

Feline Infectious Peritonitis (FIP)

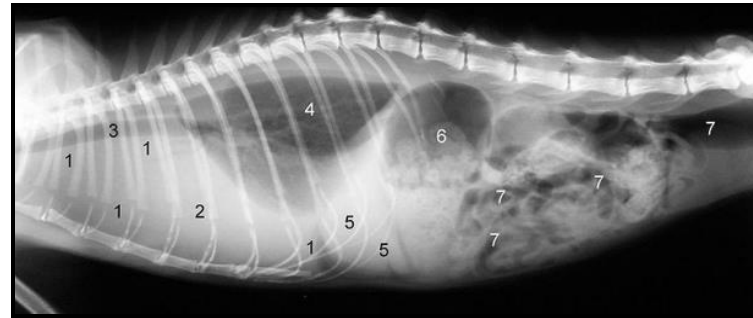
Extended Version

Classic case: Ascites, **YOUNG, MALE** cat no obvious source; malaise, wt. loss; no response to ABX

Fatal, progressive, viral, immune-complex disease of cats; Definitive Dx difficult antemortem
May involve mutation of feline coronavirus (FCoV) to virulent FIP virus

Presentation:

- **Young** cats, post-weaning - 6 mos - 2 yrs age
- **MALES >>** Females
- **Multi-cat** environments - CATTERIES, shelters
- Asian breeds, e.g. Himalayan, Birman
- Also seen in exotic felines (zoo cats)
- **Nonspecific** signs:
 - Inappetence, weight loss, wasting
 - Fever, lethargy, unkempt appearance
 - Occasional diarrhea
- **More specific** signs-
 - Not really two different kinds
 - More of a spectrum of disease



Pleural effusion in a cat with FIP,
1. Diffuse shadowing due to fluids in lower chest, 2. Heart silhouette obscured by effusion fluids. 3. Trachea, 4 Lungs (only a small part is ventilated), 5 liver, 6 stomach, 7 intestines

Image courtesy, Uwe Gille

Effusive "WET" FIP		Non-effusive , pyogranulomatous dz "DRY" FIP
<p>Acute, common</p> <ul style="list-style-type: none"> • Peritonitis <ul style="list-style-type: none"> ▪ Abdominal effusion <ul style="list-style-type: none"> ▪ Pot-bellied ▪ Palpable fluid wave ▪ Adhesions ▪ Abdominal masses ▪ Vomiting, diarrhea • +/- Pleuritis <ul style="list-style-type: none"> ▪ Pleural effusion <ul style="list-style-type: none"> ▪ Dyspnea ▪ Recumbent a lot ▪ Tire easily ▪ Muffled heart & lung sounds 		<p>Chronic</p> <ul style="list-style-type: none"> • Abdominal (palpable masses) 50% <ul style="list-style-type: none"> ▪ Icterus, hepatomegaly ▪ PU/PD ▪ Mesenteric lymphadenopathy ▪ Splenomegaly ▪ Intestinal thickening & obstruction • Pleural 10-15% cases <ul style="list-style-type: none"> ▪ Dyspnea • CNS - focal or diffuse - 60% <ul style="list-style-type: none"> ▪ Personality changes, seizures ▪ Ataxia, paralysis ▪ Nystagmus, CNS signs ▪ Hypermetria, intention tremors • Ocular 60% <ul style="list-style-type: none"> ▪ Anterior uveitis <ul style="list-style-type: none"> ○ Iris color change ○ Corneal edema ○ Aqueous flare ○ Hypopyon, hyphema ▪ Posterior chamber, fundic lesions ▪ Blindness
<p>Other signs:</p> <ul style="list-style-type: none"> • Dermatologic <ul style="list-style-type: none"> ▪ Intradermal pustules • Not pruritic • Reproductive <ul style="list-style-type: none"> ▪ Infertility, stillbirth, abortion ▪ Congenital malformation ▪ <i>Fading kittens</i> • Sequela: <ul style="list-style-type: none"> ▪ DIC* <p>*disseminated intravascular coagulation</p>		

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DDX: (nothing good)

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> • FIV • FeLV • Congestive heart failure • Neoplasia (lymphoma) • Pyothorax • Chylothorax • Lymphocytic plasmacytic cholangitis | <p>Ocular signs:</p> <ul style="list-style-type: none"> • Toxoplasmosis, • FIV • FeLV • Sysemic mycosis | <p>Hyperglobulinemia:</p> <ul style="list-style-type: none"> • Lymphoma • Multiple myeloma • Chronic infection |
|--|---|---|

Test(s) of choice:

Supportive diagnostics:

- CBC – nonregenerative anemia
- Chemistry:
 - **Hyperglobulinemia w/ low albumin/globulin ratio – a hallmark of FIP**
 - Electrophoresis - polyclonal gammopathy - $\uparrow \alpha_2$ & γ globulins most common
 - Azotemia
 - \uparrow Liver enzymes
 - \uparrow Bilirubin
- UA - Bilirubinuria

- Analysis of effusion(s)

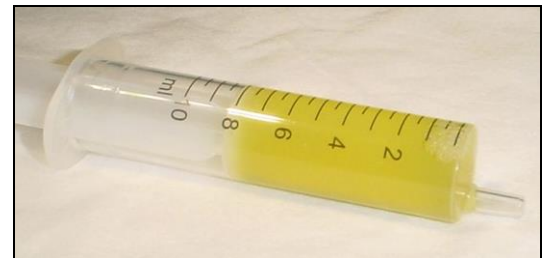
- ★★ **Nonseptic exudate – high protein, low cells**
 - Clear, straw-colored, viscous, fibrin strands
 - **Protein > 3.5mg/dL**
 - **Low total cell count (< 2000/mcL)**
 - **Globulin conc > 32% strongly suggests FIP**
 - 0.9 albumin/globulin ratio (74% sensitivity, 86% specificity for FIP)
 - Rivalta screening test for FIP
 - ◆ Mix 1 drop conc. acetic acid (vinegar) in 10 ml distilled H₂O
 - ◆ Add 1 drop effusion to above mixture
 - ◆ Neg - drop of effusion disappears into solution
 - ◆ **Pos - drop of effusion maintains shape and sinks slowly**
 - ◆ Positive predictive value (86%), neg. predictive value (96%) for FIP

- Imaging studies:

- Radiographs/ultrasound
 - Identify effusion(s), organomegaly, lymphadenopathy
- Computed tomography - **hydrocephalus in >75% FIP cases**

- FCoV serology:

- Positive titer=**exposure** to FCoV; **most + cats DO NOT develop FIP**
- Titers > 1:16,000 - suggestive of FIP **if C/S present**
- Terminal stage of FIP - titer may be negative (rare)



*FIP effusion, nonseptic exudate.
High protein, low cells
Image courtesy Kalumet*



*Positive Rivalta test
Image courtesy Kalumet*

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Test(s) of choice: (continued)

- CSF analysis:
 - High protein > 20 mg/dL
 - Cell count >5 cells/uL - mononuclear pleocytosis w/ neutrophils
- α_1 Acid glycoprotein (AGP): Acute phase protein; \uparrow s w/infectious dz in cats
 - Plasma or effusion > 1500 ug/dL suggests FIP

Confirmatory testing:

- PCR w/ reverse transcription:
 - Blood sample: cannot distinguish between FCoV and FIP
 - Effusion sample: sensitive & specific
- FIP mRNA PCR multiTest
 - Detects mRNA of M gene expressed during replication in mononuclear cells
 - Test on whole blood – detects replicating virus particles (U of Auburn Molecular Dx Lab)
 - Enteric virus replicates only in intestine, so will not cross react in this test
- **DEFINITIVE DIAGNOSIS : Biopsy w/ immunohistochemistry**
 - Histopathology
 - Pyogranulomatous inflammation w/ vasculitis, **viral particles in macrophages**
 - + Immunohistochemistry

Dx most often based on clin sx, characteristics of effusion, & lack of other dz, esp. in a young cat

Rx of choice:

Supportive/palliative care based on clinical signs	
Minimize stress <ul style="list-style-type: none"> • Comfortable, quiet environment • Reduce intercat conflict Nutritional support for anorectic cats <ul style="list-style-type: none"> • Hand-feed • Warm food • Offer multiple types Vitamin supplementation <ul style="list-style-type: none"> • A, B complex, B1, C, E IV or SQ fluids Rx 2° bacterial infections <ul style="list-style-type: none"> • Broad spectrum antibiotics 	Acute Therapy <ul style="list-style-type: none"> • Fluids • Thoracocentesis/Abdominocentesis • Oxygen therapy Chronic Therapy Typically unrewarding, MAY improve signs, \$\$\$ <ul style="list-style-type: none"> • Immunomodulating drugs to reduce viral load <ul style="list-style-type: none"> ▪ Human α-interferon ▪ Recombinant feline interferon <ul style="list-style-type: none"> ○ w/ corticosteroids for better efficacy ▪ Acemannan – immunomodulator from Aloe • Immune suppression <ul style="list-style-type: none"> ▪ Control of immune-mediated vasculitis ▪ Prednisolone +/- cyclophosphamide ▪ Low dose aspirin <ul style="list-style-type: none"> ○ Anti-inflammatory, anti-thrombogenic • Thalidomide - immunomodulator <ul style="list-style-type: none"> ○ Teratogenic (owner approval) • Topical ophthalmic ointment w/steroid
If quality of life is poor – Consider euthanasia	

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Prognosis: Grave

- **INCURABLE**, **fatal** disease regardless of form or Rx
 - Dry form: 1 yr survival
 - Wet form: survive days to 2 mos post Dx

Prevention:

Husbandry practices (CATTERY)	Intranasal FIP Vaccine
<ul style="list-style-type: none"> • Separate seronegative from seropositive • Breed only seronegative cats • Remove kittens from queen at 5-6 weeks • Add only seronegative cats to population 	<ul style="list-style-type: none"> • NOT recommended for low risk cats • Protects 50-75% cats
Environment / hygiene / management	Client education
<ul style="list-style-type: none"> • Remove feces DAILY • Increase number of litter boxes • Disinfect - viricidal product (Bleach works) • Reduce crowding stress 	<ul style="list-style-type: none"> • Select cats only from reputable breeder • FIP + cats - keep separate ALWAYS (or euthanize)

Pearls: Dx most often based on C/S, characteristics of effusion, lack of other dz, esp. in a young cat

Pathophysiology of FIP is theorized to go like this:

- Begins with coronavirus (FCoV) infection of GI tract (many cats)
 - FCoV mutates into virulent strain (a few young cats)
 - multi-organ systemic disease and FIP

Feline enteric coronavirus (FCoV)

- Greatest risk of developing FIP is in first 6–18 mo after infection w/ FCoV.
- The risk decreases to about 4% at 36 mo post infection
- FCoV, relatively benign RNA virus, large genome, is vulnerable to mutation
 - FCoV causes a mild self-limiting diarrhea
 - **Ubiquitous** in multi-cat environments
 - **Carrier cats have no clinical signs**
 - **Many cats infected**, FEW develop FIP
- RFCoV replicates w/in enterocytes
 - +/- replication in oropharynx 1st few days
 - Shed in **feces** 2 days post-infection
 - Hours to days in **saliva**
- Transmission: Feco-oral, saliva (mutual grooming), transplacental



FIP : Sticky, high protein, non-septic exudate
Image courtesy Kalumet



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Pearls: (continued – pathogenesis of FIP)

- **FCoV spontaneously mutates into FIP virus**
 - Each FIP virus unique to cat
 - FCoV is transmissible, FIP virus is **NOT** transmissible
- FIP virus replicates w/in macrophages & regional lymph nodes, UNlike FCoV
 - Virus travels systemically with macrophages
- **Outcome of infection varies** w/ pathogenicity of mutant virus & immune response
 1. Elimination of virus
 2. Develop effusive FIP: Complement-mediated response
 3. Develop non-effusive FIP: Partial cell-mediated response
 4. Formation of antibody-antigen complexes - deposited in vascular endothelium

References: Cote, Clin Vet Advisor, Dog and C. 2nd ed. pp. 383-85, Pasquini's Guide to SA Clinics 3rd ed., pp 107, 554, 688, and the Merck Vet Manual online, Feline Infectious Peritonitis, Anterior Uvea (scroll down to uveitis)

My Notes: