

Feline Symposium

The 25th Annual Feline Symposium was held on Saturday, March 23 at VHUP. The event was generously supported by Kal Kan Foods, Inc., Mrs. R.V. Clark, Jr. and Mrs. Edith Young. Following are summaries of the faculty presentations:

Feline Vaccinations

There's that famous saying, "An ounce of prevention..." However, where vaccines are concerned, prevention can come at a price. **Dr. Margret Casal**, assistant professor of medical genetics at the School, highlighted the many variables one must consider in tailoring a vaccine protocol to a particular cat, and explained the rationale behind VHUP's feline vaccine protocol.

"Each cat's vaccine schedule should be based on its lifestyle, breed and environment," said Dr. Casal.

It should also take into account the risk:reward ratio for giving a certain vaccine to an individual cat. The negative sequela to vaccination include tissue reaction at the injection site; anaphylaxis, which occurs more commonly in dogs than cats; delayed allergic response; introduction of disease (more common with intranasal vaccine); and problems associated with vaccine contamination.

In order to minimize these risks, several decisions must be made regarding vaccination strategy. These include type of vaccine (killed vs. attenuated), route of administration – which should most closely mimic the natural route of infection, and frequency of revaccination. The patient's immune status should also be taken into consideration.

Modified-live vaccines, which may be intranasal or injectable, have the advantage of evoking a rapid immune response. Unlike some injectable vaccines, intranasal modified-live vaccines are not associated with sarcomas. However, they can cause mild clinical signs of disease, as well as a carrier state with possible viral shedding. Modified-live vaccines should never be used in pregnant queens because of potential harm to the fetus.

Killed vaccines, while posing no risk for viral shedding, require adjuvants to effectively stimulate the host's immune system. These adjuvants have been implicated in the formation of vaccine-associated sarcomas. Further,

killed vaccines must be boosted.

Frequency of revaccination is a subject with many opinions. It is difficult to determine one's true immunity to an agent by simply measuring antibodies. And cell-mediated immunity, a more targeted response that some agents stimulate, is difficult to measure. While absolute immunity is hard to gauge, annual boosters are probably overkill, said Dr. Casal, because "you've already trained the body and the immune system to remember certain virus components."

Feline calicivirus, which is highly contagious, can cause chronic ulcerative stomatitis with persistent infection. Febrile limping syndrome, a reaction sometimes associated with attenuated calicivirus vaccination, is characterized by shifting lameness and fever. VHUP's vaccine protocol for calicivirus, which is usually combined with feline viral rhinotracheitis and feline panleukopenia, is a kitten series of shots given every 3-4 weeks from 6-8 weeks to 12-16 weeks of age, a first adult booster given at 15 months, and a booster every three years thereafter.

Rabies is more likely to be transmitted by cats than dogs. Although Pennsylvania law states that rabies vaccination is mandatory only for cats that spend any time indoors, Dr. Casal recommended also vaccinating outdoor pets, such as barn cats. The traditional killed-virus vaccine must be boosted one year after the initial vaccine and every three years thereafter. The killed rabies vaccine has been implicated in causing sarcomas. Recently available is a recombinant-virus vaccine that has no potentially-dangerous adjuvants. In the absence of any long-term studies on the efficacy of this new vaccine, Dr. Casal recommended boosting it annually.

The feline leukemia virus (FeLV) vaccine is not completely effective, and can cause potentially severe adverse reactions. Therefore, it is only recommended for cats that go outdoors. To avoid maternal antibodies, the vaccine should not be given before 10 weeks of age, and must be boosted annually. Dr. Casal cautioned that there is no advantage to vaccinating FeLV+ cats. On the horizon are DNA vaccines against FeLV that have longer immunity duration and no reported side effects.

Dr. Casal discouraged vaccinating cats against *Chlamydomydia*, feline infectious peritonitis (FIP) and *bordetella*. She cited the low

disease prevalence of *Chlamydomydia* and the high frequency of adverse reactions to the vaccine. Because of their questionable efficacy, she added, the FIP and *bordetella* vaccines should not be routinely administered.

Feline immunodeficiency virus (FIV) vaccines, though not yet commercially available, are currently in development. The most promising of these are the inactivated dual-subtype and the fixed-infected-cell vaccines.

Feline Respiratory Disease

The feline mystique can be breathtaking for cat fanciers. Likewise, many medical conditions can be breathtaking literally for cats. **Dr. Reid Groman**, lecturer in emergency and critical care medicine at the School, presented the manifold causes of feline respiratory disorders.

Cats are subject to a variety of upper and lower respiratory tract problems. These include infection, nasal foreign body/polyp/malignancy, allergic airway disease, pleural space disease and congestive heart disease. Other afflictions, like stress, pain and anemia, can mimic primary respiratory disease by causing increased respiratory rate or tachypnea.

The most common upper respiratory disorder in cats is chronic nasal discharge secondary to infection. "We see cats all the time presented with chronic upper respiratory infections (URIs)," Dr. Groman said. "These chronic snuffling cats are among the most frustrating cases to treat."

Often medically incurable – though temporarily manageable – these cats are usually afflicted with a virus. The most common of these viruses is feline herpesvirus (FHV-1), which causes feline viral rhinotracheitis. Signs include sneezing, coughing, excess salivation and ocular discharge. Although infection usually resolves in a few weeks with supportive care, feline viral rhinotracheitis can lead to secondary bacterial infection and damage to the bones of the nares and sinuses. Extremely contagious, feline calicivirus is associated with milder respiratory signs and tissue ulceration.

Both herpes- and calicivirus are ubiquitous in the general cat population, have an even higher prevalence in colonies, may remain latent in the host, and can be shed when the host is under stress.

Common bacterial causes of nasal discharge are *Pseudomonas*, *Pasteurella*, *Staphylococcus*

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and *Actinobacillus*. All normal inhabitants of the nasal/sinus mucosa, these bacteria do not cause infection by themselves. Rather, they are opportunistic agents that cause secondary infection of tissues already inflamed by viruses.

Two primary bacterial causes of URIs are *Chlamydophila* and *Bordetella bronchiseptica*. Formerly called *Chlamydia*, *Chlamydophila* causes often-recurrent mild respiratory compromise and conjunctivitis. *B. bronchiseptica*, which causes kennel cough in dogs, is thought to be a common primary disease agent in cats, in whom signs include fever, nasal discharge and coughing. Associated with overcrowding and poor ventilation, *B. bronchiseptica* infection is easily treatable with antibiotics.

Feline nasal discharge can also result from fungal infection (*Cryptococcus*, *Aspergillus*, *Blastomyces*, *Histoplasma*), foreign bodies such as grass awns lodged in the nasal mucosa, malignancy (squamous cell carcinoma, lymphosarcoma, adenocarcinoma) and nasopharyngeal polyps.

Nasopharyngeal polyps occur in the eustachian tubes and present with sneezing, difficulty eating, and other signs of middle ear infection. Himalayans, Persians and Siamese cats are predisposed to nasopharyngeal polyps.

Workup of feline nasal discharge includes a thorough physical exam, complete blood count, blood chemistry panel, urinalysis, feline leukemia virus (FeLV)/feline immunodeficiency virus (FIV) testing and head/chest x-rays. CT scanning and/or endoscopy may be performed if a nasal/sinus tumor or nasopharyngeal polyp is suspected, and endoscopy is done to rule out a foreign body. If infection is suspected, a nasal flush can be performed to retrieve upper airway fluid for culture and cytology.

Treatment of feline URIs is as varied as the causes. Though symptomatic treatments like antihistamines and topical decongestants have questionable efficacy, said Dr. Groman, supportive therapies like airway humidification, appetite stimulants and flavorful foods are important. For secondary bacterial infection, Dr. Groman recommended pulsed, combination antibiotic therapy with agents like Orbax, Doxycycline and Zithromax. Viral infections are sometimes treated with antiviral drugs like Zovirax, Herplex and interferon. Endoscopy may be used to facilitate manual removal of any foreign bodies. For removal of nasopharyngeal

polyps, a surgical procedure called bulla osteotomy is recommended by many veterinarians. Without this aggressive procedure, which exposes the middle ear canal after removing the polyp, up to one third of affected cats experience polyp recurrence.

The most common lower respiratory tract disease in cats is feline bronchial asthma. An obstructive airway disease, it is marked by increased responsiveness in the airways, airway narrowing and mucus. "It is a reversible situation where animals have an exaggerated response to something provocative in the environment," Dr. Groman explained.

Associated with culprits like food allergy, dust, mold, smoke, and heartworm infection, feline bronchial asthma generally presents with sudden onset of labored breathing, chronic cough, wheezing and increased respiratory rate. Diagnostic tools include radiography, blood work and fecal exam. Treatment may consist of flow-by oxygen, bronchodilators and corticosteroids (injection and/or nebulization). "A rewarding disease to treat," said Dr. Groman, "feline bronchial asthma requires long-term therapy."

New Cancer Treatments for Cats

Cats are prone to several types of neoplastic conditions. Dr. Craig Clifford, resident in oncology at VHUP, discussed the mechanisms and treatment options for these cancers.

Cancer is an abnormal or unregulated cell growth and can be benign or malignant. Benign tumors are generally slow growing, locally invasive and often curable with a single form of therapy. Malignant neoplasia, on the other hand, is characterized by rapid growth and propensity to spread via the blood or lymphatic vessels. It requires combined therapy for effective treatment. Cancer is a multi-step process that results from cumulative damage to genes. Causes include environmental carcinogens (chemical, physical, or radiological), hormones, viruses and inflammation. Certain breeds, such as Siamese, are predisposed to developing cancer.

The common cancers in cats are lymphosarcoma (LSA), vaccine-associated sarcoma (VAS), mammary gland tumor, squamous cell carcinoma and mast cell tumor. The most prevalent of these, LSA accounts for about one third of all feline cancer cases. LSA involves

unregulated growth of lymphocytes. "One of these cells turns and becomes bad, and spreads to other parts of the body," explained Dr. Clifford. LSA most frequently affects one or more of the following tissues: gastrointestinal tract, lymph nodes, bone marrow, blood, mediastinum, nasal passages, kidney and brain. Causes of LSA include genetic factors, inflammatory bowel disease (IBD), second-hand smoke and feline leukemia virus (FeLV). Although it most frequently affects middle-aged-to-older cats, LSA has a bimodal age predisposition, peaking in young – usually FeLV+ – cats, and in older – typically FeLV- – cats. Recent studies show that up to 15 percent of cats with LSA are FeLV+. The retrovirus integrates itself into the genome of the cat, allowing cells to proliferate abnormally and "throwing the entire process off," Dr. Clifford explained.

Diagnostic tools for LSA include blood work, urinalysis, radiographs, ultrasound, endoscopy and the gold standard: biopsy or cytology from fine needle aspirates. LSA treatment may involve a combination of surgery, chemotherapy and radiation. Surgery is generally limited to the excision of masses such as in the gastrointestinal tract. Radiation therapy is used to shrink focal masses, such as nasal LSA. Chemotherapy involves a sequential, weekly protocol that rotates a variety of agents. In people, the goal of chemotherapy is cancer cure. In animals, however, the goal is often palliation. Therefore, lower drug dosages are used in animals than in people. Likewise, side effects, which include anorexia, nausea and decreased white blood cell count, are generally fewer. These side effects are often preventable with the use of appetite stimulants, antiemetics (prevention of vomiting), antibiotics and fluid therapy. In our experience, side effects occur in less than ten percent of treated cats. LSA carries a varied prognosis, with survival time ranging from a few months (FeLV+ cat treated with chemotherapy) to over a year.

VAS have increased in frequency at VHUP by 61 percent from 1987 to 1991, occurring in middle-aged-to-older cats, with no breed predisposition. Associated with the rabies and FeLV vaccines, these vaccination-site tumors develop about 340 days after vaccination (11 [FeLV] 26 mos [rabies]). The risk increases with multiple injections. These tumors, which usually originate with post-vaccinal inflamma-

tion at the vaccination site, may involve mutations in tumor suppressor genes. VAS, which can metastasize by the blood, should be suspected if inflammatory tissue is still proliferating one month after vaccination, is greater than 2 cm. in size, and persists for over three months after vaccination (“1-2-3 rule”).

Although VAS are definitively diagnosed by biopsy, other diagnostic tools, like blood work, FeLV testing, radiographs, CT scans and MRIs, might be useful in further characterizing the extent of the neoplastic process. VAS are treated aggressively with surgery; however, tumor recurrence is common. For appendicular lesions, limb amputation carries the best prognosis. Radiation therapy may be performed either pre- or post-operatively, usually in 3-4-week courses of daily therapy. These treatments are often combined with chemotherapy.

Dr. Clifford urged owners to continue vaccinating their cats. “These tumors are not uncommon but are not a reason to not vaccinate,” he said. Rather, owners should ensure that the rabies vaccine is administered in the right hind leg and FeLV in the left. Also, vaccines should not be given interscapularly.

Cancer cachexia progressive, involuntary weight loss in the face of adequate nutrition, is a problem in cats suffering from various cancers, particularly VAS, lymphosarcoma, leukemia, and mammary gland tumors, but can occur with any cancer. This common condition is associated with decreased response to therapy, impaired immunity and poor quality of life. Cats suffering from cancer cachexia should be fed complex carbohydrates, high-quality protein sources and increased fat (omega-3 fatty acids).

Lastly, Dr. Clifford discussed many of the clinical trials in VHUP’s oncology service and the goal of these trials is “to provide a more efficacious therapy for different cancers as well as to improve the quality of life in our patients.” Due to limitations in funding for veterinary studies, Dr. Clifford encouraged owners to become proactive in helping to fund feline cancer studies.

Feline Urinary and Renal Problems

Working as the filtration unit for the blood, the urinary system purges the body of metabolic end products and maintains serum electrolyte concentrations within narrow param-

eters. If any part of this system malfunctions, the consequences can be serious. **Dr. Meryl Littman, V75**, associate professor of medicine at the School, summarized the problems that commonly affect the feline upper and lower urinary tracts.

When urinary pathology occurs, the first step is to localize the problem to the upper (kidneys) versus the lower (bladder/urethra) urinary tract. Kidney disease usually presents with vague, often subtle, systemic signs. These include lethargy, decreased appetite, vomiting, polyuria/polydipsia and possible hypertensive damage, such as stroke and retinal detachment. “When the kidneys are sick, the whole body is sick,” Dr. Littman explained, “because the kidneys are not getting rid of the waste products from the bloodstream.”

On physical examination, abdominal palpation may reveal shrunken kidneys – possibly due to chronic renal failure – or enlarged kidneys, with etiologies ranging from acute renal failure to lymphosarcoma to feline infectious peritonitis (FIP).

The main diagnostic values for kidney disease are blood urea nitrogen (BUN) and serum creatinine, which become elevated with the loss of 75-85% of renal function. Other diagnostic tests include complete blood count (CBC), serum chemistry panel, T4, urinalysis, urine culture, blood pressure measurement, imaging studies, testing for infectious agents such as Toxoplasmosis and feline leukemia virus (FeLV), and kidney aspirate +/- biopsy.

Renal failure is treated with rehydration, correction of electrolyte imbalances, dietary modification (reduced protein/phosphorus), antihypertensives, erythropoietin (to correct associated anemia), antiemetics, anti-ulcer drugs, and medications such as antibiotics or chemotherapy to address underlying problems. For suitable candidates, renal transplantation is also available.

Feline lower urinary tract disease (FLUTD) – a constellation of disorders affecting urine outflow via the bladder and the urethra – is most commonly caused by cystitis, or inflammation (usually sterile, in cats) of the bladder. Other causes of FLUTD, in descending order of frequency, include urethral blockage (male cats), urinary tract stones (male and female cats), bacterial cystitis and anatomic defects.

Unlike kidney disease, FLUTD tends to

manifest overtly. Clinical signs include increased frequency of urination, straining to urinate, vocalizing, and expelling small amounts of bloody urine. In urethral blockage, vomiting, lethargy and death can also occur.

Physical exam helps to characterize the cause of FLUTD. If cystitis, or bladder inflammation, is present, the bladder is usually small and may contain “sand” or calculi that can sometimes be palpated. If the urethra is blocked, however, the bladder will be enlarged and tense.

Diagnostic tests for FLUTD include urinalysis, urine culture, imaging studies, and rarely, cystoscopy and/or surgery/biopsy. Stone analysis may also be performed, pursuant to determining appropriate dietary modifications: Dietary acidification can reduce and prevent struvite sand or calculi, while alkalinizing agents are effective against calcium oxalate sand or calculi. In addition to special diets and dietary pH modifiers, sterile cystitis can be treated with amitriptyline, antispasmodics and antiinflammatory medications.

Calculi or sandy plugs can cause complete obstruction at the narrow part of the urethra. A proteinaceous mix of mucus and sandy grit – usually struvite or oxalate, the plug must be dislodged via urethral catheterization. A clinical emergency, urethral blockage must be treated rapidly with intravenous fluids, antispasmodic medications and sometimes eventually surgery (penile urethrostomy) to excise the narrowed portion of the urethra. Therapy may also include antibiotics and dietary modification.

Bacterial cystitis, which is not very common in cats, is diagnosed with urine culture/sensitivity and treated with antibiotics. Anatomic defects, such as urachal diverticulum, are usually treated surgically.

Some of the clinical signs of intrinsic urinary problems, such as urinating outside the litter box, can also be caused by behavior problems. Once physical etiologies have been ruled out, behavior problems can be addressed. Urinating outside the litter box can be a normal, though unacceptable, territorial marking behavior. Neither punishment nor positive reinforcement is effective in reducing marking. However, Dr. Littman said, “You don’t have to make these cats live outside or put them to sleep.” Psychotropic medications such as amitriptyline, buspirone and fluoxetine are effective against this problem.

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Cats may also urinate outside the litter box because of surface or location preferences/aversions. Dr. Littman recommended experimenting with different types of litter (clumping vs. regular vs. less dusty litter; unscented vs. deodorized litter; sand, dirt, etc.), cleaning the litter regularly, and using several litter boxes in different locations.

Feline Arterial Thromboembolic Disease

Characteristically feline and exquisitely tragic, feline arterial thromboembolic disease (FATE) is the typical presentation of “stroke” in cats. **Dr. Annika Linde**, resident in cardiology at VHUP, discussed the underlying causes, pathogenesis, clinical signs, diagnosis and treatment of FATE.

Arterial emboli are not uncommon in cats, said Dr. Linde. “Cats experience these thromboembolic events more frequently and more easily than other species would,” she explained.

Cardiomyopathy either hypertrophic, restrictive or dilated – is the chief cause of FATE. In fact, said Dr. Linde, over 90 percent of cats afflicted with FATE have underlying heart muscle disease. Other etiologies include hypercoagulability, neoplasia, corticosteroid administration and presence of a foreign body.

Cats are predisposed to clot formation because their red blood cells are prone to aggregation, their platelet volume:body mass ratio is high, and their platelets have a propensity to aggregate. This tendency is exaggerated when endothelial damage is present or blood flow is sluggish as a result of heart disease. In cats afflicted with cardiomyopathy, the left atrium the cardiac delta to the systemic circulation often enlarges. “If a thrombus formed in this area dislodges,” she explained, “it can go directly out into the body and cause the syndrome that we see.”

Most commonly, a “saddle thrombus” – a clot lodged at the aortic trifurcation in the caudal abdomen – forms. Alternatively, thrombi may settle in the smaller channels, such as the brachial, renal or femoral arteries. Clinical signs depend on the location at which the thrombus/thrombi lodge(s).

The typical FATE patient is a middle-aged-to-older cat, although cats of any age can be afflicted. FATE occurs in male cats with twice the frequency as in females. Common clinical signs include pain – often accompanied by

vocalization, and cold, blue, paralyzed limbs (bilateral or unilateral; usually hind limbs). Affected cats may also exhibit vomiting, difficulty breathing and signs associated with renal failure. Alternatively, sudden death may be the only clinical sign, particularly if clots lodge in the left heart, valvular channels or proximal aorta. The other reason cats often do not present until end-stage damage has occurred, said Dr. Linde, is that “they are very good at hiding symptoms.”

FATE is diagnosed by a combination of cardiac evaluation, blood pressure measurement and laboratory tests. Heart auscultation may reveal tachycardia or – in late stages – bradycardia, arrhythmias, and murmurs. Electrocardiography (ECG) might show abnormal QRS complexes. On thoracic radiographs, the heart silhouette may appear atypical, the left atrium may appear enlarged and fluid may be apparent in the lungs as a result of secondary congestive heart failure. Echocardiography often reveals thickened heart walls and constricted chambers,

particularly since HCM is the most common form of cardiomyopathy in the cat. However, other cardiomyopathies can also be the underlying etiology. Doppler analysis may show reduced blood pressure in affected limbs. Renal values and muscle enzymes may be elevated, indicating, kidney and muscle damage, respectively.

FATE is a clinical emergency that must be treated aggressively. Therapy includes pain control, vasodilators and thrombolytic agents, such as streptokinase, urokinase and tissue-plasminogen activator (t-PA). Underlying heart disease also must be addressed, and additional thrombus formation prevented by either aspirin or coumadin.

Though treatment options are available, many cases of FATE have bad outcomes. Of 144 total cases analyzed in two separate studies between 1977 and 1998, approximately one third of affected cats died and one third were euthanized. The mean survival time in the remaining 1/3 was about one year.

–Joan Capuzzi Giresi, C’86, V’98

Foal Sitting

We need your help. Do you have time to volunteer next Spring, February through June (an average of one shift or more per week) and don’t mind getting dirty or hard work? Do you like horses and love foals? Are you curious about what cutting edge veterinary medicine is all about? Are you over 16? If so, come and join our neonatal intensive care team as a foal sitter.

Working in the NICU is like nothing you have ever done before. You will be working with critically ill newborn foals (and occasionally other newborns) that are being watched over by their anxious and attentive dams. You may be asked (after being instructed) to “sit” with the foals, insuring that a variety of patient lines (including intranasal oxygen lines, nasotracheal tubes, nasogastric feeding tubes, urinary catheters, and intravenous catheters) are not pulled out. Depending on the time of day you choose to work you will help with a variety of diagnostic and therapeutic procedures, which may include catheterization, radiography, and ultrasonography. During late night shifts you may be helping us while we work up emergencies or watch us foal mares in our high-risk pregnancy program. Of course, there are more mundane chores as well, such as putting a dent in a mountain of laundry, restock-

ing supplies or cleaning.

The work can be strenuous. There is a lot of lifting and kneeling. You have to be willing to get dirty – changing foal diapers, catching urine, etc. If you are assigned a foal that is hyperactive (as they can be as they recover from mild brain damage) you may go home black and blue and really feel your shift the next day. No matter how tired you are or how tedious some of the jobs may seem, it will all be worthwhile when you see your first foal progress from lying in a coma on a fleece lined mattress, to running and bucking at the side of its dam as it plays outside for the first time.

Who are foal sitters? They come from all walks of life. Many are college students who want to find out what veterinary medicine is all about. Others are nurses from human hospitals, looking for a change of pace. Still others are horsewomen and horsemen from the community who just feel good helping these little patients.

If you are interested, email us at foalsitters@vet.upenn.edu or call the foal sitter hot line at 610-444-5800, ext. 2445. You **must register by December 1** to be able to help during the 2003 foaling season.