Feline infectious peritonitis

Understanding the condition, its diagnosis and its treatment: a guide for caregivers

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Feline infectious peritonitis (FIP) is a disease of cats that can develop from infection with feline coronavirus. Previously fatal, it is now treatable with antiviral medications. This is a rapidly evolving area so information is likely to be updated regularly.

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What is feline infectious peritonitis?

Feline infectious peritonitis (FIP) is a serious illness affecting cats, but it develops from a common feline coronavirus infection that is usually harmless. Feline coronaviruses only affect cats, and not people, and many cats will be exposed to the virus, particularly if they live with other cats. Moreover, most cats will be exposed to feline coronavirus at multiple points in their lives.

The coronavirus is passed from cat to cat in faeces (poo) by accidentally eating it (eg, following grooming of paws after a visit to a shared litter tray) and in most cases causes no signs of illness or only mild diarrhoea that quickly resolves. However, in a small number of cats, mutations (changes) in the virus together with the way the cat's immune system reacts can lead to FIP, a fatal disease if not treated.

Which cats develop FIP?

FIP is seen most commonly in young cats (less than 2 years of age), and pedigree (purebred) cats seem more likely to develop the disease. Cats living in environments with other cats (such as breeding or shelter establishments) are at a higher risk, as are cats who have recently had a stressful experience (eg, going to a new home, a visit to the veterinary clinic for routine treatment). However, any cat can develop FIP at any time.

What are the signs a cat has FIP?

Signs of FIP can be variable between cats as the virus and resulting inflammation can affect any area of the body. Many of these signs are also seen in cats with other conditions, so simply having these signs does not confirm FIP. Conversly, not having a particular sign does not rule it out. The terms 'wet' and 'dry' FIP are used to describe cats with FIP with or without fluid build-up in their chest or abdomen, respectively. However, many cats with FIP will have signs of both 'wet' and 'dry' types when they develop FIP if investigated extensively.

The most common signs include:

- Lethargy (tiredness, lacking energy, not playing)
- Eating less and losing weight (or for kittens, not growing as quickly as expected or compared with siblings)
- A high temperature/fever (which can come and go)
- Vomiting or diarrhoea

Other signs that may be seen include:

- Fluid build-up in the abdomen (resulting in a swollen belly) (Figure 1)
- Changes in the eyes such as cloudiness, redness (Figure 2) or pupils (black part of the eye) of different sizes
- Neurological signs (walking with a wobbly gait, twitching, trembling, having fits)
- Difficult or rapid breathing
- Yellow, pale gums (Figure 3) (urine may also turn from a pale yellow to a dark yellow to brown colour)

These signs might appear to come on relatively suddenly or may sometimes develop over weeks to months.

When examining a cat, the veterinarian may feel a lump or other abnormalities in the abdomen or notice other findings that lead them to suspect FIP.

Figure 1: A cat with a distended (swollen) belly due to fluid caused by FIP. Courtesy of Sam Taylor

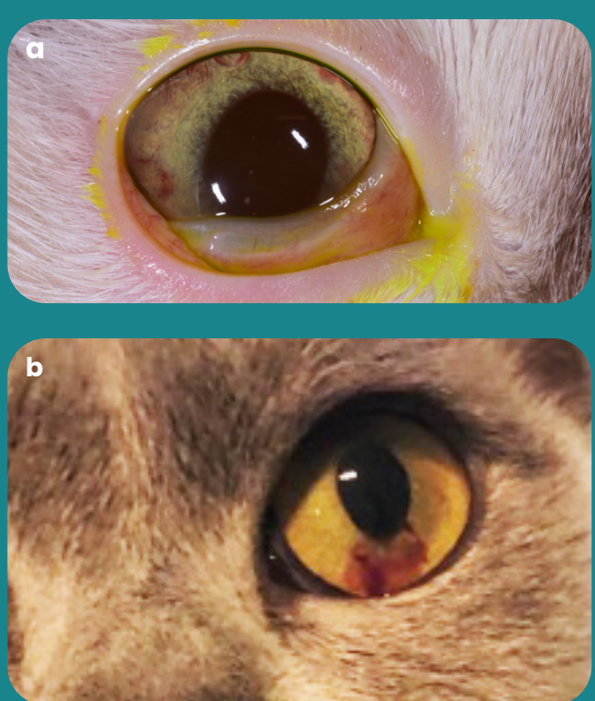

Figure 2: Cats with (a) an abnormal iris (the coloured part of the eye) due to inflammation and (b) severe changes in the eye (cloudiness, bleeding) due to FIP. Courtesy of (a) Petra Černa and (b) Sam Taylor

Figure 3: A yellow colour to the gums can be a sign of FIP. Courtesy of Sally Coggins

How is FIP diagnosed?

Diagnosing FIP is like piecing together a jigsaw puzzle. No single clue is enough on its own, but when the clues (eg, clinical signs, test results) are put together, the picture can become clearer.

The first pieces of the puzzle come from what the caregiver notices at home and what the veterinarian finds on examination. Results of blood tests and scans then add more detail, helping to raise or lower the level of suspicion for FIP, while also ruling out other diseases that can mimic or occur alongside it.

Common blood changes may include high total protein levels, particularly globulins (although albumin is often normal or low due to inflammation), low red blood cell counts (anaemia), signs of inflammation (altered white blood cell counts) or high bilirubin (which may cause yellow gums), although not every cat will display these signs. Some cats with FIP will have normal blood tests.

Imaging scans, such as ultrasound or X-ray (or less commonly CT or MRI), might then be recommended, as these allow the veterinarian to search for fluid or areas of disease. Sampling any abnormal fluid or organs with abnormalities (this may be possible using fine-needle techniques, or sometimes a surgical biopsy is taken) adds another important piece of the puzzle by showing whether the body is reacting with the inflammation typically seen in cats with FIP (called 'pyogranulomatous inflammation').

Sampling any fluid (Figure 4) or abnormal areas within organs is also a vital step to help further rule out mimicking diseases such as cancers, or other infections or inflammatory disorders.

The final, most convincing piece of the puzzle is finding coronavirus in the abnormal fluid or affected organ. This can be by:

- PCR testing, which detects the genetic material of the coronavirus directly in the fluid or tissue (not recommended for diagnosis solely on blood or faeces).
- Immunohistochemistry, which uses special stains to show the coronavirus within inflammatory cells under the microscope.

These two tests are the 'clincher' that turns a suspected diagnosis into a confirmed diagnosis of FIP.

Figure 4: Fluid found in the chest or abdomen of cats with FIP is typically yellow and sticky. Courtesy of Sam Taylor

Laboratory tests that are less helpful for making a diagnosis of FIP

Some tests are less helpful for diagnosing FIP, and these include 'coronavirus serology (antibody testing)', which is a test that shows a cat has been exposed to coronavirus. As coronavirus is so common, many cats test positive but do not have FIP.

Additionally, PCR tests for coronavirus in faeces or blood are not helpful as many healthy cats shed the virus in faeces or have it transiently (for a short time) in their bloodstream without ever developing FIP.

Treatment trials

In some situations, it is not possible to completely confirm a diagnosis of FIP before starting treatment. This might be because the cat is very unwell and needs urgent treatment, test results are inconclusive or taking certain samples could be associated with higher risks. Even so, it remains very important to rule out other conditions as much as possible. This means carrying out at least basic blood tests and checking for, and sampling, any fluid present. Without this, a cat could end up on FIP treatment when they actually have a different disease, and their health may consequently keep getting worse.

It is also now recognised that some cats with FIP may have another disease at the same time, such as additional infections, heart disease or diseases where the immune system attacks the body by mistake. This means it is important that they are checked for other problems, as these might change the way the cat is treated.

If a cat starts an FIP treatment trial, closely monitoring their response is vital. If the cat does not have a significant clinical improvement within a week, it is even more important to be checking for other diseases or problems.

Treatment of FIP: antiviral medications

In the past, there was no effective treatment for cats with FIP. However, antiviral medications are now widely available and successful. The types of antiviral available vary between countries but include GS-441524, remdesivir, EIDD-1931 and molnupiravir, as well protease inhibitors such as Paxlovid and GC376.

Oral antiviral medications (tablets or, if available, liquid) can be given from the first day of treatment to cats with all forms of FIP. For cats with FIP who have very severe neurological (brain) signs who cannot swallow safely, or who are extremely unwell and hospitalised in the veterinary clinic, remdesivir, if available, may be injected intravenously (directly into the blood).

The veterinarian will decide the appropriate dosage (amount per kg or lb of the cat's weight and how often) of antiviral to give, and the dosage may need to be adjusted according to how the cat responds; higher doses are typically recommended for cats with neurological signs. Importantly, the amount of antiviral given should be increased as the cat gains weight/grows so that the dosage remains the same. *Note that caregivers should handle molnupiravir and EIDD-1931 wearing gloves and not handle these at all if pregnant. Medications must always be kept away from children.*

Sources of medication: where to obtain medications for FIP

Medications to treat FIP should be obtained via prescription from a veterinarian. This means the medication is correctly labelled, tested for quality and guaranteed to contain the correct amount of the specified antiviral drug, allowing an accurate dosage to be given. It is possible to buy antiviral medications from other sources such as the internet.

However, publications have shown that such drugs contain different amounts of antiviral agent and their quality varies enormously, which could negatively affect a cat's response to the drugs or, at worst, be dangerous for the cat. If a veterinarian is unclear on the availability of antiviral drugs in their country, they can contact their medicines authority, regional feline medicine group (**icatcare.org/about-us/international-partners**) or email **fipadvice@gmail.com** (this is an email address for veterinarians only) for help with availability.

Length of treatment course

To date, most cats with FIP have been treated with antiviral medication for 12 weeks.

However, some cats may be suitable for a shorter 6-week course if they respond rapidly and completely to treatment. This will be decided by the veterinarian after 2–4 weeks of treatment and if test results are normal and no fluid remains. If there is any doubt about response, or the cat has ocular (eye) or neurological (brain and spinal cord) signs, the longer course may be recommended.

Side effects of medication

The antiviral medications precribed by veterinarians to treat FIP are well tolerated by cats. Side effects may include changes in blood test results (elevated liver enzymes, changes in white blood cells) that generally do not require any treatment or discontinuation (stopping) of the medication. Remdesivir and GS-441524 cause pain if injected under the skin because of their low pH (acidic) and so giving medication in this way is not recommended unless it is the only treatment option. Molnupiravir and EIDD-1931 can cause some hair loss, whisker loss or folding of the ears and are more likely to impact white blood cells, hence why monitoring blood tests are particularly important during treatment. All side effects should resolve when stopping the medication. Molnupiravir and EIDD-1931 can cause developmental abnormalities in humans, but while potential damage to growing bone and cartilage has also been shown in some animal studies, this has so far not been investigated in cats. Uroliths (stones in the urinary tract) have been occasionally reported, primarily with GS-441524. If a treated cat shows signs of straining to pass urine or blood in the urine, veterinary advice should be sought.

Treatment of FIP: other medications and nutrition

As well as antivirals, other treatments may benefit cats with FIP. Many affected cats have lost weight and are not eating well, and appetite stimulants and anti-sickness drugs can improve the amount of food they eat until they start to feel better (treatment is often not needed for more than 5 days). Some cats should have a tube inserted to provide food while they recover (Figure 5) and medication can also be given through the tube. If a feeding tube is recommended, more information and video guides can be found in International Cat Care's Cat Carer Guide, 'Managing a cat with a feeding tube', available at **icatcare.org/resources/cat-carer-guides**.

Figure 5: Sometimes placing a tube to provide food and medications can support the recovery of a cat with FIP. This image shows a cat with an oesophagostomy tube. Courtesy of Sam Taylor

Cats with seizures (fits) may need specific medications and cats with changes in their eyes may need drops. FIP may cause pain and so veterinarians might prescribe painkillers initially that can be stopped once a cat shows improvement. Generally, drugs such as corticosteroids are not needed but these are sometimes prescribed for cats with ocular or neurological signs. Occasionally, cats with FIP will have other complications such as anaemia or inflammation of the heart muscle (myocarditis). These cats may need other treatments in addition to antivirals, such as corticosteroids or diuretics.

Cats with FIP do not need a specific diet, but it is important they eat well and receive a quality diet, complete with all the nutrients required by cats. Appetite may be reduced initially, and cats might need to be tempted with their favourite foods. When eating well, the cat's diet should be chosen according to their age and requirements. Nutritional supplements are not needed if a cat is eating a good quality diet.

Tips for giving medication

Treatment for FIP needs to be given for several weeks; however, giving medications to cats can be difficult. Tips to help include:

- Trying both tablets and liquids (if available) to see which is easier to give to the cat
- Adding the medication to a treat (eg, liquid paste or mouldable treat; different flavours and textures can be tried) (Figure 6)
- Removing food for a short period before offering the treat/medication to ensure the cat is hungry
- Trying to associate giving medication with positive experiences; for example, following with treats without medication, stroking, brushing or providing a toy to play with (if enjoyed by the cat)
- Giving medication directly into the mouth (after demonstration by the veterinary team)
- Giving cats with poor appetite an appetite stimulant, which can help encourage them to take treats and medication

Figure 6: Antiviral medication can be given in a treat or small amount of tasty food. Courtesy of Sam Taylor

Putting medication in a main meal should be avoided as it can be difficult to see how much has been eaten. Caregivers struggling with giving medication should contact their veterinary team as soon as possible so they can provide help and support. More information can be found on the International Cat Care website at **icatcare.org/articles/how-to-give-a-cat-medication**

Monitoring a cat being treated for FIP

Cats with FIP should show signs of improvement (increased appetite and activity levels) within 3–5 days of treatment starting; if they are not improving, they should be re-examined by the veterinarian. It can be useful to keep a diary or record of medications given, appetite, weight (digital scales for babies or animals, which can be purchased online to use at home, work well for cats [Figure 7]) and any other signs the cat is showing to discuss with the veterinary team. Caregivers can measure around the cat's belly with a tape measure as a way of monitoring fluid. The veterinarian will likely monitor the cat with:

- Repeat examinations (eg, to check temperature, eyes, neurological signs)
- Blood tests
- Body weight measurement
- Fluid assessment (eg, with an ultrasound to check fluid is disappearing)

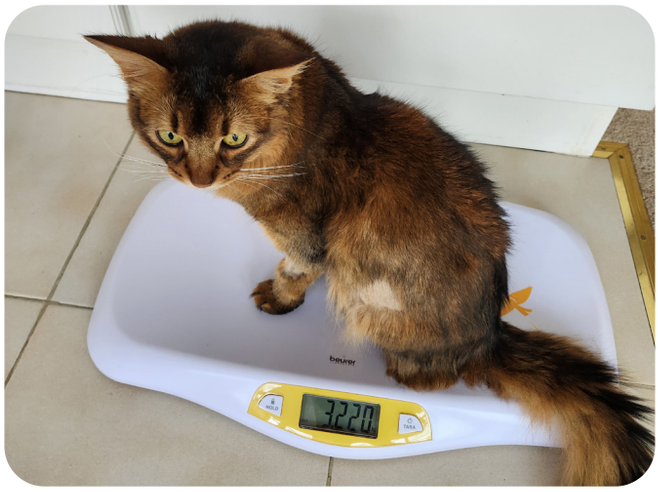

Figure 7: It is important to weigh cats being treated for FIP at least once a week as their weight can go up and affect the amount of medication they need. Weighing cats at home can reduce the need for trips to the veterinary clinic and scales like this are inexpensive. Courtesy of Sam Taylor

The frequency of monitoring will vary between cats and should be discussed with the veterinary team. Test results should be normal before stopping the antiviral medication.

Success of treatment for FIP

Research has shown that most cats (around 85%) will respond well to treatment. These cats appear to be cured and go on to live normal lives. However, it is possible for a small proportion of cases to 'relapse' and show signs of FIP again; this is often within a couple of weeks of completing treatment, although this can also occur during treatment. In this situation, the veterinarian should review the diagnosis of FIP and the dosage of medication; many cats can be successfully treated with adjustments in their care and medication.

Preventing FIP

Preventing FIP occurring is difficult. A vaccine was previously available but is not currently recommended and coronavirus is very common worldwide. Some considerations include:

- Reducing stress by ensuring the cat's environment at home contains all the resources (food, water, sleep/resting areas, hiding spaces, vertical space, scratching posts, litter trays) the cat needs, and the correct number of each of these resources if it is a multicat household (one per cat plus one). Litter trays must be kept away from food bowls, and emptied and disinfected frequently. Information on reducing stress can be found on the International Cat Care website at **icatcare.org/articles/stress-in-cats**
- In breeding environments, avoiding breeding from queens or tom cats who have a history of producing kittens who develop FIP, and never breeding from cats who have recovered from the disease
- Avoiding overcrowding by keeping cats in small groups (eg, less than five cats) rather than having many cats in the same environment

Note that using antiviral medications to prevent coronavirus shedding (in faeces) is not recommended as cats are rapidly reinfected and this may result in antiviral drugs becoming less effective for the treatment of FIP in the future.

Frequently asked questions

Can my cat be neutered (desexed) while being treated for FIP?
Neutering is ideally performed a month or more after the treatment is completed but it can be performed towards the latter end of treatment if needed and the cat is well. Ideally, neutering will be performed in a Cat Friendly Clinic (see **catfriendlyclinic.org**) to reduce the stress of the clinic visit.

Can a cat being treated for FIP receive vaccinations?
Vaccination is important for preventing serious diseases. Ideally vaccination is given a month or so after completion of the treatment to avoid confusing a mild vaccine reaction with a relapse. The efficacy of vaccines given to cats during antiviral treatment is not known, although they are occasionally given if the cat is at high risk of infection from a vaccine-preventable disease (eg, from an outbreak in a shelter). Vaccinations should be discussed with the veterinarian according to the cat's lifestyle (indoor versus outdoors) and national regulations (eg, rabies vaccine).

Frequently asked questions continued

Can I worm a cat being treated for FIP and give a treatment for fleas?
Yes, appropriate parasite treatment and prevention is recommended.

Should the cat being treated for FIP be isolated from my other cats?
When cats are very unwell, they may benefit from being cared for in a smaller area away from other cats, but they are not a risk to the other cats and when they feel better they can be reintroduced.

When can I get another cat if one of my current cats has been treated for FIP?
It is important to reduce stress for cats who are recovering from FIP and introducing new cats can be a cause of upset in a home. It is sensible to wait at least 3 months after completing FIP treatment and ensure introductions are slow and following recommendations to avoid stress (information can be found on the International Cat Care website at **icatcare.org/articles/introducing-cats**).

One of my cats has FIP; should my other cats also be treated as they have been in contact?
FIP is not transmitted from one cat to another, and all the cats have likely encountered the same coronaviruses in the environment/home already. Cats without FIP should not be treated with antivirals. It is important to ensure there are enough litter trays (one per cat plus one) and that these are cleaned daily. Reducing stress in a multicat home is always recommended to reduce the risk of illnesses (information can be found on the International Cat Care website at **icatcare.org/articles/multi-cat-households**).

Should I give my cat my cat being treated for FIP any supplements?
If a diet designed for cats that contains all the necessary nutrients is being fed, there is no need to add additional nutritional supplements, and sometimes giving more tablets/liquids can cause stress. Similarly, there is no need to give supplements to, for example, protect the liver during antiviral treatment, as the antiviral treatments are known to work well alone. Any product a caregiver is thinking of giving should be discussed with their veterinarian.

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