Feline Infectious Peritonitis (FIP) in Cats & Kittens
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FIP is a viral disease of cats that can affect many systems of the body. It is a progressive disease and almost always fatal. It is found worldwide and affects not only domestic cats, but many wild ones as well, including cougars, bobcats, lynx, lions, and cheetahs.

What causes FIP?

FIP is caused by a virus. Cats can be infected with feline coronavirus (FCoV). There are two types of this virus which cannot be distinguished from each other in laboratory tests. One is avirulent (does not cause disease) or only mildly virulent and is called feline enteric coronavirus (FECV). Infection with this virus does not produce any signs other than maybe a very mild diarrhea. The other type is virulent (produces disease), is the cause of FIP, and is called feline infectious peritonitis virus (FIPV). It is believed that FIP occurs when FECV mutates to FIPV in the cat and starts to replicate in the cat's cells. What causes this mutation is unknown.

How common is FCoV infection and the development of FIP in cats?

Studies have shown that approximately 25-40% of household cats, and up to 95% of cats in multi-cat households and catteries are or have been infected with FCoV. The development of fatal FIP occurs in 1 in 5000 cats in households with one or two cats. In multi-cat households and catteries 5% of cats die from FIP.

How is the virus transmitted?

FCoV can be found in the saliva and feces of infected cats. Therefore, cat-to-cat contact and exposure to feces in litter boxes are the most common modes of infection. Contaminated food or water dishes, bedding, and personal clothing may also serve as sources of infection.

FCoV may possibly be transmitted across the placenta. The significance of this is unknown.

FCoV can live in the environment 3-7 weeks. After 3 weeks, however, the number of virus particles present is probably too small to cause infection. Many disinfectants will kill the virus, including household bleach diluted 1:32 in water (1/2 cup of bleach per gallon of water).

How does the virus cause disease?

When a cat is exposed to FCoV, four things can happen, depending on a number of factors including age, health status, and strength of the cat's cellular immune system. The strain and dose of the virus can also influence the outcome.

Mammals' immune systems can be divided into two parts: the antibody-producing part, and the part in which cells kill invaders through direct contact or chemicals they produce. It is this second part of the immune system, the cellular immune system which plays a very important role in determining the result of exposure to FCoV.

1. If a cat's cellular immunity is very strong, the cat can usually fight off the infection.
2. If a cat's cellular immunity is moderately strong, the cat may be unable to kill all the virus, but is able to keep it in check. This results in a "latent" infection. If the cat is severely stressed or becomes ill from other diseases, the latent infection can be reactivated and the cat can develop FIP.
3. If a cat's cellular immunity is relatively weak, the virus continues to multiply slowly, FIPV becomes the predominant virus and FIP develops. In this form of disease, called "dry FIP" nodular lesions called granulomas slowly develop in one or multiple places in the body.
4. If the cellular immune system is very weak, the virus can multiply virtually uncontrolled. A "wet" form of FIP develops. In this form, large amounts of fluid accumulate in the chest and abdomen due to damage to blood vessels and subsequent leaking of fluid and protein into the surrounding tissues.

The damage to the body from FIPV is not so much due to the virus itself, but to the body's response to it. Complexes of FIPV and antibodies the cat produces against it are deposited on the walls of blood vessels. Macrophages, which are cells that eat cellular debris and foreign material, consume the virus and the virus replicates inside these cells. These macrophages are also deposited along blood vessels and in tissues. When they accumulate in large numbers they can form granulomas.

Which cats are more likely to develop FIP?

As you would imagine, the cats most likely to develop FIP are those with the weakest immune systems. This includes kittens, cats infected with feline leukemia virus (FeLV), and geriatric cats.

The largest number of FIP cases occurs in young cats. Kittens are often infected when they are 4
A negative test could mean:

- The cat was exposed to FCoV (either FECV or FIPV) and has eliminated the virus
- The cat was exposed to FCoV and is a carrier
- The cat was recently vaccinated against FIP
- The cat was exposed to FCoV and has developed FIP

A negative test could mean:

- The cat has not been exposed to FECV or FIPV

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The cat is infected with FIPV but is so early in the disease process antibody is not yet detectable

The cat is infected with FIPV but can no longer make antibody

The cat is infected with FIPV but all the antibody that is made is bound in complexes to FIPV and is not detected by the test

The test was not sensitive enough to detect the antibody present

How is FIP diagnosed?
Because we cannot rely totally on the antibody test for a diagnosis, we must combine the history, clinical signs, laboratory results, FCoV test result, and possibly radiographs to come to a "probable" diagnosis. The only way to be absolutely sure of an FIPV infection is to biopsy affected tissues and have them examined by a veterinary pathologist. As a result, most often the diagnosis is made after the cat has died, a postmortem examination has been performed and tissues have been examined.

In an attempt to try to make the best diagnosis we can while the cat is still alive, we can follow these criteria for a cat with clinical signs of FIP:

1. The cat has a low number of lymphocytes: $1.5 \times 10^3$ cells/µl.
2. The cat has a positive FCoV test result (titer $> 1:160$).
3. The cat has elevated globulins in his blood $> 5.1$ gm/dl.

If the cat meets all three criteria, the probability the cat has FIP is 88.9%. If the cat does NOT meet all three criteria, the probability the cat does NOT have FIP is 98.8%.

In those cats who have fluid in the thorax or abdomen that can be analyzed:

- If the gamma globulin fraction in the fluid is greater than 32%, the chances that the cat has FIP are almost 100%.
- If the albumin fraction is greater than 48% or the ratio of albumin to globulin is greater than 0.81, it is almost 100% certain that the cat does NOT have FIP.

From this discussion, you can see that a certain diagnosis of FIP is not made very easily. Remember, the "gold standard" for diagnosis of FIP is through microscopic examinations of biopsies (a procedure called histopathology).

How is FIP treated?

There is no cure for FIP. A survivor of FIP is very rare. We can give the cat supportive care which will make her more comfortable and possibly extend her life for a short amount of time. Because the dry form of FIP progresses more slowly, cats with this form can sometimes live longer than those with the wet form. This is especially true if the eye is the only organ affected by granulomas. Cats who have an appetite, no neurological signs, and no anemia usually respond better to the supportive care.

Supportive care includes:

- Periodic draining of abdominal or thoracic (chest) fluid in those with the wet form. If the fluid is drained too often, the cat loses large amounts of protein which can exacerbate the condition.
- Fluid therapy
- Quality nutrition
- Antibiotics for secondary bacterial infections
- Blood transfusions in cases of severe anemia

Cats with FIP are often treated with prednisone at an immunosuppressive dose of 2-4 mg/kg daily to decrease the virus-antibody complexes in the blood vessels. In cats with eye involvement, ophthalmic solutions containing corticosteroids, and injections of steroids into the inner side of the eyelid (conjunctival sac) can be used.

Research is ongoing to find other immunosuppressive drugs that may slow down the course of the disease. Attempts are also being made to find antiviral drugs that will kill or slow down the replication of the virus.

How is FIP prevented and controlled?
Managing a Cattery or Multi-cat Household:

- Litter boxes should be kept clean and located away from food and water dishes. The litter should be cleaned of feces daily and totally removed at least once weekly when the box is thoroughly cleaned and disinfected.

- Cats should be divided into families with 4-5 cats per group and kept separate from each other. These groups should also be divided according to age, with cats less than 4 months old separated from older cats.

- Newly acquired cats and any cats that are suspected of being infected should be separated from the other cats.

- Caretakers of the cats must use extreme care to make sure they are not bringing contaminated clothing, dishes, or other articles from one area to another. In general, kittens should be cared for first, and any suspect animals cared for last to minimize possible transmission to those most susceptible.

- Eliminating FeLV from all cats is important.

- Using the FIP test to identify potential carriers or immune animals is NOT possible.

Managing Litters:

- Pregnant and nursing queens should be kept separate from all other cats in the cattery (only one litter per room).

- If the queen is suspected of being a carrier, kittens should be weaned and removed from the queen at 4-6 weeks. They should also be kept separate from other cats in the cattery.

- Queens who repeatedly produce litters of kittens which eventually die of FIP should be removed from a breeding cattery.

Vaccination:

There is currently only one licensed FIP vaccine available. Primucell FIP, produced by Pfizer Animal Health, is a temperature-sensitive, modified-live virus vaccine that is given as an intranasal vaccine, and is licensed for use in cats at least 16 weeks of age. The vaccine appears to be safe; however, this vaccine has minimal if any effectiveness in preventing FIP, and it is not generally recommended by the American Association of Feline Practitioners Feline Vaccine Advisory Panel. Cat owners should consult their veterinarian to help them decide if their cat should be vaccinated.