## FELINE INFECTIOUS PERITONITIS (FIP)

<table>
<thead>
<tr>
<th>Animal Group(s) Affected</th>
<th>Transmission</th>
<th>Clinical Signs</th>
<th>Severity</th>
<th>Treatment</th>
<th>Prevention and Control</th>
<th>Zoonotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felids – domestic cats and some exotic cat species</td>
<td>Primary mode of transmission is through feces. The virus is highly infective and over 90% of cats in multi-cat households typically seroconvert.</td>
<td>Malaise, inappetance, weight loss, and fluctuating fever. Effusive form – ascites, thoracic and/or pericardial effusion. Ocular lesions and CNS signs more common in the dry form.</td>
<td>Some cats exposed to the virus remain healthy while those that develop the disease have a poor prognosis. Clinical course is a few days to several months. The course is typically rapid with the effusive form of the disease and may be longer with the dry form.</td>
<td>No treatment has yet proven effective in curing cats of FIP. The disease is considered fatal.</td>
<td>Proper management can decrease the incidence of FIP in catteries.</td>
<td>No</td>
</tr>
</tbody>
</table>

### Fact Sheet compiled by: Danelle M. Okeson

**Sheet completed on:** 17 November 2010; updated 22 September 2012

**Fact Sheet Reviewed by:** Ellen Bronson; Connie J. Ketz-Riley

**Susceptible animal groups:** Felids – domestic cats and African lion, mountain lion, leopard, jaguar, lynx, serval, caracal, European wild cat, sand cat, Pallas cat, and cheetah which seem to be more susceptible than other exotic felids. Most deaths in domestic cats occur in cats 3-16 months of age and are uncommon after 5 years.

**Causative organism:** Feline infectious peritonitis virus (FIPV) is a virulent form (biotype) of feline enteric coronavirus (FECV). “…FECV and FIPV are genetically distinct in a minor but crucial manner, and this difference is essential for causing FIP…. However, host and environmental factors admittedly play a role in whether or not FIP is clinically manifested” (Pedersen). Only a portion of cats infected with the coronavirus develop FIP.

**Zoonotic potential:** No

**Distribution:** FIP may occur wherever FECV occurs – worldwide and ubiquitous among cat populations.

**Incubation period:** Under experimental conditions, 2-14 days is required for the effusive form of the disease while several weeks longer for experimentally induced dry/non-effusive form.

**Clinical signs:** Early signs of the disease may be non-specific: lethargy/malaise, fluctuating fever, loss of appetite, weight loss, and may cause failure to thrive in young cats.

The disease is categorized as two forms:
- effusive/wet form with vasculitis and polyserositis - ascites, thoracic and/or pericardial effusion. The
FELINE INFECTIOUS PERITONITIS (FIP)

Effusive form is the more common form of the disease.
- non-effusive/dry form with granulomatous lesions in kidneys, intestinal tract (leading to chronic diarrhea), lymph node enlargement.

Ocular and neurologic signs occur in <9% of cats with the wet form, but are relatively frequent in cats with the dry form. Ocular signs may include chorioretinitis and retinal perivascular cuffing, keratic precipitates in the anterior eye, and uveitis. Neurologic signs may include nystagmus, cranial nerve defects, seizures, ataxia, hyperesthesia, and behavioral changes.

Post mortem, gross, or histologic findings:
Effusive (wet) form of FIP - gross findings: viscous thoracic or abdominal fluid; pyogranulomas that tend to follow the course of the cranial mesenteric artery – leading to thickened omentum containing pyogranulomas, and pyogranulomas covering the serosal surface of the abdominal viscera. The pyogranulomas appear as small, coalescing, fibrinous plaques.
Dry form – gross findings: pyogranulomas that appear as raised, gray-white nodules (>0.5 – 2 cm) in the kidneys, liver, intestines, and visceral lymph nodes. CNS lesions and ocular lesions are more common in the dry form. Eye lesions may include iridocyclitis or chorioretinitis, and anterior uveitis, retinitis with hemorrhage and/or retinal detachment, and optic neuritis. Pyogranulomas may be found in the brain and spinal cord, or CNS lesions may manifest as more diffuse meningitis.

Diagnosis: The disease can be difficult to diagnose. Currently, there is no test specific for FIP. “Ultimately, FIP must be diagnosed by applying a workable knowledge of the disease with sensible weighing of signalment, history, clinical signs, clinicopathologic findings, serology, and ante- or post-mortem examination of affected tissues by histopathology and immunohistochemistry” (Pedersen).

Antibody testing: Serology - ELISA, IFA (immunofluorescent antibody), and virus-neutralization tests detect the presence of coronavirus antibodies in a cat, but these tests cannot differentiate between the various strains of feline coronavirus.

Antigen testing: Immunohistochemistry on effusions or lesions containing infected macrophages is currently the gold standard for FIP diagnosis. Testing for RNA using PCR technology is currently not specific for the coronavirus that causes FIP. Some popular PCR tests are based on the lack of a specific gene (7b). However, the lack of this gene is an artifact of one viral prototype and has likely occurred during tissue culture adaptation in the laboratory setting. Therefore, this PCR test is considered invalid (Pedersen). Clinicians should also be aware that PCR tests can be highly susceptible to laboratory contamination; a problem that can be virtually eliminated if real-time PCR (TaqMan) is employed.

A PCR test that looks for mRNA has also been developed. In theory, mRNA would only be present in replicating forms of viral RNA, and therefore would only be found in blood of cats with FIP. While original results were promising for the test method, the same results were not found when the same test was applied to blood samples from another population of cats.

Material required for laboratory analysis: Effusions or lesions (such as pyogranulomas) containing infected macrophages – for immunohistochemistry (IHC). IHC tests for viral antigen. IHC using fluorescein staining requires fresh or frozen tissue sections. IHC using horseradish peroxidase (HRPO) staining may be performed on formalin fixed and paraffin embedded tissues. Both methods may be used on cells collected from effusions that have been acetone fixed. The fluorescein staining method is 5-10 times more sensitive than the HRPO method. Test sensitivity is dependent on having infected macrophages, so random biopsies of liver or kidney (biopsies not containing macrophages) in cats with FIP will not yield positive results.

Relevant diagnostic laboratories: Several veterinary college laboratories and commercial veterinary labs offer FIP testing or referral to the appropriate lab.
**FELINE INFECTIOUS PERITONITIS (FIP)**

**University of Tennessee**  [www.vet.utk.edu/diagnostic/virology/index.php](http://www.vet.utk.edu/diagnostic/virology/index.php)

**University of California Davis**  [http://www.sockfip.info/fip-studies/114-instructions-to-veterinarians-for-sending-fip-fluid-samples.html](http://www.sockfip.info/fip-studies/114-instructions-to-veterinarians-for-sending-fip-fluid-samples.html)

**Treatment:** No treatment has yet proven effective in curing the disease. Supportive care can be provided. Since clinical disease is caused by the cat’s immune response to the virus, proposed treatments have been aimed at controlling that response. In one study, feline interferon omega reportedly induced complete or partial remission in two-thirds of cats with FIP. However, the treatment proved totally ineffective in a larger double blinded study. A pilot study at the University of Tennessee using an immunostimulant on three cats with the dry form (non-effusive) of FIP showed some promise. Two of three cats were still receiving treatment and were still alive 2 years after diagnosis (Legendre).

**Prevention and control:** In case of a suspected outbreak or a seropositive animal, clinicians should contact FIP experts and/or clinicians who have dealt with similar situations in a captive wildlife setting. It is beyond the scope of this fact sheet to provide recommendations for every possible scenario. FIP is typically a problem in group-housed cats, such as in breeding catteries or rescue groups. Since there is no readily available ante-mortem test, cats cannot be effectively tested prior to introduction to a group. Strict hygiene (especially for litter boxes) and keeping cats in small groups can help reduce viral contamination. Although a licensed FIP vaccine available, no effective vaccine is available as this vaccine has not been proven to prevent FIP, and it is not generally recommended by the American Association of Feline Practitioners Feline Vaccine Advisory Panel.

**Suggested disinfectant for housing facilities:** The virus can survive for approximately 2 months in a dry environment. However, the virus is readily inactivated by detergents and disinfectants.

**Notification:** Not a reportable disease

**Measures required under the Animal Disease Surveillance Plan:** None

**Measures required for introducing animals to infected animal:** See information under prevention and control. While not all cats exposed to the coronavirus that causes FIP will develop the disease, it is advisable not to mix cats with known infected cats.

**Conditions for restoring disease-free status after an outbreak:** Difficult in a multi-cat facility when other cats in the household or facility are likely infected. While many cats will not develop FIP disease, they may still shed the virus. Shedding may follow one of three patterns: 1) persistent for 18 months or more, 2) persistent for 4-6 months and intermittent for months thereafter, or 3) cleared within 6-8 months – most cats (Pedersen).

**Experts who may be consulted:**
Dr. Niels C. Pedersen, University of California, Davis College of Veterinary Medicine, contact information and further information on submitting samples may be found at the [www.sockfip.info](http://www.sockfip.info) web site under information for veterinarians.

**References:**
FELINE INFECTIOUS PERITONITIS (FIP)


