



Feline Diseases

Feline Viral Upper Respiratory Tract Disease

Feline viral upper respiratory tract disease is typified by signs of rhinosinusitis, conjunctivitis, lacrimation, salivation, and/or oral ulcerations. The principal causative agents are feline herpesvirus type 1 (FHV-1) and feline calicivirus (FCV). These viruses are host-specific and pose no known human risk. Other infectious agents (e.g. *Bordetella bronchiseptica*, mycoplasma spp., reoviruses) can also be involved in causing similar signs of respiratory disease, but it is believed that around 80% of cases are caused by either FHV-1, FCV or a dual infection with both agents.

FCV

Etiology and Pathogenesis

FCV is a small single-stranded RNA virus which is susceptible to most common disinfectants. It is relatively resistant to environmental conditions and can potentially survive up to a month in the environment, although in most cases probably does not survive more than 7-14 days. A feature of FCV is that it readily mutates during replication resulting in many different strains of the virus which exist in the field, some of which are more pathogenic than others.

FCV is shed via oral and nasal secretions during acute disease. Following clinical recovery, most cats continue to shed the virus for at least a month and a few continue to shed for several years.

Feline calicivirus infection is widespread in the general cat population. The prevalence of infection is broadly proportional to the number of cats in the household, ranging from 10% for household pets kept in small groups up to 40% in some large colonies. Transmission of infection is most commonly via direct contact with saliva, ocular or nasal secretions or inhalation of aerosols. However, since the virus can easily survive for some time in the environment, transmission is also possible via infected fomites such as food bowls, litter trays, bedding and grooming equipment.

Following infection via the nasal, oral or conjunctival route a transient viraemia occurs 3 to 4 days later and the virus can then be detected in many other tissues. Typically FCV induces signs of upper respiratory tract disease and lingual ulceration. However FCV can also cause other manifestations of disease such as lameness, due to acute synovitis and, more recently, certain strains of FCV have been shown to cause a much more severe, potentially fatal systemic condition involving widespread vasculitis with multiorgan involvement referred to as virulent systemic disease.

Clinical and Pathological Findings

Clinical signs vary depending on factors such as strain virulence and the age of the affected cat. In some cases infection is subclinical, however in many others, following an incubation period of 2-10 days, there are typical signs of lingual erosions (resulting in hypersalivation), sneezing and serous nasal discharge accompanied by fever and anorexia. More severe cases can occur, particularly in young kittens, with signs of dyspnoea, coughing, fever and depression.

FCV can be isolated from nearly all cats with chronic gingivo-stomatitis. However the disease has not been reproduced using isolates from clinical cases and it has been suggested that the condition represents some sort of immune-mediated reaction to FCV and possibly other oral antigens.

Occasionally, particularly in young cats, FCV infection can result in signs of lameness due to acute arthritis (synovitis). This is a transient problem, usually only lasting a few days and there will often, be signs of respiratory disease at the same time.

Rarely, outbreaks of a much more serious systemic disease have been associated with particular strains of FCV, referred to as 'virulent systemic strains'. Infection with these strains can result in severe pneumonia, hepatitis, pancreatitis, skin swelling and ulceration, and bleeding from the nose and intestine. In these outbreaks up to 50% of affected cats can die.

FHV-1

Etiology and Pathogenesis

FHV-1 is an enveloped double-stranded DNA virus which is readily inactivated by most commercially available disinfectants, antiseptics and detergents. It is relatively fragile and probably only survives for 1-2 days in the environment. It exists as a single serotype although virulence can vary between different isolates.

FHV-1 is shed via oral, nasal and ocular secretions in clinically affected cats. Viral excretion starts as soon as 24 hours after infection and lasts for 1 to 3 weeks. After infection, virtually all cats will remain latently infected, becoming life-long carriers of the virus. Some of these cats will intermittently shed virus again, commonly following episodes of stress or immunosuppression. Along with reactivation of shedding, some cats will also develop a recrudescence of clinical signs.

The prevalence of viral shedding ranges from less than 1% in households with small numbers of healthy individuals to 20% amongst large groups, especially where clinical disease is present. The true prevalence of infection will of course be much higher due to latently infected cats not shedding virus at the time of sampling. Transmission of infection is largely via direct contact with saliva, ocular or nasal secretions or inhalation of aerosols.

The virus infects via the nasal, oral or conjunctival routes. During infection, the virus spreads along the sensory nerves and reaches neurons, particularly in the trigeminal ganglia, which are the main sites of latency.

Clinical and Pathological Findings

Acute upper respiratory tract disease is the most common manifestation of FHV infection. The respiratory signs caused by FHV-1 are often broadly similar but generally more severe than those caused by FCV. Typical signs include conjunctivitis, ocular discharge, sneezing, nasal discharge, salivation, pharyngitis, lethargy, fever, anorexia and sometimes coughing. These signs can last from a few days to a few weeks.

A less common manifestation of chronic FHV infection is conjunctivitis and keratitis. FHV infection causes the development of multiple small branching corneal ulcers (called 'dendritic keratitis') which is considered diagnostic of FHV infection. Rarely, chronic FHV infection can result in skin

inflammation and ulceration. This is most commonly seen around the nose and mouth, but can affect other areas such as the front legs.

Diagnosis

In most cases, a specific diagnosis of FCV or FHV-1 infection will not be required. The presence of typical upper respiratory signs is enough for a presumptive diagnosis of FCV and/or FHV-1 infection. Signs of oral ulceration and milder respiratory signs tend to suggest the involvement of FCV whereas more severe respiratory illness and signs of keratitis may suggest the involvement of FHV-1. If a specific diagnosis is required, ocular or oral swabs can be submitted for viral culture or, more commonly nowadays, PCR detection. The detection of virus in skin biopsies and can be useful for the diagnosis of FHV-associated dermatitis.

Feline Bordetellosis

Bordetella bronchiseptica (Bb) has long been recognized as an important agent in Canine Infectious Tracheobronchitis (CITB) but only in recent years has its role in the development of Upper Respiratory Tract Disease (URTD) of cats been recognised. The clinical signs of Bb infection are very similar to those of viral upper respiratory tract disease and there is mounting evidence that infection is widespread. Stress predisposes cats to the development of disease associated with Bb and this is most common in multicat households and catteries. The disease is most severe in kittens (where fatal bronchopneumonia has been reported).

Etiology and Pathogenesis

B. bronchiseptica bacteria are small (0.2 mm X 0.7 mm), aerobic, motile, Gram negative coccobacilli which occur singly, in pairs, or in small clumps.

Transmission of infection occurs between in-contact animals directly via intimate contact or by droplet infection. The organism does not survive for long periods outside the host and is readily killed by many common disinfectants and extremes of pH and temperature. However, in a heavily contaminated environment, particularly within infected mucus, survival may be long enough for indirect transmission to occur.

B. bronchiseptica colonizes the ciliated respiratory mucosa, a surface designed to eliminate foreign particles, thereby making the adherence and persistence mechanisms of these bacteria crucial. The release of toxins following colonisation is responsible for local and systemic inflammatory damage for the first 3-5 days after infection. Damage and loss of tracheal epithelial cells containing adherent bacteria contributes to respiratory disease and ciliostasis, destruction of the cilia and failure of the mucociliary clearance mechanism together facilitate further colonisation, persistence, and transmission of bacteria.

After onset of the local immune response the bacteria are gradually eliminated. In cats most illness appears self-limiting with spontaneous resolution occurring after about 10-14 days. However, severe bronchopneumonia associated with *B. bronchiseptica* may occur, particularly in kittens, and can be lethal.

Studies have shown that *B. bronchiseptica* is able to induce respiratory disease in the absence of other pathogens. However, although *B. bronchiseptica* can act as a primary pathogen and cause URTD in cats it is highly likely that in many circumstances other factors are involved including stress and concurrent infection with respiratory viruses. *B. bronchiseptica* may also act as a secondary pathogen, particularly in cases of URTD which progress to more lethal bronchopneumonia.

Clinical and Pathological Findings

B. bronchiseptica associated URTD is a complex disease. There is a considerable overlap between the clinical signs seen with other agents that can cause URTD including FCV and FHV-1. In studies in cats in which *B. bronchiseptica* is known to be the only causative agent, clinical signs have include fever, sneezing, nasal discharge, submandibular lymphadenopathy, coughing and, pulmonary rales. In most cats the disease is usually mild and signs normally disappear after about 10 days. However, in some cats, particularly younger animals, it can develop into bronchopneumonia and be life-threatening. Some cats may become long-term carriers and recovered cats have been shown to shed Bb for at least 19 weeks after initial exposure.

Diagnosis

The presence of Bb can be confirmed by either isolation and culture or PCR on oropharyngeal or nasal swabs . For bacterial isolation and culture, swabs should be placed into bacterial transport medium and cultured on a selective medium such as charcoal/cephalexin agar, which reduces overgrowth by other respiratory flora.

Sensitive real-time PCR methods are capable of detecting the presence of low numbers of organisms. Some laboratories have developed multiplex assays that allow the simultaneous detection of all common feline respiratory pathogens.

Serology is of limited diagnostic use due to the high seroprevalence in the general cat population.

Feline Panleukopenia

Feline panleukopenia is a highly contagious, often fatal, viral disease of cats that is seen worldwide. Kittens are affected most severely. The causative parvovirus is very resistant; it can persist for 1 yr at room temperature in the environment, if protected in organic material.

Etiology and Pathogenesis

Feline panleukopenia virus (FPV) is closely related to mink enteritis virus and the type 2 canine parvoviruses (CPV) that cause canine parvoviral enteritis. FPV can cause disease in all felids and in some members of related families (eg, raccoon, mink), but it does not harm canids.

Virus particles are abundant in all secretions and excretions during the acute phase of illness and can be shed in the feces of survivors for as long as 6 wk after recovery. Being highly resistant to inactivation, parvoviruses can be transported long distances via fomites (eg, shoes, clothing). However, FPV can be destroyed by exposure to a 1:32 dilution of household bleach (6% aqueous sodium hypochlorite), 4% formaldehyde, and 1% glutaraldehyde for 10 min at room temperature. Peroxygen disinfectants are also highly effective.

Cats are infected oronasally by exposure to infected animals, their feces, secretions, or contaminated fomites. Most free-roaming cats are thought to be exposed to the virus during their first year of life.

FPV infects and destroys actively dividing cells in bone marrow, lymphoid tissues, intestinal epithelium, and—in very young animals—cerebellum and retina. In pregnant queens, the virus may spread transplacentally to cause embryonic resorption, fetal mummification, abortion, or stillbirth. Alternatively, infection of kittens in the perinatal period may destroy the germinal epithelium of the cerebellum, leading to cerebellar hypoplasia, incoordination, and tremor. FPV-induced cerebellar ataxia has become a relatively rare diagnosis, because most queens passively transfer sufficient antibodies to their kittens to protect them during the period of susceptibility.

Clinical and Pathological Findings

Most infections are subclinical, as evidenced by the high seroprevalence of anti-FPV antibodies among unvaccinated, healthy cats. Those cats that become ill are usually <1 yr old. Peracute cases may die suddenly with little or no warning. Acute cases show fever (104°–107°F [40°–41.7°C]), depression, and anorexia after an incubation period of 2–7 days. Vomiting usually develops 1–2 days after the onset of fever; it is typically bilious and unrelated to eating. Diarrhea may begin a little later but is not always present. Extreme dehydration develops rapidly. Affected cats may sit for hours at their water bowl, although they may not drink much. Terminal cases are hypothermic and may develop septic shock and disseminated intravascular coagulation.

Physical examination typically reveals profound depression, dehydration, and sometimes abdominal pain. Abdominal palpation—which can induce immediate vomiting—may reveal thickened intestinal loops and enlarged mesenteric lymph nodes. In cases of cerebellar hypoplasia, ataxia and tremors with normal mentation are seen. Retinal lesions, if present, appear as discrete gray foci.

The duration of this self-limiting illness is seldom >5–7 days. Mortality is highest in young kittens <5 mo old.

There are typically few gross lesions, although dehydration is usually marked. Bowel loops are usually dilated and may have thickened, hyperemic walls. There may be petechiae or ecchymoses on the intestinal serosal surfaces. Perinatally infected kittens may have a noticeably small cerebellum. Histologically, the intestinal crypts are usually dilated and contain debris consisting of sloughed necrotic epithelial cells. Blunting and fusion of villi may be present.

Diagnosis

A presumptive diagnosis is usually based on compatible clinical signs in an inadequately vaccinated cat and the presence of leukopenia (nadir 50–3,000 WBC/ μ L). Neutropenia is a more consistent finding than lymphopenia. Total WBC counts <2,000 cells/ μ L are associated with a poorer prognosis. During recovery from infection, there is typically a rebound neutrophilia with a marked left shift. Diagnosis can sometimes be confirmed using an in-office immunochromatographic test kit intended for detection of fecal CPV antigen. However, fecal antigen is detectable only for a short time after infection and false-negative results are common.

Feline Leukemia

Despite the widespread use of vaccines, feline leukemia virus (FeLV) remains one of the most important causes of morbidity and mortality in cats. It causes a variety of malignancies, but persistent infection can also cause severe immunosuppression and profound anemia. The virus is present worldwide and infects domestic cats and a few other Felidae.

Etiology and Pathogenesis

FeLV is a retrovirus in the family Oncovirinae. There are 4 FeLV subgroups of clinical importance. Subgroup A viruses are found in all naturally infected cats. FeLV-A, the original, archetypical form of the virus, is efficiently transmitted among cats. FeLV-A viruses tend to be less pathogenic than viruses of the other subgroups. Almost all naturally infected cats are originally infected by FeLV-A. Within the infected cat, in addition to the original FeLV-A mutated forms, FeLV-B, FeLV-C, or FeLV-T exist. FeLV-B increases the frequency of neoplastic diseases, FeLV-C is strongly associated with the development of erythroid hypoplasia and consequent severe anemia, and FeLV-T has the propensity to infect and destroy T lymphocytes, leading to lymphoid depletion and immunodeficiency. Viruses of all 4 subgroups are detected (but cannot be distinguished) by commonly used FeLV diagnostic test kits.

The incidence of FeLV infection is directly related to the population density of cats. Infection rates are highest in catteries and households with multiple cats, especially when cats have access to the outdoors.

Persistently infected, healthy cats are the major reservoir of FeLV. Carriers excrete large quantities of virus in saliva. Lesser amounts of virus are excreted in tears, urine, and feces. Oronasal contact with infectious saliva or urine is the most likely mode of transmission. Nose-to-nose contact, mutual grooming, and shared litter trays and food dishes facilitate transmission. Bite wounds from infected cats are an efficient mode of transmission but occur relatively infrequently in cats kept indoors 100% of the time. Bites may be a more important mode of transmission in indoor-outdoor cats.

Age resistance is significant. Young kittens are much more susceptible than adults. The virus may be transmitted vertically (in utero or by milk) or horizontally (by secretions and excretions). Because FeLV is a fragile, enveloped virus and because of age resistance, horizontal transmission between adults usually requires prolonged, intimate contact. In addition, the dose required for oronasal transmission of the virus is relatively high.

After oronasal inoculation, the virus first replicates in oropharyngeal lymphoid tissue. From there, virus is carried in blood mononuclear cells to spleen, lymph nodes, epithelial cells of the intestine and bladder, salivary glands, and bone marrow. Virus later appears in secretions and excretions of these tissues and in peripheral blood leukocytes and platelets. Viremia is usually evident 2–4 wk after infection. The acute stage of FeLV infection (2–6 wk after infection) is rarely detected. It is typically characterized by mild fever, malaise, lymphadenopathy, and blood cytopenias.

In ~70% of adult cats, viremia and virus shedding are transient, lasting only 1–16 wk. A few cats continue to shed virus in secretions for several weeks to months after they cease to be viremic. Virus may persist in bone marrow for a longer period, but even this latent, or sequestered, infection usually disappears within 6 mo. Some FeLV-exposed cats (~30%) do not mount an adequate

immune response and go on to become persistently (ie, permanently) viremic. Persistently viremic cats develop fatal diseases after a variable time period.

Clinical and Pathological Findings

FeLV-related disorders are numerous and include immunosuppression, neoplasia, anemia, immune-mediated diseases, reproductive problems, and enteritis.

The immunosuppression caused by FeLV results in an increased susceptibility to bacterial, fungal, protozoal, and other viral infections. Numbers of neutrophils and lymphocytes in the peripheral blood of affected cats may be reduced, and those cells that are present may be dysfunctional. Many FeLV-positive cats have low blood concentrations of complement; this contributes to FeLV-associated immunodeficiency and oncogenicity because complement is vital for some forms of antibody-mediated tumor cell lysis.

Lymphoid or myeloid tumors (eg, lymphoma, lymphoid leukemia, erythremic myelosis) develop in up to 30% of cats persistently infected with FeLV.

Leukemia is a neoplastic proliferation of hematopoietic cells originating in the bone marrow. The cell lines that become neoplastic are neutrophils, basophils, eosinophils, monocytes, lymphocytes, megakaryocytes, and erythrocytes. In cats, the leukemias are strongly associated with FeLV infection and sometimes (but not always) associated with neoplastic cells circulating in the blood.

The anemia caused by FeLV is usually nonregenerative and normochromic. There is frequently an idiosyncratic macrocytosis.

Immune complexes formed in the presence of moderate antigen excess can cause systemic vasculitis, glomerulonephritis, polyarthritis, and a variety of other immune disorders. In FeLV-infected cats, immune complexes form under conditions of antigen excess, because FeLV antigens are abundant and anti-FeLV IgG antibodies are sparse. These conditions are ideal for the development of immune-mediated disease.

Reproductive problems are common; 68–73% of infertile queens have been reported to be FeLV-positive, and 60% of queens that abort are FeLV-positive (although abortion is a relatively uncommon cause of feline infertility). Fetal death, resorption, and placental involution may occur in the middle trimester of pregnancy, presumably as a result of in utero infection of fetuses by virus transported across the placenta in maternal leukocytes. Occasionally, infected queens give birth to live, viremic kittens. Latently infected (ie, nonviremic) queens may pass virus on to their kittens in milk.

Enteritis, resembling feline panleukopenia both clinically and histopathologically, may develop. Clinical signs include anorexia, depression, vomiting, and diarrhea (which may be bloody). Because of the concurrent immunosuppression associated with FeLV infection, septicemia may develop.

Other disorders may also develop. FeLV occasionally causes a neuropathy leading to anisocoria, urinary incontinence, or hindlimb paralysis. Certain FeLV-induced lymphomas can produce identical clinical signs. If antineoplastic therapy is planned, it is important to distinguish neoplasia from neuropathy. FeLV can also cause quasineoplastic disorders such as multiple cartilaginous exostoses (osteochondromatosis).

Diagnosis

Two types of tests are readily available for clinical use. The immunofluorescence assay (IFA) tests for the presence of FeLV structural antigens (eg, p27 or other core antigens) in the cytoplasm of cells suspected to be FeLV-infected. In clinical practice, peripheral blood smears are usually used for the IFA, but cytologic preparations of bone marrow or other tissues can also be used. The IFA is considered to be the most reliable but requires submission to a commercial laboratory, so results are delayed. IFA-positive cats are considered to be persistently viremic and have a poor longterm prognosis.

The more convenient ELISA can be performed in the veterinary clinic and tests for the presence of soluble FeLV p27. FeLV antigen may be present in the absence of intact, infectious viral particles because excess FeLV antigens are released from infected cells free of viral particles. The ELISA detects antigenemia rather than viremia. Several different test kits are available; most have sensitivities and specificities of 98%. Accuracy can be improved by running both the IFA and ELISA on the same cat.

Diagnosis of FeLV-induced neoplasia is similar to that of other tumors. Cytologic examination of fine-needle aspirates of masses, lymph nodes, body cavity fluids (eg, pleural effusion), and affected organs may reveal malignant lymphocytes. Bone marrow examination may reveal leukemic involvement, even when the peripheral blood appears normal. Biopsy and histopathologic examination of abnormal tissues is often necessary for diagnostic confirmation.

Feline Chlamydial Disease

Although disease caused by *Chlamydomphila felis* in cats has been referred to as feline pneumonitis, chlamydiae rarely cause pneumonia in cats. *Ch. felis* is regarded as a primary conjunctival pathogen and infection always involves the eye, resulting in conjunctivitis and occasionally also causing signs of rhinitis, with sneezing and nasal discharge.

Etiology and Pathogenesis

Chlamydiae are obligate intracellular bacteria that form inclusions within the cytoplasm of epithelial cells. Although antibody titers to *Chlamydomphila felis* are common in some cat populations, the organism is rarely isolated from clinically healthy cats. Cats with chlamydial conjunctivitis are generally <1 yr old, and cats 2–6 mo old appear to be at highest risk of infection. Cats with conjunctivitis that are >5 yr old are very unlikely to be infected, and cats <8 wk old may be less at risk because of the presence of maternal antibody. Transmission occurs as a result of direct, close contact between cats, because the organism survives poorly in the environment. Infected cats also shed chlamydiae from their rectum and vagina, although whether venereal transmission may occur has not been confirmed. There is weak evidence that chlamydiae may be capable of causing reproductive disease and lameness in cats, although these associations have not been definitively documented.

Clinical and Pathological Findings

The incubation period after exposure to an infected cat ranges from 3 to 10 days. Signs can include serous to mucopurulent conjunctivitis, nasal discharge, and sneezing. Cats with signs of rhinitis in the

absence of conjunctivitis are unlikely to be infected with *Chlamydophila felis*. Early signs include unilateral or bilateral conjunctival hyperemia, chemosis, and serous ocular discharge, with prominent follicles on the inside of the third eyelid in more severe cases. Corneal disease is rare, and if present, may be the result of co-infection with organisms such as feline herpesvirus 1. The signs are most severe 9–13 days after onset and then become mild over a 2- to 3-wk period. In some cats, clinical signs can last for weeks despite treatment, and recurrence of signs is not uncommon. Untreated cats may harbor the organism for months after infection.

Diagnosis

Chlamydial conjunctivitis in cats should be differentiated from conjunctivitis caused by feline herpesvirus 1 and feline calicivirus. Diagnosis can be confirmed by demonstration of intracytoplasmic chlamydial inclusions in exfoliative cytologic preparations, by isolation of the chlamydial organism in cell culture, or by PCR for chlamydial DNA on conjunctival swabs. Scrapings for cytologic examination are prepared by lightly but firmly moving a spatula over the conjunctiva and smearing the scraped material onto a glass slide; the preparation is air-dried and stained.

Source: Merck Vet Manual