Biogal Laboratories and www.catvirus.com present:

Feline Coronavirus and Feline Infectious Peritonitis Diagnosis and Prevention

Diane D. Addie
PhD, BVMS, MRCVS
May 2020

PART 1: FCoV AND FIP DIAGNOSIS

Feline infectious peritonitis (FIP) is caused by infection with feline coronavirus (FCoV), which is an RNA virus. There are two types of FCoV: Type I is purely feline, Type II FCoV strains arise by recombination with canine coronavirus (CCoV).

Herrewegh et al 1998; Terada et al, 2014

KEY MESSAGE: FOR FIP TO DEVELOP, FCoV INFECTION MUST OCCUR: IF YOU CAN PREVENT FCoV INFECTION, YOU PREVENT FIP.

FCoV transmission is faecal-oral, primarily through sharing litter trays, and from cat litter fomites. Virus transmission is mainly indirect, not direct.

Videos for further information on FCoV transmission (watching these films counts towards your continuing education: these films are suitable for practice waiting room monitors)

English: http://www.youtube.com/watch?v=rkqUjeQNEQs
French: http://www.youtube.com/watch?v=JrnopBFAr8A&feature=plcp

Virus shedding: cats shed virus in their faeces from about 2-3 days post-infection. Kipar et al, 2006
Type I FCoV shedding persists for weeks to months. Addie et al, 2001 & 2003 The duration of Type II FCoV shedding is unknown, but based on experimental infections, is likely about 2 weeks.

Around 13% of cats infected with Type I FCoV become persistently infected, carrier cats. Addie & Jarrett, 2001

FCoV shedding is detected by reverse-transcriptase polymerase chain reaction (RT-PCR) testing of a faecal sample.

[The majority of cats exposed to SARS-CoV2 infected people do not get infected but in those who do, virus shedding begins 2-5 days post-exposure and the duration of SARS-CoV2 shedding by cats is 4-5 days. Halfmann et al, 2020] The median duration of SARS-CoV2 shedding by humans is 18 days in respiratory secretions, 22 days in faeces. Zheng et al, 2020

Seroconversion to FCoV occurs at 18-21 days post-infection.
Initial FCoV infection of kittens can cause diarrhoea, stunting or not be detected. In the majority of cats FCoV infection is not detected by their guardians although the trained eye will spot uneven litter sizes, stunting, or a history of diarrhoea. FCoV-associated diarrhoea ranges from minor and transient, to major, life-threatening and even fatal, Kipar et al, 1998 especially where there are co-infections with viruses, protozoa or pathogenic bacteria.

**Key messages:**

- Most cats who become infected with FCoV do **NOT** develop FIP.
- Most people who become infected with SARS-CoV2 do **NOT** develop severe acute respiratory syndrome.

**FIP:** up to 10% of FCoV-infected cats develop FIP—the figure is highest when kittens, with undeveloped immune systems, become infected: 70% of FIP is in purebred cats, probably because they become infected as young kittens when maternally derived antibody wanes between 5-7 weeks.

**Q:** Why does FIP mostly affect young kittens but SARS-CoV2 mainly cause serious symptoms in the over-eighties with co-morbidities?

**A:** The answer is to do with both groups having poor immune systems relative to healthy adults, and both tending to be in densely populated spaces where they are exposed to high virus doses and stress.

**SARS-CoV2** mortality varies considerably: as with all seasonal colds and flu, it is more severe in winter months. As with influenza, the majority of deaths occurred in the very old and those with severe pre-existing conditions. At time of writing (May 2020), 98% of infections are classified as mild, and only 2% as serious.

Countries where populations take hydroxychloroquine to prevent malaria had significantly fewer cases of SARS-CoV2 than northern countries; Ahmed 2020 hydroxychloroquine inhibits SARS-CoV2. Hydroxychloroquine and azithromycin, if given early in SARS-CoV2 infection, prevents progression to pneumonia. Million et al, 2020

[Could hydroxychloroquine be used in cats with FIP? I don’t know: chloroquine causes elevated ALT in cats and only extended survival of FIP cats briefly. Takano et al, 2013 Hydroxychloroquine is safer than chloroquine: Dr Takano in Japan is evaluating its use along with feline interferon omega to treat FIP, and in Australia Prof. Norris’ group is assessing mefloquine as a possible treatment. Watch the FIP treatment page of my website, www.catvirus.com, or go on my email list, for updates.]

**SARS-CoV2 can infect cats:** Idexx conducted a study of 4,000 pets (dogs, cats, horses) and all were negative by RT-PCR. However, some cats and dogs of human COVID-19 patients have tested positive: they have mostly been asymptomatic but some cats have had respiratory signs.

**FIP diagnosis**

In many viral infections, clinical signs are a result of the virus directly damaging the target cell. However, in FIP, FCoV takes over the cell which controls the immune response: the monocyte / macrophage and an abnormal pro-inflammatory immune response is the cause
of the disease. Similarly, in SARS-CoV2 infection mortality is due to the cytokine storm, rather than virus-induced cytopathic effect, and in that respect COVID-19 resembles FIP.

Clinical signs of FIP depend on the location and severity of vascular damage and peri-vascular pyogranulomata which is why FIP can present in so many different ways.

Cartoon video on FIP pathogenesis
http://www.youtube.com/watch?v=6RylI2LI9R9Q&feature=related

Due to time constraints in this webinar, diagnosis of FIP will necessarily be extremely brief and focussed on essential messages. However, on my YouTube channel, there is a series called “Does X Have FIP?” For example, “Does Pancho Have FIP?” “Does Tommy Have FIP.” These videos go into FIP diagnosis in considerable detail and count for continuing education time.

In my online FIP referral practice, people usually subscribe in order to discuss FIP treatment—I always insist that first we establish the diagnosis: 80% of cats from first opinion practices and 40% of cats from referral practices turn out to have some other condition, they do not have FIP.

“A wrong diagnosis can be far more devastating than no diagnosis.”
Prof. Mike Willard

Such erroneous FIP diagnoses have included toxoplasmosis, tumour, bacterial peritonitis or pleurisy, nutritional problems. One cat simply required a dental! These mis-diagnoses were sometimes made for the flimsiest of reasons: raised globulins (globulins rise in ALL infections!) or the presence of a FCoV antibody titre.

Key message:
A positive FCoV antibody test does NOT equate to a diagnosis of FIP: cats sick with non-FIP conditions can be co-incidentally antibody positive for FCoV.

FIP confirmation in a nutshell:

Effusive FIP: positive FCoV RT-PCR test on effusion

Non-effusive FIP: positive FCoV RT-PCR test on a mesenteric lymph node ultrasound guided fine needle aspirate

Key message:

Never do a FCoV RT-PCR test on blood—even if your veterinary laboratory requests a blood sample for this test.* Most cats with FIP will have a negative FCoV RT-PCR test on blood and 5% of healthy, or non-FIP sick cats, will be positive.

*Consider changing your laboratory if they know so little about FIP as to ask for blood for FCoV RT-PCR testing.

Although immunohistochemistry is considered the gold standard for FIP diagnosis, and is certainly what to do for a cat post mortem, it requires too invasive an intervention in the
living cat, and in practice, most clinicians accept that a positive FCoV RT-PCR test on an effusion, or—in non-effusive cases—mesenteric lymph node (MLN) fine needle aspirate (FNA), or aqueous humour, to be sufficiently diagnostic of FIP \cite{Dunbar19} to begin FIP treatment. A positive FCoV RT-PCR result on an effusion or MLN FNA is 96% specific for FIP: in my view that is sufficient evidence to begin specific FIP treatment, provided the cat ticks most of the boxes on the FIP diagnostic algorithm (free download from catvirus.com).

However, FCoV RT-PCR testing requires a wait of about one week, and you need some answers more quickly when faced with a sick cat.

A negative FCoV antibody test can quickly and inexpensively rule out a diagnosis of FIP but only IF THE TEST IS SENSITIVE ENOUGH (see below).

<table>
<thead>
<tr>
<th></th>
<th>IFA FCoV</th>
<th>IFA TGEV</th>
<th>ELISA</th>
<th>Rapid Immunomigration / lateral flow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biobest</td>
<td>VDS</td>
<td>EVNA</td>
<td>Zurich</td>
</tr>
<tr>
<td>Sensitivity %</td>
<td>96.1</td>
<td>100</td>
<td>96.2</td>
<td>100</td>
</tr>
<tr>
<td>Specificity %</td>
<td>100</td>
<td>100</td>
<td>97.5</td>
<td>83.3</td>
</tr>
</tbody>
</table>

Biobest Laboratories Ltd., Penicuik, Scotland.
VDS: Veterinary Diagnostic Services, University of Glasgow Veterinary School, Scotland.
EVNA: UMR 1161-Virologie-INRA-ENVA-ANSES, Maisons-Alfort, France.
Zurich: Clinical Laboratory, Vetsuisse Faculty, University of Zurich, Switzerland
FCoV Immunocombe, Biogal, Israel.
Speed F-Corona, Virbac, Nice, France.
FASTest FIP, MegaCor Diagnostik, Hoerbranz, Austria.
Anigen Rapid FCoV Ab Test Kit, Bionote Inc, Seoul, Korea.
Of all the in-house tests, the FCoV Immunocomb (Biogal) fared best in that study. I like the Immunocomb because it doesn’t require sophisticated laboratory equipment such as a plate ELISA reader; it only requires a fridge (to store the kit in) and the CombCam for reading the combs, which can be purchased from Biogal. I highly recommend you use the Biogal reader rather than trying to eyeball the results: we found poorer sensitivity and specificity in a previous study we conducted on the FCoV Immunocomb, probably because we relied on human observation of the result grey spots.

The less good sensitivity results of the in-house lateral flow / rapid immunomigration tests in our study could have been partly due to the fact that mostly effusions were used, rather than plasma or serum: virus in the effusion may have bound available antibody rendering it unable to bind with viral antigen in the test kits.

**Recommendation:** perform in-house FCoV antibody tests on plasma or serum, rather than on effusion or whole blood.

**IN USING THE FIP DIAGNOSIS ALGORITHM, DON’T BE TEMPTED TO SKIP THE CAT’S HISTORY STAGE**

**Key message:** for FIP to develop, a cat must become infected with FCoV.

I have diagnostic flowcharts for effusive and non-effusive FIP, as well as for FCoV diarrhoea and for using FCoV antibody and RT-PCR tests on the [www.catvirus.com](http://www.catvirus.com) website on the Downloads page. I know it’s time consuming to take a thorough history, so I have made printable question sheets that your clients can fill in in the waiting room: that is also available to download from the website. In the webinar, I gave an example of this Step 1 of the algorithm saving the life of a cat who had been diagnosed as having an FIP pyogranuloma in the brain: the cat was a teenage, ex-street cat living in a household with no other cats—he had had no opportunity to become infected with FCoV and his guardians realised that from Step 1 of the algorithm and questioned the diagnosis. The diagnosis (made in a UK vet school referral clinic) was wrong; the FCoV antibody titre had been a false positive. Following correct diagnosis, the cat was put onto chemotherapy, instead of being subject to painful GS-441524 injections for 12 weeks.

**Key message:** for FIP to develop, a cat must have had the opportunity to become infected with FCoV.

Most cats who develop FIP do so within the first 18 months post-infection, by 36 months post-infection, there is only a 5% chance of FIP developing. Therefore, it is not only important to establish that a cat could have become infected, but also if the opportunity was within the previous 3 years.

*[5 minute break for questions: note, all questions will be answered in a document uploaded to the Biogal website.]*
PART 2: PREVENTING FIP

Key message: if you prevent FCoV infection, you prevent FIP.

FULLER’S EARTH BASED CAT LITTERS CAN REDUCE BUT NOT ABROGATE FCoV TRANSMISSION
We found that bentonite-based (Fuller’s earth) cat litters abrogated FCoV transmission in vitro (i.e. in cell culture) but studies in two multicat households with endemic FCoV showed that virus transmission was reduced, but not abrogated. Addie et al, 2020 Dr Elsey’s Cat Attract cat litter performed the best. Lack of tracking is an important quality in minimising FCoV transmission.

Video on the cat litter study:
https://www.bitchute.com/video/JnxhgvQqo9Xq/
https://youtu.be/eEkOFXh8Xd4
Open source paper:
https://journals.sagepub.com/doi/full/10.1177/1098612X19848167

A FOUR TO SEVEN DAY COURSE OF MUTIAN PILLS STOPS FCoV SHEDDING
The percentage of cats shedding FCoV at any one time is very low in the general population, but can be very high in multicat environments such as rescue shelters, boarding and breeding catteries.

We heard about cat breeders who were experimenting with anti-virals in an attempt to stop FCoV shedding amongst their cats, sometimes with disastrous consequences for the cat. Following her discovery that Mutian could stop FCoV shedding, Ragdoll breeder, Sheryl Curran, who had a scientific training, approached me for advice about how to eradicate the virus from her cats. For years, Sheryl had been following my advice about keeping cats in small groups, testing them annually for FCoV antibodies, and she had managed to reduce the number of FCoV shedders in her household, but she was unfortunate in having quite a number of FCoV carrier cats. About 13% of cats who get infected with FCoV-infected become chronic persistently-infected virus shedders. Addie & Jarrett, 2001 I requested that Sheryl keep note of the drug dosages she was using, and take faecal samples from her cats daily which we tested by quantitative real-time reverse-transcriptase PCR (RT-qPCR), which detects FCoV RNA, to monitor virus shedding. In our study, 2mg/kg of Mutian stopped 8 of 10 cats shedding FCoV; therefore the dose was increased to 4mg/kg. Addie et al, 2020 (See table below for quantity of the active anti-viral, Mutian Xraphconn, in each capsule.)

Dose of Mutian to stop FCoV shedding: 4mg/kg for 4-7 days. For an average-sized cat of 4 to 5 kg, two Mutian 200 capsules (Nantong Biotechnology, China) given for 4-7 days stops FCoV shedding. In our study, 4 of 29 cats required a repeated course of Mutian to ensure clearance of the virus, Addie et al, 2020 therefore although a four day course of Mutian stopped most cats shedding virus, it could be prudent to use it for 5-7 days.

<table>
<thead>
<tr>
<th>Actual Mutian Xraphconn content</th>
<th>Dose for stopping FCoV shedding or treating effusive FIP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutian 200 10mg</td>
<td>1 capsule/2 kg sid</td>
</tr>
<tr>
<td>Mutian 100 5mg</td>
<td>1 capsule/1 kg sid</td>
</tr>
<tr>
<td>Mutian 50 2.5mg</td>
<td>1 capsule/0.5 kg sid</td>
</tr>
</tbody>
</table>
* For treating non-effusive FIP with intra-ocular presentation use 1.5 times the normal dose, and for neurological FIP use twice this dose, until haematological and biochemical values return to normal. Monitor biochemistry (especially ALT, SDMA) and urine SG in cats on long term high dose treatment.

**Key messages**

- **it is essential to do a post-treatment faecal RT-PCR test** to ensure that all of the cats are fully negative; otherwise a single missed cat will re-infect the other cats: FCoV is extremely contagious.
- **make sure faecal samples DO NOT have cat litter on them** or that could inhibit the PCR test leading to a false negative result.
- **use a laboratory that reports virus quantity and CONTROLS FOR FAECAL PCR INHIBITORS.**

Remember that Mutian is not legal in all countries and consult your professional body for advice about its use. In the UK, the RCVS advised me not to buy Mutian myself, but that monitoring and advising on cats being treated with it would not be problematic with our governing body. I’ve been advised that the situation in France is similar.

**ADDRESSING CONCERNS THAT USING ANTI-VIRALS TO STOP FCoV SHEDDING COULD LEAD TO VIRAL DRUG RESISTANCE**

[This section is not part of the webinar unless a question arises: it is included for your information only.]

First: using anti-virals at too low a dose, or too short a duration could theoretically lead to viral resistance to the drug; therefore the purpose of our observational study was to define a drug dose and duration of one popularly used anti-coronavirus drug so that proper guidelines would exist to discourage experimental, improper, use of the drug. The fact is that cat breeders all over the world were already experimenting themselves with various anti-virals bought online since the publication of the Pedersen anti-viral papers, which were open access. **Pedersen et al, 2018 & 2019**

Secondly, drug-resistant mutations are more likely to occur where there is a higher virus load and/or where the anti-viral has to be used for a long time, and cats who have FIP have much higher virus loads and require many weeks of treatment, compared with cats who basically mainly have FCoV infection of the gastro-intestinal tract. By preventing FIP, we are reducing the amount of anti-viral that is going to be used within the riskiest group for resistant viruses emerging.

Third: treating in-contact cats of cats who have FIP prevents re-infection of the FIP recovered cat and likely prevents at least some of the in-contact cats developing FIP, reducing overall drug use. For the same amount of drug for each cat being treated for FIP for 12 weeks, at least 12 asymptomatic FCoV-infected cats can be treated and prevented from developing FIP.

Fourth: it is erroneous to call a FCoV-infected cat without FIP a “healthy” cat, even in cats without FIP, this virus has adverse effects—we have seen weight gain in cats that we thought were asymptomatic FCoV-infected cats once we got rid of the virus; often their

---

1 This will likely mean using **Veterinary Diagnostic Services** (VDS), Glasgow, Scotland, UK. VDS receive samples from all over the world.
guardians and sometimes even their vets hadn’t realised that those cats were seriously underweight.

Fifth: over 90 cats have now received Mutian to stop FCoV shedding and we have not encountered drug resistance.

**DECREASING FCoV ANTIBODY TITRES CONFIRM RECOVERY FROM FCoV INFECTION OR FIP**

I believe that eliminating FCoV infection, especially in breeding catteries, will prevent a significant amount of FIP development, but one reviewer of our paper pointed out that I had not actually proven that to be the case! They were right. Therefore I am keeping in contact with the cat guardians and if their cats have leftover blood from any samples taken for any reason, I request a FCoV antibody test on the samples. It would not be ethical to request bloods to be taken specifically for this purpose, so at present I do not have enough data on this to prove or disprove my hypothesis. FCoV titres are falling in 3 asymptomatic FCoV-infected cats who were in the same household as a cat with FIP and were treated to prevent his re-infection and 3 other cats in another household are now seronegative for FCoV antibodies. Prevention of re-infection of a FIP-recovered cat is the main reason for people using Mutian to stop FCoV shedding; other reasons include treatment of FCoV-associated diarrhoea, and to prevent infection of kittens in breeding catteries.

For a FCoV antibody titre to persist in a cat, antigenic stimulation needs to be occurring somewhere in the body, therefore when a cat’s FCoV antibody titre decreases, it is reasonable to suppose that virus has been cleared from his or her body (unless of course the cat is on some kind of immunosuppressive treatment such as prednisolone, which will artificially cause the FCoV titre to decrease).

One thing is certain, that kittens born into FCoV-free breeding catteries are far less likely to develop FIP than kittens born into catteries with endemic FCoV, and if they go to a home with no other cats, they won’t be exposed to FCoV.

Sheryl Curran was the first UK cat breeder to eliminate FCoV from her household using Mutian capsules. She proudly shared photographs of the first litter of FCoV-negative Ragdoll kittens born into her FCoV-free cattery. To reduce her concerns about what could happen if her kittens encounter FCoV in their new homes she obtained a special permit to import the FIP vaccine, Felocell FIP (Zoetis), to try to give them protection in their new homes.

**THE TRUTH ABOUT THE FIP VACCINE: FELCELL FIP (ZOETIS)**

There won’t be time in the webinar to talk about the vaccine in detail, but I have made a video about it:

> For more information on the FIP vaccine, please watch my video: *The truth about the FIP vaccine:* [www.bitchute.com/video/v06NRacWVie8/](www.bitchute.com/video/v06NRacWVie8/)

Felocell FIP is an intra-nasal temperature-sensitive vaccine which must be given at at least 16 weeks of age in order to be effective. The second dose should be given 3 weeks later. Unfortunately, by 16 weeks of age, most purebred kittens are already infected, which means that the vaccine is of limited use in the largest demographic of FIP victims: young pedigree cats. It also means that it probably won’t work in shelter kittens, although it will protect many adult cats going into shelters.
An independent placebo-controlled study \cite{Fehr1997} showed that the vaccine was effective in FCoV naïve cats, but if the cat was already viraemic with feline coronavirus, the vaccine was unable to protect the cat, since its mechanism of action is to elicit local immunity in the nares and oropharynx, which is where cats are most likely to first encounter infection.

Now that two UK cat breeders have become FCoV-free, there is interest in vaccinating kittens who are born into these households to protect them from FIP in their new homes.

**Warning: an injected SARS-CoV2 vaccine could be dangerous**

Most attempts to develop an FIP vaccine failed because of antibody dependent enhancement leading to greater mortality amongst vaccinated compared with unvaccinated cats subject to the same virus challenge \cite{Vennema1990}.

The target cell for FCoV (and SARS-CoV2) is the monocyte / macrophage: antibody to the virus can enable the virus to enter the target cell, the monocyte, via the Fc receptor, and there is every reason to believe that that could also occur with a SARS-CoV2 vaccine, since it has hampered attempts to develop a vaccine to SARS-CoV1. \cite{Jaume2012,Liu2019}.

US vaccine manufacturers have lobbied their government to prevent them being sued in the event of vaccine side effects, which has led to a cavalier attitude to vaccine safety. One repeatedly hears Bill Gates calling for a guarantee that vaccine manufacturers not be held financially responsible for side effects induced by the SARS-CoV2 vaccines he wishes to inject into every man, woman and child on the planet \cite{Corbett2020}. Such an experiment on the human race is dangerous and unnecessary.

This is one area where I would hope that medics would learn from veterinarians. Personally, I would not accept any injected coronavirus vaccine, although I might consider an intra-nasal one when I reach my dotage (but not before!).

### FCoV antibody testing to prevent FCoV infection and FIP

A FCoV antibody titre of zero shows that the cat is not shedding virus (unless in the 3 week post-infection period prior to seroconversion). FCoV antibody testing is quicker and less expensive that RT-qPCR testing of faeces, but **to be used as an effective screen, sensitivity of the test is essential**.

Please watch a cartoon video of using FCoV antibody testing to protect one’s cats: [https://youtu.be/nDy1VPiA9z8](https://youtu.be/nDy1VPiA9z8)

Also see my blog on this subject: [https://www.biogal.com/blog/how-to-avoid-fip-in-your-cat/](https://www.biogal.com/blog/how-to-avoid-fip-in-your-cat/)

Many cat breeders test annually for FeLV and FIV infection, and it would be simple for them to add FCoV antibody testing to their annual screen. FCoV-free cat breeders can remain FCoV-free by insisting that cats or kittens they intend to purchase prove that they are FCoV antibody negative. Veterinary surgeons on the Falkland (Malvinas) Islands found that the cats there were FCoV-free and insisted that imported cats be FCoV antibody negative \cite{Addie2012}.

For such FCoV/FIP prevention strategies to be effective it is essential for the antibody test to be sensitive, because a false negative result could allow a FCoV shedding cat into the household or country, and for the virus to spread throughout the population.

*****
**Would you like to help a FCoV/FIP study?**

We are interested in the vaccination histories of cats with and without FIP: if you would be willing to share your practice results please contact our veterinary student, David Lee, on: davidleeUGA@gmail.com

We are interested in all kinds of vaccines, not just Felocell FIP. If you have experience of using Felocell FIP, we would also be keen to hear about that.

*****

**RNA Virus 101: Refresher on Mutation, Deletion, Insertion, Recombination**

[This section was omitted from the webinar due to time constraints.]

RNA viruses tend to vary genetically more than do DNA viruses because the latter have a proof-reading mechanism.

**Mutation:** a change in one or many nucleotides, which may or may not lead to a change in the amino acid coded for.

**Deletion:** loss of a section of RNA or DNA. Most deletions are probably fatal (to the virus), but not always—in systemic FCoV infection, part of the 3c gene can be discarded, leading to loss of the virus’s ability to replicate in the gut. Chang et al, 2013 This deletion explains why around 25% of cats with FIP no longer shed virus in their faeces. Addie et al, 1996

**Insertion:** this is when a viral genome acquires novel genetic material. An example of that having been done intentionally by scientists was published in Nature Medicine, when Menachery et al, 2015 deliberately inserted genetic code into the first SARS-CoV to confer upon it the ability to infect the human angiotensin converting enzyme II (ACE2) receptor. I have been unable to establish whether or not this laboratory-created virus is the virus we know as SARS-CoV2.

**Recombination:** this is when viruses exchange genetic material. Type II FCoV is an example of this: wholly feline Type I CoVs recombine with canine coronavirus (CCoV) to make Type II FCoVs, which, because they are new to the cat population, are frequently more lethal than Type I viruses, to which the cat population may have some herd immunity. Recombination is a problem for human health, in that emerging viruses, especially influenza viruses, frequently arise from the combination of large densities of animals in industrial farms in close contact with humans, allowing for the animal pathogens to jump species. Greger 2006

*****

**Useful Websites**

Diane Addie’s FCoV/FIP, FGS, blood typing and genetic conditions website: www.catvirus.com

To download the FIP/FCoV enteritis diagnosis algorithms: www.catvirus.com/downloads

Addie’s book for cat guardians: *FIP and Coronavirus*, available from Amazon: www.amazon.com/Feline-Infectious-Peritonitis-Coronavirus-Everything-ebook/dp/B00P8BNA0I/ref=sr

Biogal website: www.biogal.com
Queries about purchasing FCoV Immunocomb antibody test kit: email info@biogal.com.
Mutian website: www.Mutian.us
University of Glasgow Veterinary Diagnostic Services Laboratory: www.gla.ac.uk/schools/vet/cad/
SARS-CoV2 information online:
Obviously PubMed (https://pubmed.ncbi.nlm.nih.gov/) is the go-to for peer-reviewed papers on COVID-19 as well as FCoV /FIP.
There is also a website which publishes papers prior to peer review: www.medrxiv.org/
For latest numbers on SARS-CoV2: https://www.worldometers.info/coronavirus/
I recommend the YouTube channel of Dr Mike Hansen who is a thoracic specialist: (www.youtube.com/channel/UCMSsLqxqvZsNXi0Z-VjN89A).
SARS-CoV2 in domestic animals: https://www.avma.org/resources-tools/animal-health-and-welfare/covid-19/depth-summary-reports-naturally-acquired-sars-cov-2-infections-domestic-animals-and-farmed-or?fbclid=IwAR3FHl3wpZuy7aT0THY1cVUf_SsisvT5jMZJtunGsd73-PX82hNBdj94-A
SARS-CoV2 and cats ABCD guideline:

ONLINE VIDEOS
How FCoV transmission occurs:
   English: http://www.youtube.com/watch?v=rkqUjeQNEQs
   French: http://www.youtube.com/watch?v=JrnopBFAr8A&feature=plcp
FIP pathogenesis: http://www.youtube.com/watch?v=6RyI2LU9R9Q&feature=related
Cat litter video: https://www.bitchute.com/video/JnxhgQqo9Xq/
   https://youtu.be/eEkQFXh8Xd4
Preventing FIP by antibody testing: https://youtu.be/nDy1VPiA9z8
The truth about the FIP vaccine: www.bitchute.com/video/v06NRacWVie8/
In protest against YouTube’s censorship of many content producers, I release my videos first on Bitchute and am exploring producing my videos on freedom platforms such as Lbry and Pocketnet, at present I have only mastered uploading to Bitchute though.

Freedom of speech is a fundamental human right which many of our ancestors died to protect. Future generations depend upon our actions, and one method of non-violent non-cooperation with those who seek to control us is to leave their data-collecting social media such as Facebook, Google, Instagram, WhatsApp, Twitter and YouTube and to give our valuable attention time instead to platforms that endorse privacy, such as the DuckDuckGo search engine, Brave browser, MeWe, etc.

Contact: please do NOT try to contact me via Facebook; I am unlikely to reply to you for reasons given above. If you want to contact me, my email address is draddie@catvirus.com. If you want to refer your clients to me please direct them to the consultation packages on
the home page of catvirus.com and send me an email with your consent to contact your client (RCVS rules to which I am bound). If you would like to subscribe to my veterinary email list, email me with “Subscribe vet” as the subject.

ACKNOWLEDGEMENTS

Enormous thanks to Dr Len Small and Dr Yotam Copelovitz of Biogal Laboratories for arranging, sponsoring, and promoting this webinar. Especially I thank them for not influencing in any way the content of the webinar or these notes. I am grateful to Dr Albert Ahn for chairing the webinar so graciously.

None of my research could have been conducted without the amazing cat guardians and their veterinary surgeons who—for over 3 decades—have provided me with material from naturally-occurring FCoV and FIP cases for my research: I will be forever indebted to them. I will also be forever indebted to Prof. Os Jarrett for being brave enough to take on a PhD student who refused to experiment on laboratory cats.

I am sincerely grateful to the catvirus.com subscribers and donors who have funded the majority of my research, and recently have supported me personally as well.

REFERENCES


Corbett J. 2020. Investigative journalist James Corbett has also made a series of documentaries on Bill Gates: https://www.bitchute.com/video/wQSYdAX_9JY/ (the videos are also on YouTube, but will likely be censored and taken down shortly).


**EFFUSIVE FIP DIAGNOSTIC ALGORITHM**

1. **HISTORY: AGE BREED**
   - An opportunity for FCoV infection is essential
   - Around 70% of cats with FIP are pedigree
   - Any age, but over 50% of cats with FIP are < 2 years old (see table)
   - Usually a history of stress within weeks prior to presentation

2. **CAT PRESENTS WITH ABDOMINAL ENLARGEMENT OR DYSPNOEA**
   - Clinical examination reveals an effusion which may be abdominal, pleural, pericardial or scrotal.
   - Cats with effusive FIP may be bright or dull, sometimes anorexic, and are usually pyrexic

3. **IN HOUSE EXAMINATION OF THE EFFUSION**
   - **Appearance**
     - Straw coloured, clear, not odiferous, chylous
   - **Protein level**
     - >35g/litre
   - **Albumin:globulin ratio**
     - <0.8
   - **Bacteria, malignant cells or mostly lymphocytes**
   - **Cytology**
     - Neutrophils and macrophages
   - 93% unlikely to be FIP
   - **Rivalta test**
     - Negative
     - **PPV 58%**

4. **SEND EFFUSION TO VETERINARY LABORATORY**
   - Normal (<500ug/ml) rules out FIP
   - AGP Raised (>1000ug/ml) indicates infection
   - **FCoV RT-PCR test**
     - Negative
     - **Positive**

5. **FIP POSSIBLE**
   - The predictive value of a negative FCoV RT-PCR test on an effusion depends entirely on the sensitivity of the test being used

* It is essential to use only the most sensitive FCoV antibody and RT-PCR tests.
**NON-EFFUSIVE FIP DIAGNOSTIC ALGORITHM**

1. **HISTORY: AGE BREED**
   - An opportunity for FCoV infection is essential
   - Around 70% of cats with FIP are pedigree
   - Any age, but over 50% of cats with FIP are < 2 years old (see table)
   - Usually a history of stress within weeks prior to presentation

2. **CLINICAL EXAMINATION (any of the signs listed here)**
   - Persistent moderate pyrexia of over 4 days duration
   - Dull, lethargic, off colour
   - Weight loss or failure to gain weight normally, i.e. stunting
   - Anorexia / poor appetite
   - Intraocular signs (e.g. uveitis, keratic precipitates, aqueous flare, retinal vessel cuffing)
   - Neurological signs (e.g. ataxia, fits (seizures), nystagmus, paralysis)
   - Enlarged mesenteric lymph nodes
   - Icterus
   - Enlarged kidneys

3. **IN HOUSE EXAMINATION OF BLOOD**
   - Albumin:globulin > 0.8*
   - Globulin > 45 g/l
   - Bilirubin > 10 mmol/l
   - Haematocrit < 30%
   - Regenerative Anaemia
   - Non-regenerative
   - Normal Lymphocyte count
   - Lymphopenia
   - Negative FCoV antibody test**
   - Positive

   **Note that 15% of cats with FIP have alb:glob of 0.8, therefore I have written over (>) 0.8 here**
   **Use FCoV antibody test kits with best sensitivity available**

4. **VETERINARY LABORATORY**
   - Normal (<500 ug/ml) rules out FIP
   - AGP Raised (>100 ug/ml) indicates infection
   - Negative FCoV RT-PCR test on MLN FNA / aqueous humour
   - Positive ***

   **The predictive value of a negative FCoV RT-PCR test depends on the sensitivity of the test being used; the integrity of the RNA during mailing and that an FIP lesion was accurately selected**

5. **IS FIP**
   - Treat for FIP

* **Use FCoV antibody test kits with best sensitivity available**

**Addie et al, 2015**

**Positive FCoV RT-PCR on CSF does not equate with a diagnosis of FIP**
FCoV-associated diarrhoea diagnostic algorithm

1. HISTORY: AGE BREED
   An opportunity for FCoV infection is essential
   e.g. pedigree kitten; history of coming from a shelter, introduction of new cat or kitten: see Step 1 questionnaire

2. CLINICAL EXAMINATION
   Diarrhoea
   Possible stunting or weight loss
   Possible third eyelid protrusion
   Gassy abdomen possible
   Thickened large intestine possible
   Enlarged mesenteric lymph nodes

3. BLOOD SAMPLE
   Negative*  FCoV antibody test
   Check other parameters to see if FIP is a concern
   (see non-effusive FIP algorithm)
   Positive  FCoV enteritis possible

   FCoV enteritis unlikely: depends on sensitivity of test used

4. FAECAL SAMPLE
   Negative  FCoV RT-PCR
   Positive
   FCoV enteritis possible
   Be sure to rule out other bacterial, viral, protozoal, nutritional and parasitic causes
   Treat with Mutian pills or feline interferon omega and probiotics