cats with regressive infections should be balanced against the risk of panleukopenia infection. If serum transfussion is performed, vaccination should be delayed by 2-4 weeks, and continued 2-4 weeks longer than usual.

Cleaning and disinfection

As noted above, FPV can remain viable for months to years, especially in a dark, moist environment[5]. Happily there are products now available that reliably inactivate FPV even on porous or unsealed surfaces.

Bleach has long been a standby product for inactivating FPV. Products in the same family as bleach that have also been found effective against FPV include calcium hypochlorite (e.g. Wysiwash®) and sodium dichloroisocyanurate (e.g. Bruclean®). However, all products in the bleach family have the significant disadvantage of being inactivated by organic material and offering limited penetration on porous surfaces. These products are fine to use on surfaces such as stainless steel or sealed floors, but choose one of the other options below for surfaces such as scratched plastic, unsealed concrete, wood, carpet, etc.

Potassium peroxymonosulfate[11] (e.g. Trifectant® or Virkon) and accelerated hydrogen peroxide[12] (e.g. Accel/Rescue®) both have greater detergent properties and better activity in the face of organic

matter compared to bleach and related products. Accel/Rescue in particular has been shown to have good activity even in the face of organic matter contamination. Either of these can be used in carpet cleaners on contaminated carpets and furniture (always check first to test for staining).

Other important information about disinfection:

- Quaternary ammonium disinfectants (e.g. Triple Two, Parvosol, Roccal) do not reliably kill FPV[6,7,8]
- Alcohol hand sanitizers do not kill FPV
- Use and change gloves or wash hands well with soap and water after handling suspect cases
- Routinely use a disinfectant proven effective against FPLV daily at least during known high risk periods; preferably use at all times (you never know)
- Eliminate swapping of cages and carriers without thorough cleaning between cats
- For wood, plastic and other porous material that cannot be eliminated, disinfect with Accel/Rescue® or Trifectant®
- Think about other contaminated areas during an outbreak, especially if FPV has spread widely. Ensure that carriers in animal control vehicles, intake areas, and other common contact surfaces are also disinfected
- Known heavily contaminated areas should be cleaned, then disinfected thoroughly before being reopened to cats – repeating the process 2-3 times may be helpful to ensure that every nook and cranny is covered. However, there is no need to close areas off for any set time period. If cleaning/disinfection is effective, it is safe to open the area immediately. If not, no amount of waiting will be sufficient, as the virus persists for months to years.

*** Notes on bleach:** Bleach must be applied to a clean surface to be effective and thus disinfecting with bleach is always a two-step process. 5% household bleach should be freshly diluted at 1:32 (1/2 cup per gallon). Correct dilution is very important: too weak is ineffective, too strong is overly corrosive and irritating to cats and humans. Bleach remains stable ~200 days when undiluted, and ~30 days after dilution provided it is stored in a light proof container[9,10] since it is rapidly inactivated by light.

Treatment

Treatment is the same as that in a private practice setting, including anti-emetics, broad spectrum antibiotics to control secondary infections, fluid

therapy and blood product transfusion as needed. Treatment of FPV infected animals should only be undertaken in a shelter when sufficient facilities exist to isolate the patients such that the rest of the population is not put at risk and staff and veterinary oversight is adequate to ensure humane and appropriate care.

Other options include treatment at an off-site veterinary clinic or transfer to another shelter with sufficient facilities. Unless specifically set up for FPV treatment, foster and rescue homes are generally better used for quarantine of exposed animals rather than treatment of ill cats and kittens.

If facilities or staff are insufficient and off-site options are not possible, euthanasia of infected animals may ultimately save lives by preventing continued spread.

Reintroduction of recovered animals

Viral shedding can continue for up to ~14 days following recovery from clinical signs thus isolating recovered animals for an additional two weeks is the safest option to limit spread within the shelter. Socialization is still required for kittens during this period, making prolonged isolation a potential challenge for many shelters.

A negative FPV SNAP test is suggestive that significant quantities of virus are no longer being shed. In practice, SNAP testing recovered kittens/cats and moving the negative animals to adoption is relatively low risk, especially if these animals can be housed separately from other kittens and recently vaccinated adults (or immediately adopted into a home meeting these same criteria).

Adopters should be asked to observe a voluntary two week caution period in which their new pet is not exposed to other kittens or unvaccinated adults. Exposure to vaccinated adults is fine.

Bathe recovered animals prior to re-introduction to a shelter in order to remove virus persisting on the coat. There is no contra-indication to performing surgery on recently recovered animals. Continue vaccinating kittens following the normal revaccination schedule; although recovery from FPV infection will confer long term immunity, protection is still needed against the other agents included in the multivalent vaccine.

Cat Intake

Cat intake should be minimized until exposed/at risk cats are evaluated

and transferred to quarantine or out of the shelter and any necessary cleaning is performed. If kittens are out in foster care, return to the shelter should be discouraged if possible. Ideally, they should be adopted through off-site events or directly out of the foster home. If returned to the shelter, kittens should be vaccinated at least a week prior to return. If cat intake must be continued, designate one clean area of the shelter for this purpose.

Facts about Panleukopenia for the Public

- Local veterinary hospitals, other shelters and rescue groups should be notified of the occurrence of FPV in the community
- FPV is a highly infectious viral disease. Signs include diarrhea (sometimes bloody), vomiting, lethargy and fever, and death. It can range from mild diarrhea to fatal disease.
- Diarrhea in an otherwise bright, alert, eating, drinking kitten is more likely due to diet change, stress, parasites, or dietary indiscretion.
- Because it is so contagious, cats that were potentially exposed to FPV should be quarantined in an easily cleaned area for 14 days to make sure they are not going to come down with it.
- If a high risk exposed cat is in a household with other kittens or unvaccinated adults, it should be kept strictly separate or brought back to the shelter for the 14 day quarantine period.
- FPV is part of the vaccine series recommended for all cats and provides excellent protection. Adult cats that are current on their vaccinations are at minimal risk for this illness.
- And...what your shelter's policy will be regarding what to do if an adopter's newly adopted cat develops clinical signs or comes down with FPV: Whom to call, who will pay, etc.

Other Resources

Infectious Disease Management in Animal Shelters – chapter 12

Dr. Karsten's slides from the 2015 CVC in Washington DC presentation on CPV and FVP

ASPCApro Webinar – Panleuk 101

Animal Sheltering Magazine – Canine and Feline Parvovirus: what you need to know

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