



FELINE INFECTIOUS PERITONITIS

FIP virus is a fatal disease of cats caused by a pathogenic coronavirus infection. The FIP virus is a genetic mutant of a common benign virus of the intestines called Feline enteric coronavirus (FECV). The mutation responsible for producing the fatal virus is a small one but it lets the virus grow in cells other than those lining the gut, specifically in monocytes or macrophages involved in cellular immunity.

Feline infectious peritonitis is an immune complex mediated disease, which means systemic antibodies do not protect the cat. Antibodies already circulating actually accelerate disease symptoms and cats don't die of FIP unless they make antibodies to the virus. This is called antibody-dependent enhancement because the complex formed between the virus and the antibody results in infection of cells instead of virus neutralization. Infected phagocytic cells move throughout the body and the mutant virus is then spread from the gut to other organs.

If white blood cells don't find and kill the virus where it tries to enter the body then the humoral immune system steps in with antibody production. Antibodies are proteins in blood made by plasma cells in the bone marrow which respond to specific antigens. Antigens are seen as foreign agents by the body and include viruses, bacteria, fungi or anything else that isn't recognized as "self". B cells in bone marrow get antibodies on their surface which will respond to and bind with its antigen, in this case FIP virus. Once these B cells form a bond with their antigen they differentiate into plasma cells that can produce the specific antibody for the virus. The result is usually neutralization of toxins, immobilization of microorganisms to allow phagocytosis by white blood cells, activation of complement which "primes" invaders to be eliminated from the system and populations of memory cells that will be able to produce the specific antibody in the future.

Unfortunately, the antibody-virus complex containing FIPV is very harmful to the body and the cat's own immune response appears to be the cause of death for infected cats.

How the FIP infection proceeds is determined by cell-mediated immunity. This is part of the immune system's protection designed to respond when an antigen has gotten into cells.

The cellular immune system consists of the white blood cells that find and destroy pathogens infecting cells. If the immune system produces humoral antibodies but fails to mount an effective response to FIPV growing inside cells an intense inflammatory reaction develops in the tissues where the infected cells locate to. This is termed the "wet" form of FIP. The "dry" form is thought to result from a partially protective response to infection within cells that is unable to completely contain the virus. Cats that don't have a good cell mediated response may be more susceptible to the disease. Cats that mount a quick and successful cell mediated response don't develop active FIPV but do carry the latent virus. These "immune carriers" are not sick but can reactivate their latent infection and may periodically shed infectious FIPV, providing a source of infection for other cats.

Feline infectious peritonitis tends to affect cats bred and/or raised in catteries or multiple cat households most. Stress, crowding, poor sanitation, parasitism and concurrent diseases (particularly immunosuppressive diseases like FeLV and FIV) may increase likelihood of cats contracting FIP in these environments. Cats that don't produce antibodies to the virus don't die of FIP and about 75% of average housecats don't have pre-existing antibodies against coronavirus. However, in catteries about 80-90% of pure-bred cats do have circulating antibodies for coronavirus and the fatal immune response is more likely.

The two forms of lethal FIP are also known as the non-effusive (dry) form and the effusive (wet) form. The clinical signs of lethal FIP may be acute or severity may gradually increase over several weeks. Cats may have nonspecific signs such as weight loss, sporadic lack of appetite, lethargy, eye disease, rapid breathing, rough hair coat, swelling of the abdomen and fever.

The effusive form of the virus is characterized by ascites, or abnormal fluid accumulation in the abdominal cavity. The fluid accumulation is due to vasculitis from the body's response to the circulating virus-antibody complexes. The inflammation damages small blood vessels and allows leakage of serum protein and fluid into body cavities. The abdomen is most common but sometimes fluid is also found in space around the lungs and heart, which may cause breathing problems for infected cats. Death usually results within five to seven weeks.

FIP virus is shed in the secretions and excretions of infected cats, but fortunately cats that have FIP and do shed the virus shed the FECV form. Transmission is by oral or nasal routes so close contact is required for infection. FIP can remain infectious under ideal conditions for at least six weeks and up to several months. It is easily destroyed by most disinfectants and detergents but a 1:32 dilution of bleach and water will definitely kill the virus in the environment.

A commercial vaccine was developed for FIPV but doctors at Cornell University did not support the manufacturer's experimental trials which reported it as "reasonably efficacious". Because this virus kills cats by using their own immune response development of a successful vaccine would need to find a way around the antibody-dependent enhancement that characterizes the disease. Also, it's expected that the only cats that are enough at risk to need protection are in catteries and already have coronavirus antibodies so a vaccine would need to include a strict isolation program in order to **prevent** infection of kittens being adopted out.

FIPV can be difficult to diagnose because testing is not very accurate and clinical signs (except ascites) can appear to be many other diseases. Antibody titers for coronavirus can be measured but it is not FIPV specific. Most laboratory tests are only suggestive of FIP infection and the diagnosis is usually "suspected" FIP until a necropsy can confirm infection.

There currently is no known effective treatment for FIP. The most promising treatment is not really promising at all, but consists of combination therapy with an antiviral to stop virus replication and an immune response modifier to enhance protective immune defenses.