

## Diagnosis of feline systemic viral infections (FIP, FeLV, FIV)

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### Feline infectious peritonitis (FIP)

What you need to know about the virus to understand the diagnosis

FIP is caused by feline coronavirus (FCoV). FCoV is ubiquitous and highly infectious but infection is most commonly limited to the GIT. It is hardy and will survive for several weeks in a dry environment. Transmission is faeco- oral (direct / via fomites). *There are different FCoV types. Type I and II vary in their tissue culture characteristics. Type II is thought to be a recombination of a type I virus with a canine coronavirus. You will also see references to two biotypes<sup>13</sup> - feline enteric coronavirus and FIP virus. This is misleading because there are NO SPECIFIC coronavirus strains that cause FIP.* All lab strains can cause FIP (though it appears some are more likely to than others)<sup>9</sup>.

Coronaviruses readily and frequently mutate. Any FCoV can mutate and if the right mutations happen, the virus can spread systemically. A cat may be infected with multiple mutants (particularly if it has developed FIP).

What you need to know about the pathogenesis to understand the diagnosis

Seventy percent of cats with FIP are less than 1 year old. Recent stress (moving home, surgery, boarding, co-infection with FeLV) is known to increase the likelihood of an individual developing FIP. In a breeding cattery, kittens are most commonly infected with FCoV by the mother at around 5-6 weeks of age. Some breeds (Persians) and some lines within breeds are more likely to develop FIP if infected with FCoV.

**Clinical signs of feline enteric coronavirus** infection are typically mild and transient (diarrhea, vomiting or both) or absent. Occasionally, signs can be severe / chronic and associated with respiratory signs, weight loss and / or stunted growth. Immunity to enteric infection is short-lived. This means that FCoV will be maintained in households with 10 or more cats because cats are re-infected as their immunity wanes.

To develop FIP the following needs to occur<sup>13</sup>

1. FCoV has to mutate so that it is able to infect macrophages (and not be destroyed by them). This occurs in about 20% of cats infected with FCoV. **You can find FCoV in circulating macrophages in animals with FIP as well as in cats that only ever have enteric disease.** Circulating FCoV may persist for months or even years in cats that have recovered from infection.
2. The cat's immune response has to be predominantly antibody-mediated before signs of FIP will develop. If the cat has an active cell mediated immunity it can eliminate the infection. Antibodies cannot inactivate virus in macrophages (they're not entirely sure why). Instead, antibodies against FCoV bind to systemic virus released by dying infected macrophages and facilitate uptake into an uninfected macrophage, propagating infection.
3. Macrophages infected with FIP adhere to blood vessel walls and cause a vasculitis. If severe, serum leaks causing effusions and wet FIP. If

milder, granulomas form affecting organ function resulting in dry FIP. Thus dry FIP is the consequence of a partially effective immune response to FCoV.

FIP is not infectious in a clinical setting. The mutated viruses causing FIP are very rarely shed in faeces. Even if they were, the above shows that you'd still need a poor cell mediated immunity and an enthusiastic antibody mediated response before FIP will develop. Occasional FIP outbreaks may occur with incidences between 5-50%. These are thought to arise from interplay of high stress, high population density or high prevalence of FeLV/FIV and other concurrent infections suppressing the immune system. Outbreaks seldom last for more than 6-12 months. Genetic predisposition may be involved in some cases and breeding with cats whose offspring showed a high incidence of FIP is not advised.

### **Clinical signs of FIP:**

1. Fever unresponsive to antibiotics +/- decreased appetite, weight loss
2. wet FIP: most commonly ascites, but also pericardial, pleural / scrotal effusions
3. Dry FIP: signs depend on where granuloma form, eg
  - Renal: enlarged irregular kidneys +/- azotaemia
  - Ocular: iritis (change in iris colour, anisocoria / change in pupil shape), uveitis (flare, keratic precipitates), chorioretinitis (retinal detachment, haemorrhage, change in colour in areas of tapetal fundus)
  - Mesenteric ln: enlarged nodes
  - Hepatic: raised liver enzymes, increased total bilirubin
  - CNS: ataxia, hyperaesthesia, nystagmus, seizures, behavioural changes and cranial nerve defects

### What you need to know about the tests to understand the diagnosis

**Albumin and globulin:** Albumin levels higher than globulin levels are incompatible with the disease pathogenesis and thus with the diagnosis of FIP. The higher the globulins, the more likely FIP becomes. Remember that haemolysis and lipaemia cause false increases in albumin levels - so check sample quality.

**Serum protein electrophoresis:** In cases with FIP, this shows a polyclonal gamma globulin spike with a much smaller alpha 2 peak. Electrophoresis will exclude a monoclonal gammopathy associated with B cell / plasma cell neoplasias. Modern capillary zone serum protein electrophoresis adds useful supporting evidence for the diagnosis of FIP if you also have high globulins, consistent signalment and clinical signs and consistent FCoV titres.

### **FCoV antibody levels**

- **More cats have been killed by coronavirus titres than by FIP**
  - Many cats with high coronavirus antibodies are healthy

**Very high titres (> 1600) in a cat WITH OTHER SIGNS OF FIP may be used to corroborate your case BUT should NEVER be used to diagnose FIP on their own.** Antibodies show ONLY that the cat has been exposed to FCoV, so has the potential to go on and develop FIP. Many completely NORMAL cats have high FCoV antibody titres. Some cats with FIP(esp the wet form) can have low / no FCoV antibodies - it is thought

that they're all bound to the virus so the test can't detect them. Cats with dry FIP usually have high titres.

**Analysis of effusion:** Effusions caused by FIP are typically clear, yellow and sticky (because of the high protein content) and clot on exposure to air. The TP is usually > 35 g/l, the total nucleated cell count < 5000 and the SG > 1.025. Cells in the effusion consist predominantly of macrophages, mildly degenerate neutrophils with some lymphocytes, plasma cells and mesothelial cells. The cytology is not specific but the absence of bacteria excludes peritonitis and the absence of a neoplastic cell population makes lymphoma unlikely. The albumin: globulin ratio in the fluid is < 0.8.

**NB Wet FIP and lymphocytic cholangitis can present with identical signs**

FIP	Lymphocytic cholangitis
Typically < 2 years old, can be older	Typically 2-4 years old, any age possible
Yellow sticky, high protein, low cell count ascites	yes
Fluctuating fever	sometimes
Icterus possible	yes
Raised liver enzymes, bile acids, total bilirubin and globulin	yes
Anaemia, neutropenia, lymphopenia	yes

**But lymphocytic cholangitis will not result in a pleural effusion**

Many cats that ostensibly survived infection with FIP probably had lymphocytic cholangitis instead. These two conditions can only be differentiated reliably on hepatic biopsy.

**PCR:** run through MDS (call 031 2677000 or you can submit the samples via Idexx)

There is no single consistent mutation / common gene that is found ONLY in FCoV causing FIP. Many cats with only enteric disease have FCoV in macrophages. Even quantitative PCR is not able to separate cases with FIP and enteric coronavirus disease reliably. Coronavirus is an RNA virus and is susceptible to being broken down by RNase enzymes during transport to the lab- thus false negatives can also occur.

**Real time-PCR** could be considered in the following specific situations

- On abdominal fluid: to identify coronavirus in macrophages within a typical FIP effusion.
- On faeces: to identify chronic shedders in a cattery (repeated samples necessary as is careful sample handling to prevent false negatives)

**Fluid alpha-1 acid glycoprotein:** You'll see this test discussed in the references. It is an acute phase protein that is often elevated in FIP ... and other conditions associated with severe inflammation. Normal levels would make FIP very unlikely. I couldn't find anywhere to run this test in SA though.

**CSF analysis:** This is only slightly useful in cats with neurological signs. A dry tap is common. FIP cats will have raised CSF total protein and cell counts. Antibody levels to FCoV in CSF are expensive and not specific<sup>13</sup>.

**Histopathology:** Lesions on H+E staining are highly suggestive if present, but the diagnosis should be confirmed with immunohistochemistry. As lesions are not evenly distributed, random tru-cut biopsies may miss the lesions. Positive

immunohistochemistry on **fluid** macrophages confirms FIP. You can't exclude FIP based on a negative result as there may just be insufficient virus in the macrophages you collected. **Immunohistochemistry on histopath samples is the gold standard test.** Immunofluorescence (frozen tissue required) is 5-10 times more sensitive than immunoperoxidase (formalin fixed tissue is fine)

### Likelihood of ante mortem diagnosis of FIP <sup>1</sup>

Very UNLIKELY if	Supportive evidence	Few diseases other than FIP cause	Definitive diagnosis
Serum albumin > globulin or albumin: globulin >0.8	Fever (lethargy and anorexia) that does not respond to antibiotics	Clear yellow sticky ascites	Immunostaining on macrophages in effusion positive (false negatives do occur, not available in SA)
Effusion has TP < 30 g/l	Young cat, multicat environment and recent stress	Globulins > 70 g/l	Immunohistochemistry on macrophages in granulomas in tissue biopsies
Effusion cytology shows bacteria / lymphocytic effusion	Affected relatives	Serum (if globulin high) / effusion protein electrophoresis	(Clear yellow sticky thoracic or pericardial effusion in a cat with consistent signs and signalment)
Effusion highly cellular	Renal masses	Effusion albumin: globulin < 0.45	
Alpha one acid glycoprotein is normal	Iritis, chorioretinitis, Anterior uveitis, retinal detachment	Increased total bilirubin in the absence of decreased Hct, and in the absence of increased liver EN	
	High coronavirus antibodies		
	Mesenteric lymphadenopathy		
	Focal, multifocal / diffuse neurological signs		
	Increased globulins, albumin: globulin < 0.45		

### Feline leukaemia virus (FeLV)

What you need to know about the virus to understand the diagnosis

Once a cat is infected, DNA copies of the FeLV virus RNA are inserted into the cat's own DNA - particularly in cells in the bone marrow and lymphocytes. Once incorporated, virus DNA is replicated every time the cell divides.

There are the following FeLV subgroups:

FeLV A	the only subgroup able to infect a cat	Less pathogenic. Causes haemopoetic neoplasia
FeLV B	Formed when FeLV A mutates / combines	Causes tumours and

	with host DNA or DNA from other retroviruses. Retroviruses in the cat's genome are inherited and cannot cause disease on their own	leukaemias
FeLV C		Causes non-regenerative anaemia, erythemic myelosis
FeLV T	Evolved from FeLV A. T cell tropic	Causes lymphopenia, neutropenia and severe immunosuppression

Before FeLV tests and vaccines were available, FeLV was thought to cause 1/3 of all feline neoplasms and be responsible for even greater numbers of deaths because of the anaemias and immunosuppression it induces. In the USA and Germany, infection rates have halved since the introduction of vaccines.

What you need to know about the pathogenesis to understand the diagnosis

FeLV is most effectively spread in saliva. Healthy infected cats shed as many virus particles as clinically ill ones. FeLV has been found in fleas and their faeces, so fleas could serve as a mechanical vector. Iatrogenic transmission via needles, surgical instruments or transfusions containing infected blood is possible. Transplacental infection is possible.

The virus is labile and is inactivated within a few seconds of exposure to the environment which means that

- close contact is necessary for infection to occur
- environmental decontamination is not necessary before introducing a new cat into a household where a cat has died from FeLV related disease

Variable susceptibility to infection:

- Young cats (< 4 months) are MUCH more likely to become persistently infected than adult cats
- Immunosuppressed cats are more likely to develop a persistent viraemia
- The risk of a cat developing a persistent viraemia after a single contact with an infected cat is around 3%. The risk of a cat in close contact with a persistently viraemic cat becoming persistently viraemic itself is around 30%<sup>5</sup>

After FeLV enters a new host, the following can happen:

1. The virus may be cleared before it can replicate. This is called an **abortive infection**. No virus can be detected by any means.

2. If the immune system does not inactivate the virus immediately, it is integrated into host DNA - initially into lymphocytes and macrophages in the thymus, spleen, lymph nodes, as well as into the salivary glands. Cats at this stage can shed virus and can infect other cats. PCR for proviral DNA on whole blood detects circulating integrated virus. When the virus starts replicating, it needs to synthesize RNA so it can make new virus envelopes. This is what the PCR for viral RNA in serum / plasma detects<sup>7</sup>. Soluble p27 antigen is part of the virus envelope and is released into circulation. This p27 antigen is what the bench top tests (ELISAs and Rapid immunomigration tests (RIM)) look for. The PCR test is much more sensitive than the benchtop tests.

A proportion of cats are able to control the infection, limiting viral replication. This is called a **regressive infection**. The provirus usually remains integrated in the DNA of

some cells. Viral RNA and proviral DNA loads decrease markedly and the ELISA/RIM becomes negative. In the majority of cases this happens within 6 weeks of infection and it would be unusual for a cat to be able to control the infection after it has been infected (and ELISA/RIM positive) for 4 months.

3. When cats cannot control the infection, and usually from about 3 weeks post infection, the virus infects the bone marrow. Virus isolation (VI) detects virus in the bone marrow. FeLV infects granulocyte precursors and megakaryocytes and can thus be found circulating in neutrophils and platelets. The direct immunofluorescence test detects virus in these cells. Once infection has reached this stage, the vast majority of positive cats will remain **persistently infected**. Persistently infected cats will be ELISA/RIM positive, VI positive and have high viral RNA and proviral loads on PCR - continuously.

4. The few cats that are able to clear the viraemia AFTER the bone marrow has become infected, remain **latently infected ie the virus persists in the bone marrow**. By definition, latent infection refers to cats with FeLV DNA in the bone marrow that are ELISA/RIM negative. We used to think that they cleared the viraemia completely, but the advent of the more sensitive PCRs has shown that this is not the case<sup>7</sup>. Thus cats with a regressive infection and those with a latent infection differ only in that someone has shown that the individual with the latent infection has FeLV in the bone marrow.

In a small proportion of cases with regressive / latent infection, the virus can become **reactivated** during periods of stress, immunosuppression or pregnancy. These cats shed virus again and can develop FeLV associated disease. Experimentally, reactivation is more difficult the longer the time interval from the initial viraemia and is almost impossible 2 years after infection<sup>5</sup>. It is possible that latent infections contribute to myelosuppressive disease or malignancies in ELISA / RIM negative cats.

	Virus in cell DNA	Virus RNA in serum in first 1-3 months	Virus RNA in serum after 3 months	ELISA / RIM positive	Virus isolation from bone marrow
<b>Abortive infection (rare)</b>	No	Possible, but unlikely to detect without PCR	No	No	Negative
<b>Regressive infection</b>	Yes	Yes, may have high loads	Yes, markedly decreased	Possible initially but negative within 2-4 mo, can be reactivated	negative
<b>Latent infection</b>	Yes	Yes	Yes, markedly decreased	Possible initially but negative within 2-4 mo, can be reactivated	positive
<b>Progressive infection</b>	Yes	Yes	Yes, high viral loads	Yes	positive

**Clinical signs** associated with FeLV infection:

- lymphoma and lymphoid leukaemias
- fibrosarcoma - through recombination of FeLV A with cellular oncogenes
- immune-mediated haemolytic anaemia, thrombocytopenia or neutropenia
- pancytopenia
- pure red cell aplasia - associate particularly with FeLV-C infection
- immunosuppression: the most common secondary infections associated with FeLV are FIP, haemotropic mycoplasma, coccidiosis and upper respiratory tract infections
- diarrhea
- neurological signs may be the result of CNS lymphoma. In addition, anisocoria, mydriasis, central blindness, Horner's syndrome, hyperaesthesia, abnormal vocalization, paresis and urinary incontinence may develop without an obvious CNS infiltrate

What you need to know about the tests to understand the diagnosis

### 1. Benchtop tests (ELISAs and Rapid Immunomigration (RIM) tests:

The tests look for soluble p27 virus antigen in the serum<sup>10</sup>. They may give you a false positive because the test didn't work ie the test says the cat is infected when actually it isn't. You can also get transiently infected cats that are able to control the infection and will not become ill (the regressive infections above). In this case, the test worked, but the cat will recover. You can generally rely on a negative result. You need to treat a positive result with caution, particularly if you're testing a population where the disease is rare eg healthy cats prior to vaccination.

If a test is positive in a clinically healthy cat

- Repeat immediately with a different test system to exclude false positive as a result of test issues (eg haemolysis, anti mouse antibodies, fairy). You could also use a RT-PCR for provirus to determine whether there were technical issues with the benchtop test.
- Repeat ELISA/RIM in 4 months to exclude transient viraemia ie a regressive infection.

### 2. PCR: run through MDS (call 031 2677000 or you can submit the samples via Idexx)

PCRs can be used to look for

a. Provirus incorporated into circulating WBC. Real time PCRs will also quantify viral load. PCRs for provirus can be used to corroborate a positive ELISA/RIM. This is the version that MDS usually run.

b. viral RNA in blood. If you find viral RNA in a cat's blood, it means that the virus is replicating. Cats with regressive infections retain circulating proviral DNA, but the virus does not replicate. If you ask MDS nicely, they could do this for you too.

Indications:

- Excluding technical error esp. with a positive ELISA / RIM test in a healthy cat
- Excluding a false negative e.g. A patient has disease related typically associated with FeLV but is ELISA/RIM negative eg lymphoma, chronic gingivitis, RBM disorders
- Population screening: it is possible to pool samples from up to 30 cats for PCR if you want to screen populations at reduced cost

### 3. Direct fluorescent antibody (not available in SA)

This test is performed by reference laboratories on good quality blood smears made from blood WITHOUT anti-coagulant. The fluorescent antibodies bind to p27 virus protein associated with neutrophils and platelets. These cells are only infected in persistently infected cats. It takes at least 3 weeks after infection for these infected cells to appear. The sensitivity of the test is significantly lower than the bench-top tests, particularly in leucopenic animals. The **specificity for persistent infection is very high**: The likelihood of a transient cell associated viraemia is between 3-9%.

**4. Virus isolation (VI):** (the only place that may run it for you in Onderstepoort IF they have a research project running at the time)

This was the original gold standard for confirming infection. It can be performed on blood / bone marrow. False negatives are rare and it is the first test that will detect virus after infection. It is laborious, time consuming and costly and is only available in reference labs.

#### **5. Antibody tests**

These are not reliable / useful. Many cats develop antibodies to their own endogenous FeLV. Cats inherit endogenous FeLV from their parents in their DNA. Endogenous FeLV are not infectious and can cause disease only if they recombine with a new FeLV-A infection. FOCMA (feline oncornavirus associated cell membrane antigen) antibodies were thought to be associated with tumours triggered by FeLV, but this was later found to be inaccurate.

What you need to know about vaccination to understand the diagnosis

**FeLV vaccination does not affect the diagnostic tests because the tests look for VIRUS not for antibodies.**

**Vaccinated cats can still become infected with FeLV.** The risk is reduced, but it is difficult to quantify by how much. Vaccine technology varies between brands so their efficacy is likely to vary too. There is insufficient information in the public domain to decide which vaccine is likely to be most effective.

#### **Feline immunodeficiency virus (FIV)**

What you need to know about the virus to understand the diagnosis

FIV is a lentivirus related to HIV. There are 5 different subtypes or clades (A-E) that are defined by the gene sequence in their envelope (env) gene<sup>14</sup>. This has no relevance for diagnosis but a great deal of relevance for vaccine production and efficacy. FIV is an RNA virus that gets incorporated into host DNA - much like FeLV.

What you need to know about the pathogenesis to understand the diagnosis

As with HIV, transplacental transmission is possible, as is infection via the milk from an infected queen. **Different to HIV: the most important means of transmission between adult cats is thought to be via bites.**

As with HIV there is a lag period between infection and positive test results- because antibodies that the test detects have to be synthesized. This usually takes 2-4 weeks. As with HIV, **once the cat is infected it is not going to recover.** As with HIV, FIV evades the immune system by constantly mutating. As with HIV, the asymptomatic period between infection and AIDs can span many years (up to 8<sup>14</sup>). In some infected

cats, the terminal AIDs phase never develops<sup>8</sup>. During the asymptomatic period, there is already a steadily increasing disruption of the cat's immune responses (decreased proliferation of lymphocytes, decreased response to cytokines, apoptosis esp of CD4 cells, hyperglobulinaemia).

**Clinical signs** of acute infection are usually mild and are typically not noticed, but could include malaise, fever and generalized lymphadenopathy. The lymphadenopathy sometimes persists for weeks<sup>8</sup>. Clinical signs during the terminal phase include

- Opportunistic infections e.g. Babesia felis, Toxoplasma, FIP
- Tumours e.g. lymphoma, leukaemias
- Myelosuppression
- Neurological disease (rare) - this is isolate dependent and specific eg behavioural changes, paresis, seizures, multifocal motor deficits, disrupted sleep. Neurological signs may also develop as a consequence of opportunistic infections like FIP, toxoplasmosis or cryptococcosis
- Ophthalmic disease may be primary or consequence of secondary infections: primary changes include anterior uveitis, glaucoma, focal retinal degeneration and retinal haemorrhages

**Stomatitis may occur at any stage of the infection**

What you need to know about the tests to understand the diagnosis

**Bench top tests:** These **detect antibody** by ELISA / RIM. Usually, detectable amounts of antibody form within 2-4 weeks post infection. If only small amounts of virus were introduced it may take up to 10 weeks for a cat to seroconvert (and in rare experimental cases up to 6 months!). Generally, the tests look for antibodies to the p24 capsid protein. The SNAP test apparently looks for 2 different antibodies<sup>6</sup> but I couldn't find out which these were.

Generally you can rely on a negative result. A negative result can catch you out early in the course of the disease (ie before the animal has seroconverted - again think HIV) and in the terminal stages because high viral loads may bind all the antibody, leaving none available to bind to the test antigen<sup>8</sup>. Positive results in clinically healthy cats should be confirmed by another means. This is to eliminate test / operator error. Transient infections DO NOT OCCUR. NB because the test looks for ANTIBODY, kittens born to infected queens may test positive for 4 (rarely up to 6) months because they absorbed colostral antibodies<sup>8</sup>.

**Western Blot:** (not available in SA)

This is considered the gold standard serological test. It detects antibody so will not differentiate infected and vaccinated cats. It can be used to eliminate operator / technical error with the in-clinic tests.

**PCR:** will detect virus in plasma / peripheral lymphocytes from 2w post infection. PCR was touted as the ideal way to differentiate infected and vaccinated cats, but recent papers<sup>2,3</sup> showed that different PCRs varied markedly in their accuracy in separating these 2 populations. A PCR run by a molecular laboratory at UC Davis was about 90% accurate. Two PCRs run by commercial labs identified only 44 - 51% of vaccinated cats correctly<sup>3</sup> - as accurate (but more expensive) than flipping a coin. In general, available PCRs detect clade A viruses well and the others variably<sup>8</sup>. MDS has a PCR that

looks for proviral FIV incorporated into circulating white blood cells. The thought is that vaccine virus will not multiply so should not integrate into host cell DNA.

More recently, a Japanese group claimed to be able to differentiate vaccine induced antibodies from those triggered by natural infection by serology <sup>11,12</sup>. This is not available commercially in South Africa to my knowledge.

VI: Will detect virus from 2w post infection in heparinised blood. The test takes 2-3 weeks to run. This test is not available routinely in South Africa - if desperate, contact Prof Mouritz van Vuuren at Onderstepoort and see whether he has a research project running.

What you need to know about vaccination to understand the diagnosis

Vaccination triggers the synthesis of antibodies. The benchtop tests look for antibody - thus **vaccinated cats will test positive with your in clinic tests**. There is no practical means in South Africa to differentiate vaccinated and infected cats.

The vaccine was shown to prevent between 0 - 100% of infections depending on the number of cats in the groups, the challenge strain, the dose used and the route of exposure (more effective when challenge was performed with vaccine strains)<sup>4,15,16</sup>. This means that vaccinated infected cats are a very real possibility.

	FeLV	FIV
<b>Benchtop tests</b>	ELISA- Idexx SNAP Combo rapid immunomigration (RIM) - the rest	ELISA -Idexx SNAP Combo rapid immunomigration (RIM) - the rest
<b>Benchtop tests look for</b>	Antigen ie the virus (p27) - free in serum	Antibody
<b>ELISA</b>	Serum or plasma better than whole blood	Serum or plasma better than whole blood
<b>Lab tests</b>	Direct fluorescent antibody: looks for p27 in neuts and PLT Virus isolation (confirms) PCR (confirms)	Western blot: serology Virus isolation (confirms) PCR Japanese ELISA: to differentiate vac and infected
<b>Effect of previous vaccination on results</b>	none	Vaccinated cats will usually be positive
<b>Minimum age for first test</b>	any	After 12 weeks to allow maternal antibodies to wane. After 6 mo to be safe
<b>Interpretation of positive result</b>	May be transiently infected. Retest in 3 months if no clinical signs	Assuming unvaccinated, positive result means cat is and will remain infected
<b>Lag between exposure and positive result</b>	At least 1 month, ideally 3 months	At least 2 weeks, up to 10 weeks (6 months in exceptional cases)
<b>Most likely signalment</b>	Cat from an untested colony / multicat household	Entire tom cat

### Further reading

1. FAB (Feline advisory board - run by Bristol vet school) cats website: <http://www.fabcats.org>
2. Dr Dianne Addie (based at Glasgow Vet school and has done extensive research on FIP: <http://www.dr-addie.com/>

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