

## FELINE INFECTIOUS PERITONITIS (FIP) AND FCOV INFECTION TREATMENT SUMMARY

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**Note: this download is intended for veterinary surgeons only and should NOT be used by cat guardians to attempt to treat cats themselves.**

These guidelines represent only the personal opinions of the author. For fuller explanations of each component, or to find the references, visit the FIP treatment page on the catvirus.com website.

### 1. DOUBLE AND TRIPLE CHECK THE DIAGNOSIS

Before commencing treatment, make absolutely certain that the cat has FIP: around 80% of cases presented to me as FIP turn out to have some other condition. Work through the [FIP diagnosis algorithm](#) and be sure that the cat ticks most of the boxes of all of the steps. If you are unsure about how to use the FIP diagnosis algorithm watch my YouTube video “Does Pancho Have FIP?”

**It is essential to ensure that the diagnosis is correct: immunosuppressive drugs will markedly worsen other conditions (such as bacterial peritonitis or pleurisy) and even be fatal in other cases, for example toxoplasmosis, leishmaniasis.**

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## **2. NUTRITION: this section applies to cats with wet or dry FIP; FCoV associated diarrhoea and asymptomatic healthy FCoV infected cats**

It is my opinion that feeding as varied and natural a diet as possible to cats with FCoV infection and FIP is essential: avoiding highly processed, pro-inflammatory grain-based, commercial foods (even the expensive so-called “veterinary” diets are usually cereal based).

Give real meat daily to augment arginine levels: even just a tablespoonful a day will make a difference. Or regularly use commercially available real meat based cat foods e.g. Applaws & Almo Nature (available from the Zooplus website in Europe: use [Zooplus link](#) on the catvirus website [links page](#) to obtain a discount).

### **Feed cats with FIP a little salmon, sardines, pilchards or other fish rich in omega 3**

Increase the anti-inflammatory omega 3 fatty acid content of the cat’s diet (i.e. add sardines, pilchards, salmon, mackerel twice a wk for 6 weeks). Both Applaws and Almo Nature have canned food including real fish. However remember the risk of hypervitaminosis A (excessive laying down of bone at the joints) so be wary of feeding too much real fish – reassess the situation after 6 weeks.

Remember to instruct the cat’s guardian in a gradual changeover of the food: to change it over a period of weeks otherwise the cat will wolf down the new food for a few days, then get sick of it and never touch it again! The way to introduce a new food is to give it for one meal, then go back to the customary diet for the next few meals, then give a little of the new food again, and so on, gradually increasing the frequency of the new foods, until giving a different food every meal becomes the norm for the cat. To introduce new foods gradually properly will take at least a month.

### **FCoV associated diarrhoea helped by chicken and pumpkin cat food**

I’ve had remarkable success using Applaws or Almo Nature chicken and pumpkin canned food in these cases. Applaws and Almo Nature are available from the Zooplus website in the UK and Europe: use the [Zooplus link](#) on the catvirus website [links page](#) to obtain a discount.

### **Probiotics**

Probiotics such as Protexin Pro-Kolin+ can help cats with FCoV associated diarrhoea. Use the Protexin powder from

[www.pets-megastore.com.au/protexinprobioticpowder250gms-p-1733.html](http://www.pets-megastore.com.au/protexinprobioticpowder250gms-p-1733.html)

## **3. CORTICOSTEROIDS / IMMUNOSUPPRESSANTS - given to both effusive and non-effusive FIP cases**

Cats receiving immunosuppressants should also receive antibiotic cover to protect them against other infections.

### **Prednisolone**

Prednisolone is the main immunosuppressant used in feline infectious peritonitis therapy, though unfortunately it suppresses both the humoral and cell-mediated immune response.

Prednisolone should never be used in cats with toxoplasmosis, or septic peritonitis or pleurisy, which is why cytology of the effusion is a very important part of FIP diagnosis, as there will be many more white blood cells in the effusion of a cat with sepsis, and a good cytologist will detect the bacteria or fungi.

**Dose:** 2 mg/kg/sid given by mouth, halving the dose every 10-14 days, right down to 0.5 mg/kg every other day or until an optimal dose for that cat is found (this will be the dose at which alpha-1 acid glycoprotein (AGP) levels have reduced to, and remain at, normal. (See the section below on monitoring treatment.)

### **Dexamethasone / injectable corticosteroids**

Dexamethasone (or other injectable corticosteroids) can be used to kick start the immunosuppressive treatment (or for cats which cannot be pillled). It can also be administered directly to the site of inflammation in effusive FIP cases.

**Dose:** dexamethasone 1 mg/kg intrathoracic or intraperitoneal injection on one occasion or every 5 days.

### **Thalidomide**

The rationale of using thalidomide instead of steroids in the treatment of feline infectious peritonitis is to reduce inflammation and the humoral immune response to feline coronavirus while leaving the cell mediated (anti-viral) immune response intact.

Be sure to obtain the owner's consent for using a drug not licenced for cats.

**Dose:** 50-100mg at night. CANNOT BE USED IN PREGNANT CATS as it is teratogenic.

## **4. EFFUSIVE FIP - treatment for cats with wet FIP**

Also see the effusive FIP staging table in section 6.

### **Drain the effusion to obtain most accurate diagnosis, give physical relief, and remove virus**

In addition to the treatments in 2 and 3 above and 8 below, drain off as much of the effusion as possible: you will be removing virus infected cells and the source of pro-inflammatory cytokines as well as giving the cat physical relief. In addition, you will learn a lot more for diagnosis from examining the fluid than from blood tests.

While you have your canula in the abdominal or thoracic cavity, you can administer dexamethasone and feline interferon omega directly to the site of the inflammation.

### **Recombinant feline interferon omega (Virbagen Omega, Virbac)**

Recombinant feline interferon omega (IFN omega) is available in many countries now. Once a vial is reconstituted, it will keep for up to 3 weeks at 4°C, or up to 6 months in a freezer.

**Dose:** give IFN omega initially into the abdominal or thoracic cavity (i.e. the site of the effusion) or subcutaneously at 1 MU\*/kg every other day, and then twice a week for however long it takes until remission is obtained.

### **Human interferon alpha**

In those countries in which Virbagen Omega is not available, treatment with human interferon can be attempted. Feline interferon is infinitely preferable to human interferon since interferon is species specific,

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\* MU = Million units

plus cats will mount antibodies to human interferon if injected. However, I know it isn't always easy to obtain, and human interferon may be better than nothing.

**Dose:** In effusive FIP 30 i.u./daily per os can be used, or larger doses of interferon can be given by intramuscular injection daily ( $10^4 - 10^6$  i.u. per day). By 6-7 weeks, if the cat is still alive, interferon will no longer work at this dose because the cat will make antibodies against it.

To obtain human interferon-alpha (Roferon or Intron A), write a prescription for your local pharmacist.

## **5. NON-EFFUSIVE FIP - treatment for cats with dry FIP**

See also Polyprenyl Immunostimulant

In addition to the treatments in 2 and 3 above and 8 below, treat the cat with feline interferon omega (Virbagen Omega).

**Dose:** 100,000 Units of feline interferon omega per day per os

### **Diluting Virbagen Omega**

Virbagen Omega (VO) comes in vials of 10 million units. It is reconstituted with 1ml of diluent. Using 10 x 1ml insulin syringes withdraw 0.1ml into each of ten 1ml syringes (you now have 1 MU of VO per syringe).

Freeze 9 of the syringes in a baggie (they will last up to 6 months in the freezer). Put 1 syringe content (0.1ml) of reconstituted VO IFN (which now has 1 million units of VO) into 4.9 mls of saline or water: this gives you 100,000 units per half ml. Give the cat 0.5 mls of the mixture daily on food, or gently squirted into the side of the mouth at the commissure of the lips, with the head gently tilted backwards to encourage swallowing. This diluted mixture will last up to 21 days at 4°C.

### **Human interferon alpha**

In those countries in which Virbagen Omega is not available, treatment with human interferon can be attempted. Feline interferon is infinitely preferable to human interferon since interferon is species specific, plus cats will mount antibodies to human interferon if injected. However, I know it isn't always easy to obtain, and human interferon may be better than nothing.

**Dose:** Non-effusive feline infectious peritonitis (FIP): 30 i.u./daily or for 7 days at alternate weeks given by mouth.

To obtain human interferon-alpha (Roferon or Intron A), write a prescription for your local pharmacist.

### **Ursodeoxycholic acid (Ursodiol; Destolit; Urdox, Ursofalk; Ursogal)**

Reduces bilirubin levels, TNF alpha, IL-6 and has antioxidant effects. However, no clinical trial has ever been published about whether or not it can improve survival of FIP cases.

**Dose:** 10 – 15mg/kg

### **S-adenosyl-L- methionine (SAME)**

Consider using SAME (e.g. Hepatosyl, Ceva; Denamarin) for its anti-TNF-alpha action. In combination with ursodeoxycholic acid, it can decrease bilirubin levels.

S-adenosyl-L-methionine (SAMe) is the principal methyl donor in methyltransferase reactions and SAMe supplementation restores hepatic glutathione deposits and attenuates liver injury.

**Dose:** Denamarin comes in both feline and canine tablets. The dose is one feline tablet sid in cats up to 5.5kg and one bid in cats over 5.5kg.

## 6. MONITORING FIP TREATMENT / PROGNOSIS

**Apha-1 acid glycoprotein (AGP)** is a direct measure of inflammation and AGP measurement gives the most rapid idea if FIP treatment is working or not: initially monitor every 7 – 10 days, then increase the intervals to monthly if appropriate. If AGP is reducing, you can safely reduce corticosteroid dose. If it increases, you may have to go back to the previous corticosteroid level. AGP should be less than 500ug/ml. In effusive FIP it is in the thousands, in non-effusive FIP it is usually 2 to 3 times normal.

In the UK, AGP testing is available from the University of Glasgow Veterinary Diagnostic Services. <http://www.gla.ac.uk/schools/vet/cad/>

**Haematocrit (Hct; packed cell volume PCV), bilirubin, lymphocyte count, globulins, albumin to globulin ratio** are also useful parameters to monitor, especially in non-effusive FIP. One is looking for a reversal of the lymphopenia and non-regenerative anaemia (reticulocytes appearing in blood smears), decrease to normal levels of bilirubin and globulin (which will increase the alb:glob ratio). Decreasing Hct and increasing bilirubin are bad prognostic signs.

**Cat's weight** is especially useful in non-effusive FIP, where one would hope it would increase. In effusive FIP it is complicated by the presence or absence of fluid: weight increase might be a bad thing if it means the effusion is returning. Monitor weekly to monthly (can get the guardian to do this at home to reduce stress on the cat).

**FCoV antibody titre:** it is not worth measuring the FCoV antibody titre more often than every 3 - 6 months, there will be no discernible difference within a shorter period (or it may be simply lowered by the high amounts of corticosteroid which can be misleading). However at the end of treatment FCoV serology is a very useful measurement to let you know that it is absolutely safe to discontinue the interferon. (NB sometimes it is cheaper in your lab package to just keep getting the FCoV antibody titre with the FIP profile, than to ask for components individually.)

**Staging for effusive FIP Tsai et al, 2011 to help you to assess whether it's worth treating or continuing treatment**

The average survival time for effusive FIP cases is 21 days ( ±19 days). However, cats treated with Virbagen Omega have been documented as surviving 18 months.

In this system the severity of effusive FIP can be worked out, which will give you an idea of whether or not it is worth obtaining special drugs to treat, or whether it is worthwhile continuing treating a case. Look at the parameter in the left hand column, then look at where the result of your case falls in the range, then put the score for that parameter into the last column in the grey shaded cells.

Finally work out the total score for your case:

- 0-4: survival time more than 2 weeks
- 5-11: survival time less than 2 weeks
- over 12: survival time less than 3 days

Remember that even giving the cat a few more days can help the cat's guardian come to terms with the imminent demise of their pet: corticosteroids don't cost much and will help ease those last days, and draw off the effusion to make the pet more comfortable. FIP doesn't seem to be a painful condition.

Parameter	Range	Score	Your case
PCV (%)	>26	0	
	20 – 26	2	
	<20	4	
AST (U/l)	<150	0	
	150 – 300	2	
	>300	4	
Total bilirubin (mg/dl)	< 0.5	0	
	0.6 – 2.2	2	
	> 2.2	4	
Potassium (mmol/l)	4.0 – 5.8	0	
	3.0 – 3.9	2	
	< 3.0	4	
Sodium (mmol/l)	156 – 165	0	
	150 – 155	2	
	<150	4	
Total			



## When to opt for euthanasia

Negative signs that the treatment isn't working are AGP remaining high, bilirubin increasing; globulins staying high or increasing, Alb:Glob decreasing, weight loss. When Hct gets to below 20% and is non-regenerative (no reticulocytes seen on blood smear examination) and if your clinical opinion is that the cat is no longer getting any happiness out of life, then he or she should probably be humanely euthanased. Clearly, if the cat is distressed at any point in the treatment, then euthanasia will be required. Sadly, the average survival time for cats with effusive feline infectious peritonitis is 21 days (plus or minus 19 days), although I notice that cats with a thoracic effusion seem to survive much longer than cats with abdominal effusion. Cats with non-effusive FIP can last many weeks or months, though after neurological signs begin euthanasia usually ensues fairly rapidly.

## 7. FCoV ASSOCIATED DIARRHOEA

Which kind of FCoV diarrhoea are you dealing with?

Small intestinal diarrhoea ( $\pm$  vomiting, failure to thrive) of initial FCoV infection

Large intestinal diarrhoea of chronic FCoV infection – i.e. a FCoV carrier

Diarrhoea due to colonic FIP

In the first two cases, see the supportive treatment listed below, but in the third situation, colonic FIP, you will need to also apply the directions for non-effusive FIP given above.

Apply advice given in sections 2 and 3 above.

Give weekly Vit B12 injections – see note 8 below.

Try Applaws chicken and pumpkin food, if the cat gets dry food in addition to canned food, make sure it is Applaws or another meat-based diet and not a cereal-based food. Applaws and Almo Nature are available from the Zooplus website in the UK and Europe: use the [Zooplus link](#) on the catvirus website [links page](#) to obtain a discount.

Gil et al got a response to Virbagen Omega (Virbac), giving 5 x s/c injections of 1 MU/kg sid, repeating the course at 2 weeks and 2 months. FCoV shedding should be monitored by quantitative RT-PCR on monthly faecal samples (from a laboratory that reports a quantity, e.g. a Ct).

## 8. VITAMINS and ANTIOXIDANTS

### Vitamin B12 (cobalamin) - essential

Cats with GI disease will be unable to absorb sufficient cobalamin, so will require a supplement by injection. Vitamin B12 supplementation is advisable in FIP cases because of its lowering effect on homocysteine and because it stimulates appetite.

**Dose:** inject 250ug per cat (not per kg) cyanocobalamin once a week s/c

**Note to vet students and new graduates:** this stuff stings like crazy! Be sure to rub the skin between thumb and forefinger both before and after the injection to release natural endorphins.

### Vitamin E (optional)

Vitamin E is an antioxidant.

**Dose:** 25-75 i.u./cat twice daily given by mouth or in food.

### **Vitamin A** (optional)

Vitamin A is an antioxidant. Vitamin A supplementation is unnecessary in cats being fed real fish regularly. Cats cannot metabolise the beta-carotene form so must be given vitamin A as fish or fish oil, e.g. halibut liver oil. Real fish in the diet is preferable to just giving supplements. However hypervitaminosis A will cause excessive laying down of bone at the joints, so do not use frequently for more than 4-6 weeks.

### **Vitamin B complex** (optional)

Multivitamins B are a good appetite stimulant and can be obtained from health food shops or chemists (I particularly like the one from Boots Chemists in the UK).

**Dose:** paediatric dose.

### **Vitamin B1 (thiamine)** (optional – if not giving B complex)

**Dose:** 100 ug/day given orally (i.e. by mouth or in food).

### **Vitamin C (ascorbic acid)** (optional)

Vitamin C is an antioxidant. Remember that given over a long period of time, vitamin C can predispose to oxalate crystals in the urine, so again this should only be used for a few weeks.

**Dose:** 125 mg twice daily given by mouth or in food.

## **9. MISCELLANEOUS NOTES**

### **Antibiotics**

Antibiotic cover is essential when immunosuppressing a cat. Your choice of antibiotics will depend on what your major differential diagnoses are, given the presenting clinical signs. For example, if you are awaiting FIP confirmation from your laboratory and your major differential diagnoses are toxoplasmosis, or bacterial peritonitis / pleurisy, then clindamycin (Antirobe) will be your antibiotic of choice; if your major differential is infectious anaemia, then doxycycline or oxytetracycline will be your choice.

### **Feliway spray / diffuser**

For reducing stress (which is pro-inflammatory) keep a feline pheromone (Feliway, Ceva) diffuser plugged in at all times.

### **Polyprenyl immunostimulant (PPI) – for treating dry FIP only**

PPI is NOT recommended in effusive (wet) FIP.

I have little personal experience of using this compound, and given Prof. Legendre's updated report to the AAFP in January 2013, it does not seem to be especially effective.

**Dose:** 3.0 mg/kg orally of Polyprenyl Immunostimulant three times a week.

Cost: about £230 to get 60ml (6x 10ml bottles) including postage from America

Obtain it from Vetimmune (To download a Vetimmune order form [click here.](#))

UK veterinary surgeons will need to apply to the VMD for special import permission.

### **Coronavirus protease inhibitor (GC 376)**

There are none commercially available at time of writing. Watch Dr Pedersen's SOCK website for news of updates and new clinical trials. [www.sockfip.org](http://www.sockfip.org)

### **Human interferon alpha**

Feline interferon is infinitely preferable to human interferon since interferon is species specific, plus cats will mount antibodies to human interferon if injected. However, I know it isn't always easy to obtain, and human interferon may be better than nothing.

**Dose:** Non-effusive feline infectious peritonitis (FIP): 30 i.u./daily or for 7 days at alternate weeks given by mouth.

In effusive FIP 30 i.u./daily can be used, or larger doses of interferon can be given by intramuscular injection daily ( $10^4$  -  $10^6$  i.u. per day). By 6-7 weeks, if the cat is still alive, interferon will no longer work at this dose because the cat will make antibodies against it.

To obtain human interferon-alpha (Roferon or Intron A), write a prescription for your local pharmacist.

### **Diluting human interferon**

To get 30 i.u./ml: Intron A can be obtained as 1 million i.u. Dilute whole vial in one litre of saline, giving 3000 i.u./ml. Put one ml of 3000 i.u./ml into 99ml of saline, to get 30 i.u. per millilitre. Aliquot into 1ml volumes<sup>†</sup> and freeze for up to a year. Defrost as required, keep refrigerated for up to a week.

To obtain  $10^4$  i.u./ml put 1 x 1 million i.u. vial of Intron A or Roferon into 99ml sterile saline and divide into 1ml doses and freeze. For  $10^5$  i.u./ml use 9mls saline and proceed as above. For  $10^6$  i.u./ml use the whole vial.

### **Aspirin**

For anti-inflammatory activity and pain relief.

Dose: 10mg/kg every 48-72 hrs per os.

### **Anabolic steroids**

For appetite encouragement and anti-catabolism, especially if the kidneys are affected.

Choose from the following (in the UK):

Laurabolin injection: 2-5mg/kg every 21 days.

Nandrolin injection: 2-5mg/kg as a weekly injection.

Nandoral tablets - one a day either whole or crushed into food.

Retarbolin injection: 1mg/kg every 21 days.

Orandrone tablets: 0.5mg/kg daily (the tablets are 5mg).

Remember to warn the owner that the cat's urine could become more strong smelling with this treatment. The injectables usually require to be kept in the dark.

## **10. TREATMENTS NOT RECOMMENDED**

### **Adipose stem cell therapy**

Two cats were treated: it did not work.

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<sup>††</sup> Note that you can buy cheap 2ml tubes from laboratory suppliers such as Sarstedt or Anachem.

### **Cyclophosphamide**

Contra-indicated

### **Cyclosporine (Atopica)**

Inhibition of the cell mediated immune system is the last thing you want in FCoV infection.

### **L-lysine**

Contra-indicated since antagonises arginine

### **Pentoxifyline (Trental)**

Doesn't work.

### **Thromboxane Synthetase Inhibitors**

Two cats with abdominal effusions were treated with ozagrel hydrochloride with success (Watari *et al*, 1998). However, follow up studies failed to confirm the usefulness of this compound.

Dose: 5-10mg/kg twice daily and prednisolone at 2mg/kg/day.

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**For references and further reading, plus free CPD, visit [www.catvirus.com](http://www.catvirus.com)**

Dr Diane D. Addie February 2014 Updated July 2015 and March 2017

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