## FIP: diagnostic approach I

Evidence contributing to being *highly suspicious* of a diagnosis of feline infectious peritonitis

#### **ABCD TOOL Clinical examination**

Fever (typically <40°C) +++

Mucous membranes:

Icterus/iaundice ++

Pallor +

Abdominal palpation:

Fluid thrill due to ascites ++++

Irregular organomegaly (e.g. kidneys, lymph nodes) +++

Masses (e.g. abdominal lymph nodes, intestinal) ++

Auscultation:

Absence or dullness of heart sounds ++

Heart murmur / arrhythmia -

Absence of lung sounds ++

Increased lung sounds with crackles -

Percussion of chest dull ventrally ++

Tachypnoea or dyspnoea ++

Otoscopic examination:

Evidence of ear disease (e.g. polyps, otitis externa /media) -

Ocular examination (unilateral or bilateral changes):

Change in iris colour ++++

Dvscoria/anisocoria +++

Hyphaema ++

Aqueous or vitreous flare ++

Other signs of uveitis ++

Perivascular cuffing of retinal vessels ++

Nvstaamus ++

Retinal detachment +

Neurological examination:

Ataxia +++

Seizures +++

Mental state or behaviour changes +++

Head tilt ++

Priapism ++

Scrotal enlargement ++

Multiple skin nodules or papules +

Body condition score < 5/9 ++

Bicavitary effusion +++

#### Haematology

Severe non-regenerative anaemia +

Key: The + & - symbols indicate how likely or unlikely factors listed are to make a diagnosis of FIP

**Signalment & history** 

**Clinical examination** 

including looking for any evidence of an effusion

**Serum biochemistry** 

Locate & analyse effusion

if present\*

Haematology

Neurological findings consistent with FIP? Go to diagram (3)

Ocular findings consistent with FIP? Go to diagram (4)

\* Absence of effusion & presence of

nonspecific clinical signs? Go to diagram (2)

- slightly less likely moderately less likely far less likely
- --- extremely unlikely
- slightly more likely moderately more likely
- far more likely ++++ extremely likely

#### Signalment

<2 years ++++

>5 years -

Male +

Pedigree + (breeds vary geographically)

Dietary history compatible with thiamine deficiency -

#### Serum biochemistry

Hyperbilirubinaemia +++

Hyperglobulinaemia +++

Hyperproteinaemia (or total solids) ++

Hypoalbuminaemia +

Albumin to globulin [A:G] ratio

A:G ratio < 0.4 +

 $A \cdot G$  ratio > 0.6 -

Alpha1-acid glycoprotein, if available:

>1.5 mg/mL ++

 $>3.0 \, mg/mL +++$ 

<1.5 mg/mL -

Serum protein electrophoresis, if performed:

Polyclonal gammopathy +

Marked elevation in ALT & ALP -

Only mild or moderate elevation in ALT &

ALP with hyperbilirubinaemia +

FCoV antibody test with high titre +

FCoV antibody test negative -

#### **Locate any effusion**

Ultrasonography is most useful to locate/direct fluid sampling

Bicavitary effusion +++

Abdominal ultrasonography:

Peritoneal (or retroperitoneal) fluid +++

Thoracic ultrasonography: Pleural (or pericardial) fluid ++

Thoracic radiography:

Pleural fluid ++

#### **History**

Weight loss/failure to thrive /stunted growth +++

Swollen abdomen ++++

Persistent/fluctuating fever non-responsive to antibiotics +++

Letharqy/dullness ++ Inappetence ++

Dyspnoea ++

Vision or ocular abnormalities incl. iris colour change &/or nvstagmus ++

Jaundiced mucous membranes ++

Ataxia/paresis (para- or tetra-), hyperaesthesia, seizures ++

Sibling (or in-contact) with FIP ++

Multi-cat household +++

Pale mucous membranes +

Diarrhoea, vomiting &/or constipation +

Recent stress (e.g. vaccination, rehoming, neutering) ++

Outdoor only/feral cat --

History of fighting -

#### Analyse any effusion

Typically, high protein low cell count effusions in

abdomen ± thorax ± pericardium

Biochemistry:

High protein (or total solids) >35 g/L ++++

Low protein (or total solids) < 25 g/L --

A:G ratio < 0.4 ++

 $A \cdot G$  ratio > 0.8 -

Yellow ++++

Rivalta's test positive ++

Rivalta's test negative - - -Cell count:

Low cell count <5 x109/L ++++ Moderate cell count ≤20 x109/L ++

High cell count > 20 x109/L -

Alpha1-acid glycoprotein, if available:

>1.5 mg/mL ++

Cytology:

Non-degenerate neutrophils & macrophages ++++ Non-degenerate neutrophils, macrophages & a few

lymphocytes ++++

Toxic neutrophils ± bacteria visible -

Neoplastic cells - - -

Marked lymphocytosis -

Marked neutrophilia -

For differential diagnoses of FIP, see box (5)



Mild non-regenerative anaemia ++

Regenerative anaemia +

Microcvtosis ++

Neutrophilia (mild ± left shift) ++

Lymphopenia ++

Lymphocytosis --

If you found this ABCD information valuable, please tell a colleague. To download the ABCD tools, fact sheets, or the full disease guidelines, please visit our website: www.abcdcatsvets.org The ABCD Europe is an independent association of experts in feline health. This tool was supported by Boehringer Ingelheim (founding sponsor), Virbac, Idexx and MSD. September 2023.

Modified from: Barker E & Tasker S. (2020). Advances in Molecular Diagnostics and Treatment of Feline Infectious Peritonitis. In Small Animal Care 1: 161–188



## FIP: diagnostic approach lla

**ABCD TOOL** 

Effusion sample cytology & biochemistry consistent with FIP Effusion sample analysis: FCoV RT-PCR &/or immunocytochemistry for FCoV antigen either test positive **FIP less likely** If **still** suspicious of FIP, either positive take FNA of accessible organs (e.g. liver, mesenteric lymph node, kidney, spleen), Positive FCoV RT-PCR then FCoV RT-PCR &/or with high FCoV RNA loads immunocytochemistry for FCoV antigen &/or positive immunocytochemistry Look for causes other than FIP for FCoV antigen laparotomy/laparoscopy/trucut to biopsy for histopathology & FIP very likely1 immunohistochemistry for FCoV antigen if still suspicious of FIP Note for IIa & IIb: If submitting fluid or cytology samples Histopathology not Histopathology for FCoV antigen immunostaining consistent with FIP & consistent with FIP & (immunocytochemistry or immunohistochemistry negative immunofluorescence), it is wise to contact the laboratory first to ask immunohistochemistry positive for FCoV for preferred samples &/or preparation antigen methods. Some laboratories may prefer to use cell pellets prepared from fluid samples for Confirms FIP FIP very unlikely immunohistochemistry. 1. Some authors regard a positive immunocytochemistry test for FCoV antigen on an

effusion (with biochemistry & cytology consistent with FIP) adequate to confirm FIP

Looking for evidence that **confirms FIP** as a diagnosis following a high suspicion: Absence of an effusion & presence of nonspecific clinical signs: perform diagnostic imaging\* Findings that could be consistent with FIP: Felten S & Hartmann K. (2019). Diagnosis of Feline Infectious Peritonitis: A Review of the Current Literature. Ultrasonography: abnormalities e.g. in lymph nodes (abdominal lymphadenopathy), liver, spleen (variable echogenicity), kidney (variable Radiography: abnormalities e.g. lymphadenopathy, alveolar pattern consistent with pneumonia FNA sample of any abnormal organ/tissue (e.g. mesenteric lymph node) with consistent cytology (neutrophilic or pyogranulomatous): FCoV RT-PCR &/or immunocytochemistry for FCoV antigen either positive FIP unlikely Positive FCoV RT-PCR with high FCoV RNA loads If still suspicious of FIP, continue monitoring as &/or abnormalities can develop over time, which can then be positive sampled for diagnosis by either FNA, trucut or full biopsy immunocytochemistry (cytology, immunocytochemistry for FCoV antigen, RT-PCR, histopathology, for FCoV antigen immunohistochemistry for FCoV antigen) not consistent. negative FIP very unlikely Positive FCoV RT-PCR FIP very likely<sup>2</sup> with high FCoV RNA loads &/or Histopathology positive immunocytochemistry consistent with FIP & for FCoV antigen with cytology In absence of any immunohistochemistry obvious localising signs or consistent for FIP abnormalities that allow positive for FCoV sampling, ultrasonography antigen indicated to evaluate abdominal & thoracic organs Adapted from: for any abnormalities & to direct sampling of tissue. FIP very likely<sup>2</sup> **Confirms FIP** 

<sup>2.</sup> Some authors regard a positive immunocytochemistry test for FCoV antigen on an FNA sample (with cytology consistent with FIP) adequate to confirm a diagnosis of FIP



## FIP: diagnostic approach IIb

Looking for evidence that **confirms FIP** as a diagnosis following a high suspicion:

**ABCD TOOL Neurological findings** consistent with FIP\* MRI: Obstructive hydrocephalus, syringomyelia, foramen magnum herniation, marked contrast enhancement of the meninges, third ventricle, mesencephalic aqueduct & brainstem reported with FIP CT: hydrocephalus &/or syringohydromyelia CSF: high protein (>0.3 g/L cisternal samples, >0.46 g/L lumbar samples), high cell count (>0.008 x 10<sup>9</sup>/L cisternal or lumbar samples). CSF sample analysis: FCoV RT-PCR &/or immunocytochemistry for FCoV antigen either positive Positive FCoV RT-PCR FIP unlikely with high FCoV RNA loads &/or If still suspicious of FIP, continue monitoring for nonpositive neurological changes as abnormalities can develop immunocytochemistry over time, which can then be sampled for diagnosis by for FCoV antigen either FNA. trucut or full biopsy (cytology, immunocytochemistry for FCoV antigen, RT-PCR, histopathology, immunohistochemistry for FCoV antigen) not consistent. negative FIP very likely<sup>1</sup> Positive FCoV RT-PCR FIP very unlikely with high FCoV RNA loads &/or positive In absence of any non-neurological immunocytochemistry Histopathology signs or abnormalities that allow sampling of alternative sites, advanced for FCoV antigen with consistent with FIP & imaging via CT, or preferably MRI, is cytology consistent for FIP immunohistochemistry indicated. Imaging allows for evaluation for positive for FCoV neurological system abnormalities & to antigen assess for any potential risk of herniation if subsequent CSF collection is planned. Referral may be needed for these procedures if FIP very likely<sup>1</sup> **Confirms FIP** vet is unfamiliar with neurological investigations.

Aqueous humour cytology consistent with FIP\* (neutrophilic or pyogranulomatous) Aqueous humour sample analysis: FCoV RT-PCR &/or immunocytochemistry for FCoV antigen either positive Positive FCoV RT-PCR FIP unlikely with high FCoV RNA loads &/or If **still** suspicious of FIP, continue monitoring for **non**positive ocular changes as abnormalities can develop over immunocytochemistry time, which can then be sampled for diagnosis by either for FCoV antigen FNA, trucut or full biopsy (cytology, immunocytochemistry for FCoV antigen, RT-PCR, histopathology, immunohistopathology for FCoV antigen). If **enucleation** is performed due to severe uveitis/glaucoma, eye can be submitted for histopathology & immunohistochemistry FIP very likely<sup>2</sup> not consistent Positive FCoV RT-PCR with high FCoV RNA loads FIP very unlikely &/or In absence of any nonpositive ophthalmological signs or abnormalities that allow immunocytochemistry Histopathology sampling of alternative for FCoV antigen with consistent with FIP & sites, collection of an cytology consistent for FIP immunohistochemistry aqueous humour sample may be indicated. positive for FCoV Referral may be indicated for this antigen procedure if veterinarian is unfamiliar with ophthalmological investigations. FIP very likely<sup>2</sup> **Confirms FIP** 

1. Some authors regard a positive immunocytochemistry test for FCoV antigen on a CSF sample (with biochemistry & cytology consistent with FIP) adequate to confirm a diagnosis of FIP

<sup>2</sup> Some authors regard a positive immunocytochemistry test for FCoV antigen on an aqueous humour sample (with cytology consistent with FIP) adequate to confirm a diagnosis of FIP



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### **FIP Differential diagnoses**

**ABCD TOOL** 

(5)

## FIP: differential diagnoses to be considered geography/lifestyle dependent

- Lymphocytic cholangitis or cholangiohepatitis: young, especially pedigree cats, jaundice ± abdominal effusion, on biochemistry elevated ALP & GGT; histopathology
- **Pyothorax**: outdoor cats, history of fighting, fever, leucocytosis with neutrophilia (± left shift) on haematology, pleural effusion with high cell count & degenerative neutrophils (septic)
- Toxoplasmosis: hunters &/or those fed raw meat diet, neurological/muscular/pulmonary/ocular signs all possible, effusions, jaundice; serology (antibody); PCR; cytology or histopathology, responds to clindamycin
- **Neoplasia**: lymphoma in young cats with lymphadenopathy &/or organomegaly, carcinoma/other in older cats, range of signs depending on type of neoplasia, can have bicavitary effusions; cytology, histopathology
- Septic peritonitis: fever, leucocytosis with neutrophilia (± left shift) on haematology, abdominal effusion with high cell count & degenerative neutrophils (septic)
- Pancreatitis: mainly middle-aged to older cats, reduced appetite, jaundice, weight loss, abdominal effusion all possible, fever not prominent; ultrasonography & feline pancreatic lipase immunoreactivity
- Mycobacterial infection: hunters &/or those fed raw meat diet: skin, abdominal, thoracic signs all possible with lymphadenopathy, fever not prominent; Ziehl-Neelsen stain, interferon-gamma release blood test assay, PCR (tissue samples), culture
- Haemoplasmosis: cats with outdoor access, pallor, lethargy, fever, regenerative anaemia; PCR
- Congestive heart failure: pleural effusion more common but bicavity effusion possible, rare to see abdominal effusion alone, heart murmur/gallop/arrhythmia, jugular vein distension possible, no fever, effusion low protein, elevated serum N-terminal pro-B-type natriuretic peptide (NT-proBNP), echocardiography for aetiology
- Retroviral infection: feline immunodeficiency virus in middle-aged to older esp. male cats with outdoor access & history of fighting: FIV serology (antibody) test, or feline leukaemia virus in cats with outdoor access & history of fighting: FeLV serology (antigen). Note that when clinical signs are seen in retrovirus infected cats, there is usually an associated infection or morbidity present in addition to the retrovirus infection per se, resulting in clinical signs



In young cats with outdoor access, pyothorax, toxoplasmosis and mycobacterial infection can be differential diagnoses for FIP.

Modified from: Barker E & Tasker S. (2020). Advances in Molecular Diagnostics and Treatment of Feline Infectious Peritonitis Advances in Small Animal Care 1: 161–188